

# The United States Geological Survey in Alaska: Organization and Status of Programs in 1977

Kathleen M. Blean, Editor

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# The United States Geological Survey in Alaska: Organization and Status of Programs in 1977

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## ABSTRACT

This report of the activities of the U.S. Geological Survey in Alaska contains up-to-date accounts of the objectives and status of projects active during 1977. It is organized in four parts: (1) services and responsibilities of the U.S. Geological Survey; (2) organization of the U.S. Geological Survey; (3) current projects of the U.S. Geological Survey; and (4) cooperative projects with Federal, State, and local agencies.

## SERVICES AND RESPONSIBILITIES OF THE U.S. GEOLOGICAL SURVEY

### INTRODUCTION

For the many people and groups deeply interested in Alaska, a report on the Alaskan activities of the United States Geological Survey serves several purposes. For the professional geologist, hydrologist, or topographer, it contains up-to-date accounts of recent results. For various private groups, the business community, and other Federal and State agencies, there is news of investigations intended to assist them in their separate and important tasks. And for the citizen whose pleasure and livelihood are linked to the natural surroundings, the report is an introduction to Geological Survey studies of the land and water of the incomparable State of Alaska.

To reach such a complex audience, this circular is organized into four chapters. In this introductory chapter, the services and responsibilities of the Geological Survey are discussed. The second chapter presents the organizational structure of the Survey, as well as a discussion of the organizational segments serving Alaska. The next two chapters together constitute a comprehensive description of Alaskan projects active during 1977, with the third describing Survey projects and the fourth detailing cooperative projects between the Survey and other Federal and Alaskan State and local agencies.

## SERVICES

The U.S. Geological Survey serves the needs of the citizens and their government for information on the land and water of the United States. This information is obtained and analyzed by U.S.G.S. scientists and distributed to the public in the form of maps and reports. Most Survey maps and reports are published by the Federal government and announced by means of monthly notices, "New Publications of the Geological Survey," which are free on application to the Geological Survey, Reston, Va. 22092. Reports referred to as book publications may be ordered from:

Branch of Distribution  
U.S. Geological Survey  
1200 South Eads Street  
Arlington, Va. 22202

Maps may be ordered from the following places:

Branch of Distribution, Central Region  
U.S. Geological Survey  
Box 25286  
Federal Center  
Denver, Colo. 80225

Alaska Distribution Section  
U.S. Geological Survey  
310 First Avenue  
Fairbanks, Alaska 99701

Maps and book publications on Alaska are available from the U.S. Geological Survey, Public Inquiries Office, 108 Skyline Building, 508 Second Avenue, Anchorage, Alaska 99501.

Some studies, in particular, those of high scientific merit, are published in professional journals; these are available at university and college, industrial, and some major public libraries.

The scope of Alaskan studies is broad and is probably best illustrated by example. The list that follows contains a selection of recent Geological Survey maps and reports accompanied by a brief explanation of what they disclose and how they may be used.

Reference: Grantz, Arthur, Barnes, P. W., Eittreim, S. L., Reimnitz, Erk, Scott, E. W., Smith, R. A., Stewart, George, and Toimil, L. J., 1976, Summary of the sediments, structural framework, petroleum potential, environmental conditions and operational considerations of the United States Beaufort Sea, Alaska area: U.S. Geol. Survey open-file report 76-830, 32 p.

Available from: Alaska Technical Data Unit, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025.

This report contains preliminary information on the geologic framework, petroleum potential, and environmental hazards in the area being considered for proposed OCS Oil and Gas Lease Sale #50. A more detailed report, incorporating data obtained in the 1976 field season, will be released early in 1977.

Reference: Imaly, R. W., 1976, Middle Jurassic (Bajocian and Bathonian) ammonites from northern Alaska: U.S. Geol. Survey Prof. Paper 854, 22 p.

Available from: Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, Va. 22202; \$1.25.

This scholarly study presents the latest available information on the stratigraphic and geographic distribution of Middle Jurassic ammonites north of 68° North latitude (Brooks Range and Arctic Coastal Plain). Information of this nature is important to understanding the complex history of northern Alaska.

Reference: Péwé, T. L., and Bell, J. W., 1975, Map showing distribution of permafrost in the Fairbanks D-2 SE quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-689A, 1 sheet, scale 1:24,000 (1976).

Available from: Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225; \$0.50.

A map showing location and ice content of permafrost in the area of Ft. Wainwright. This information can be used profitably by city planners and developers to assure that proper construction methods are used in this difficult terrain. Fifteen other maps, which detail engineering geologic information for the Fairbanks D-2 NW and NE quadrangles, and the D-1 SE quadrangle, also have been published.

Reference: Post, Austin, 1975, Preliminary hydrography and historic terminal changes of Columbia Glacier, Alaska: U.S. Geol. Survey Hydrol. Inv. Atlas HA-559, 3 sheets, scale 1:10,000 (1976).

Available from: Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225; \$1.75 per set.

This report presents a detailed hydrographic study documenting variations and stability of Columbia Glacier, the largest glacier in the Prince William Sound area of coastal southern Alaska. These data provide baseline information necessary to predict the likelihood of drastic glacial retreat

and the associated threat that would be posed by increased icebergs in the shipping lanes from Valdez, the terminus of the trans-Alaska oil pipeline.

Reference: Cobb, E. H., 1976, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Livengood quadrangle, Alaska: U.S. Geol. Survey open-file report 76-819, 241 p.

Available from: Alaska Technical Data Unit, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025.

A comprehensive annotated bibliography of mineral resource information for the Livengood quadrangle. This area includes a major part of the Fairbanks mining district, one of Alaska's richest producers. The Tolovana district, known for its placer and lode deposits, also is covered in this publication.

Reference: O'Leary, R. M., McDonald, S. K., McDougal, C. M., Day, G. W., and Marsh, S. P., 1976, Chemical analysis and statistical data for stream sediment samples from the Chandalar quadrangle, Alaska: U.S. Geol. Survey open-file report 76-492, 120 p.

Available from: Alaska Technical Data Unit, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025.

Geochemical and statistical analyses are an important part of mineral resource assessment programs. The data presented in this report were used in the mineral resource evaluation of the Chandalar quadrangle, eastern Brooks Range.

Reference: Richter, D. H., and Smith, R. L., 1976, Geologic map of the Nabesna A-5 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-1292, 1 sheet, scale 1:63,360.

Available from: Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225; (Alaska residents only) Alaska Distribution Section, U.S. Geological Survey, 310 First Avenue, Fairbanks, Alaska 99701; \$1.75.

This map shows distribution of rock units in part of the Wrangell Mountains. Tertiary and Quaternary lavas are overlain by Holocene unconsolidated deposits and large areas of ice and snow. Detailed descriptions, chemical analyses, and radiometric ages are given in the text.

Reference: U.S. Geological Survey, 1972, Arctic A-4 quadrangle, Alaska: U.S. Geol. Survey Topog. Ser., scale 1:63,360.

Available from: Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colo. 80225; (Alaska residents only) Distribution Section, U.S. Geological Survey, 310 First Street, Fairbanks, Alaska 99701; \$1.25.

This map is a standard detailed topographic map at a scale of 1 inch equals 1 mile. In addition to major streams and land forms, the map shows cultural features such as villages, roads, and trails. This kind of map is widely used by land planners and outdoor enthusiasts and as a base for most special-purpose maps.

## RESPONSIBILITIES

In addition to obtaining and analyzing land and water-resources data, the Geological Survey supervises the extraction of valuable mineral

commodities from many types of federal lands, including the offshore Outer Continental Shelf.

The Alaskan activities of the Geological Survey are carried out through all of its four main operating divisions and by a number of interdivisional programs, committees, and working groups, briefly described in the following sections.

## ORGANIZATION OF THE U.S. GEOLOGICAL SURVEY

The organization of the U.S. Geological Survey and its four main operating divisions is portrayed in figures 1 through 5.

The main structure of the Geological Survey (fig. 1) consists of four operating divisions—Geologic, Conservation, Water Resources, and Topographic—and three support divisions—Computer, Administrative, and Publications. Headquarters for all divisions are in Reston, Va.

Investigations of the geology of the United States and certain other countries are mainly conducted in the Geologic Division (fig. 2), comprising seven operating offices supported by an Office of Scientific Publications. The headquarters of the offices are located in Reston, Va.

The Conservation Division supervises oil, gas, and other mineral-extraction activities on certain federal lands. The regional responsibilities of the Division are vested in four operational offices. The Alaskan activities of the Conservation Division, detailed in figure 3, are supervised by the Western Region Office in Menlo Park, Calif.

The organization of the Water Resources Division of the Geological Survey is shown in figure 4 (with Alaskan activities emphasized). The main operating units are located under four regional subdivisions supported by Assistant Chief Hydrologist Offices for Scientific Publications and Data Management, Operations, and Research and Technical Coordination.

Topographic and other special-purpose geographic maps are prepared by the Topographic Division (fig. 5). The principal work responsibilities are met by four regional mapping centers under the supervision of the Chief of the Topographic Division.

### ORGANIZATIONAL SEGMENTS SERVING ALASKA

All four operational Divisions of the Geological Survey—Conservation, Geologic, Topographic and Water Resources—function in Alaska and are

supported by the Administrative, Publications, and Computer Divisions as well as other organizational entities of lower than Division rank.

### CONSERVATION DIVISION

The Conservation Division examines and classifies federal lands as to their mineral character and waterpower and water-storage values; determines estimated resource values for onshore and offshore competitive lease sales; supervises exploration and development for leases on Federal, Indian, and certain Naval petroleum reserve land, and the offshore Outer Continental Shelf; and maintains accounts and collects rentals and royalties from related mineral 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.

All Alaskan activities are supervised by the Western Region Conservation Manager, 345 Middlefield Road, Menlo Park, Calif. 94025. The Office of the Alaska-Pacific Mining Supervisor is located at the Menlo Park address.

The Hydraulic Engineer for the Western Region is located at 830 N.E. Holladay, P.O. Box 3202, Portland, Oreg. 97208, and the Alaska waterpower evaluation program is a function of that office. The offices of both the Alaska Area Geologist, R. H. McMullin, and the Alaska Area Oil and Gas Supervisor, Rodney A. Smith, are located at 800 A Street, Anchorage, Alaska 99501.

### GEOLOGIC DIVISION

The current scientific investigations of the Geologic Division in Alaska include 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 routes; earthquake studies; isotope age determination and interpretation;

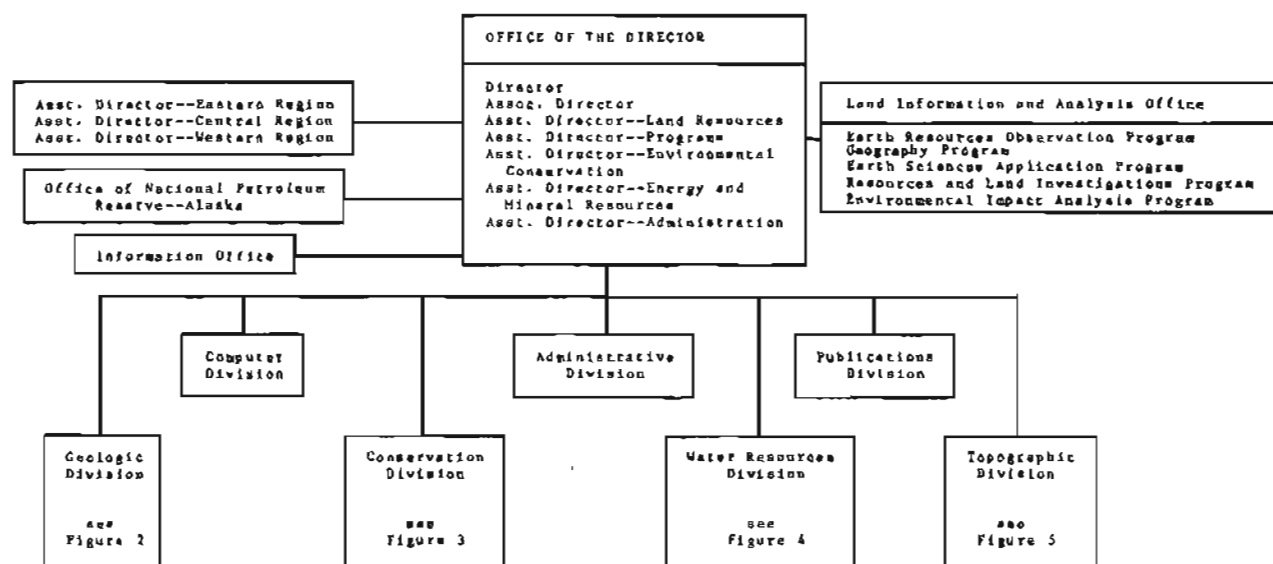


FIGURE 1.—Organization of the U.S. Geological Survey.

heat flow studies; and submarine sampling, sub-bottom profiling, and other geophysical studies of the ocean floor.

Activities in Alaska are the responsibility of several groups within the Geologic Division: the Branch of Alaskan Geology, the Office of Earthquake Studies, the Office of Energy Resources, and the Office of Marine Geology at the Pacific Coast Field Center, 345 Middlefield Road, Menlo Park, Calif. 94025; the Branches of Regional Geophysics, Electromagnetism and Geomagnetism, Exploration Research, Isotope Geology, and Engineering Geology at the Rocky Mountain Field Center, Denver, Colo. 80225; and the Branch of Paleontology and Stratigraphy at the National Center in Reston, Va. 22092. Several other branches in the Geologic Division provide services or conduct research in cooperation with these units. The Branch of Alaskan Geology maintains two offices in Alaska: the main one at 1209 Orca Street, Anchorage, Alaska 99501; (907) 272-8228, with Thomas P. Miller as geologist in charge, and the other at the University of Alaska, P.O. Box 80586, Fairbanks, Alaska 99708; (907) 479-7245, with Florence R. Weber in charge. The Branch of Electromagnetism and Geomagnetism maintains observatories at Fairbanks (College), Barrow, and Sitka. The College and Barrow observatories are under the direction of J. B. Townshend, Yukon Drive on West Ridge, Fairbanks, Alaska 99701; (907) 479-6146. The Sitka Observatory is directed by Willis Osbakken, P.O.

Box 158, Sitka, Alaska 99835; (907) 747-3332.

In its study of Alaskan geology, the Survey supports and cooperates with several universities and other public agencies, including the State of Alaska Division of Geological and Geophysical Surveys.

#### TOPOGRAPHIC DIVISION

The main task of the Topographic Division is the preparation of the various series of maps of the National Mapping Program, which includes all of the quadrangle maps covering the 50 States of the Nation. The National Mapping Program of the Geological Survey is under the direction of Robert H. Lyddan, Chief, Topographic Division. Doyle G. Frederick is Chief of the Office of Plans and Program Development, which is responsible for initiating and controlling the work of the Division.

Mapping operations in Alaska are the responsibility of A. E. Letey, Chief, Rocky Mountain Mapping Center, who directs the operational functions of the Mapping Center, including all field and office operations. He may be consulted at the Federal Center, Denver, Colo. 80225; (303) 234-2351.

The Resident Engineer in Alaska is Thomas E. Taylor, who serves as the Topographic Division's representative in that state. He may be contacted at 218 E Street, Anchorage, Alaska 99501; (907) 279-5812.



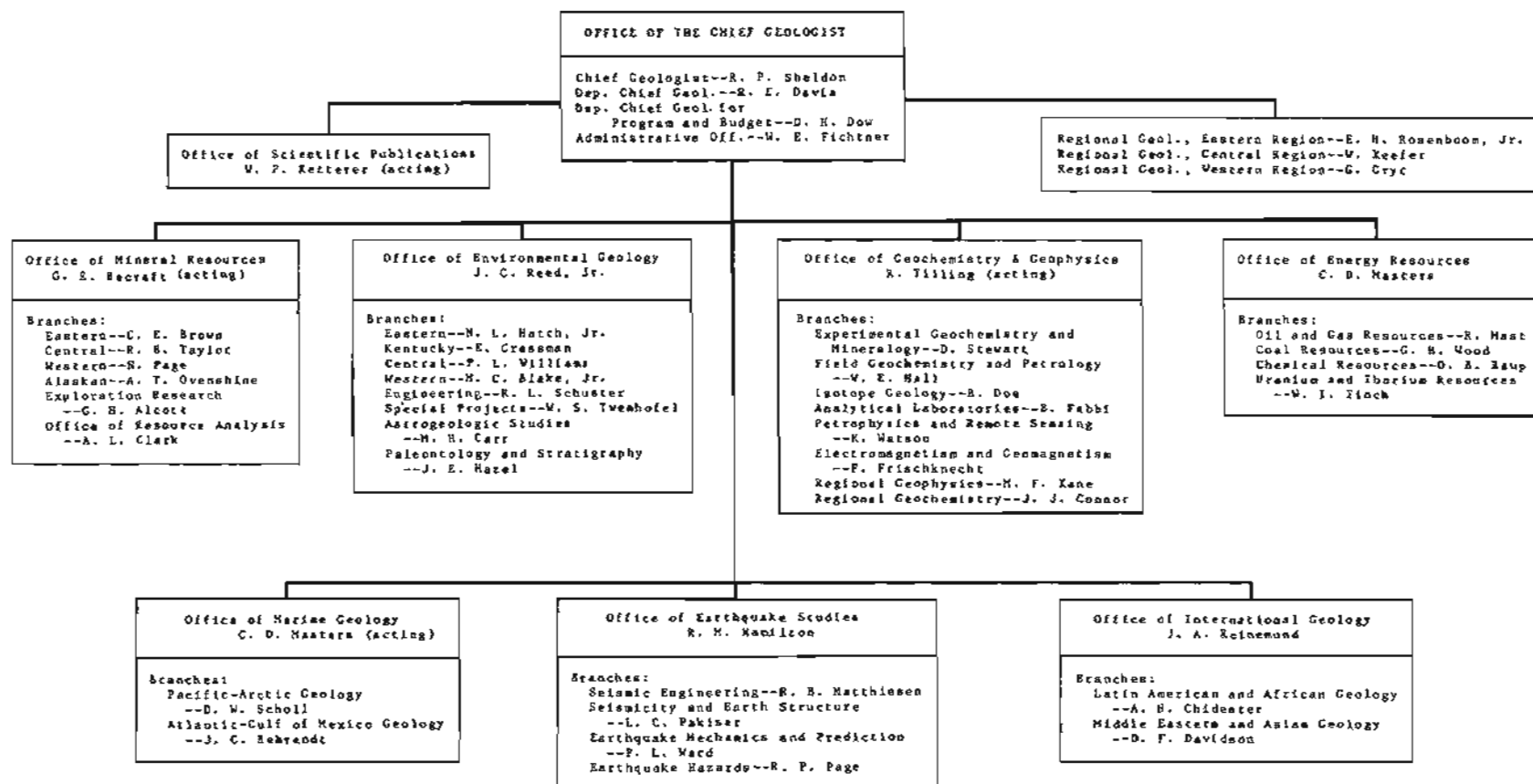


FIGURE 2.—Organization of the Geologic Division.

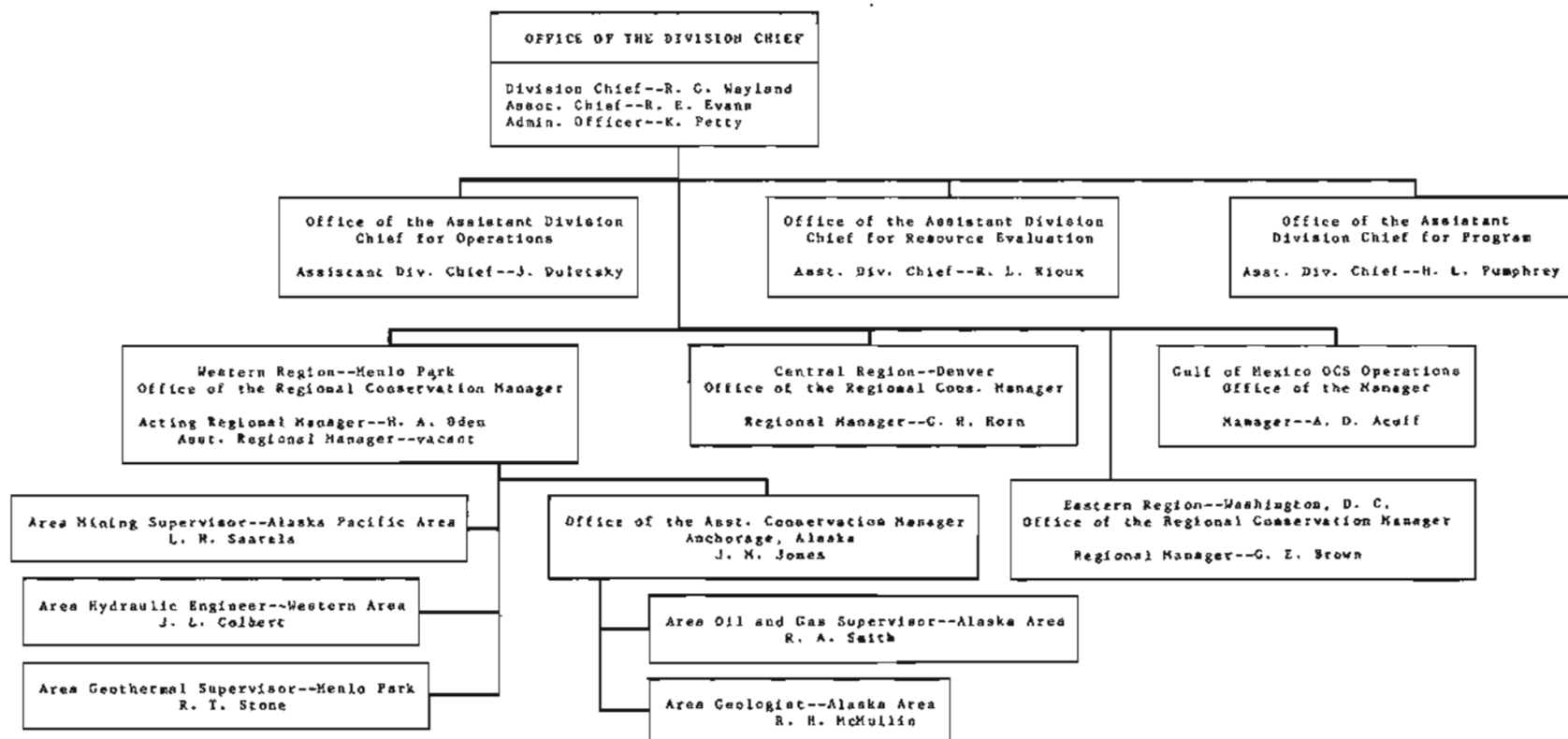


FIGURE 3.—Organization of the Conservation Division.

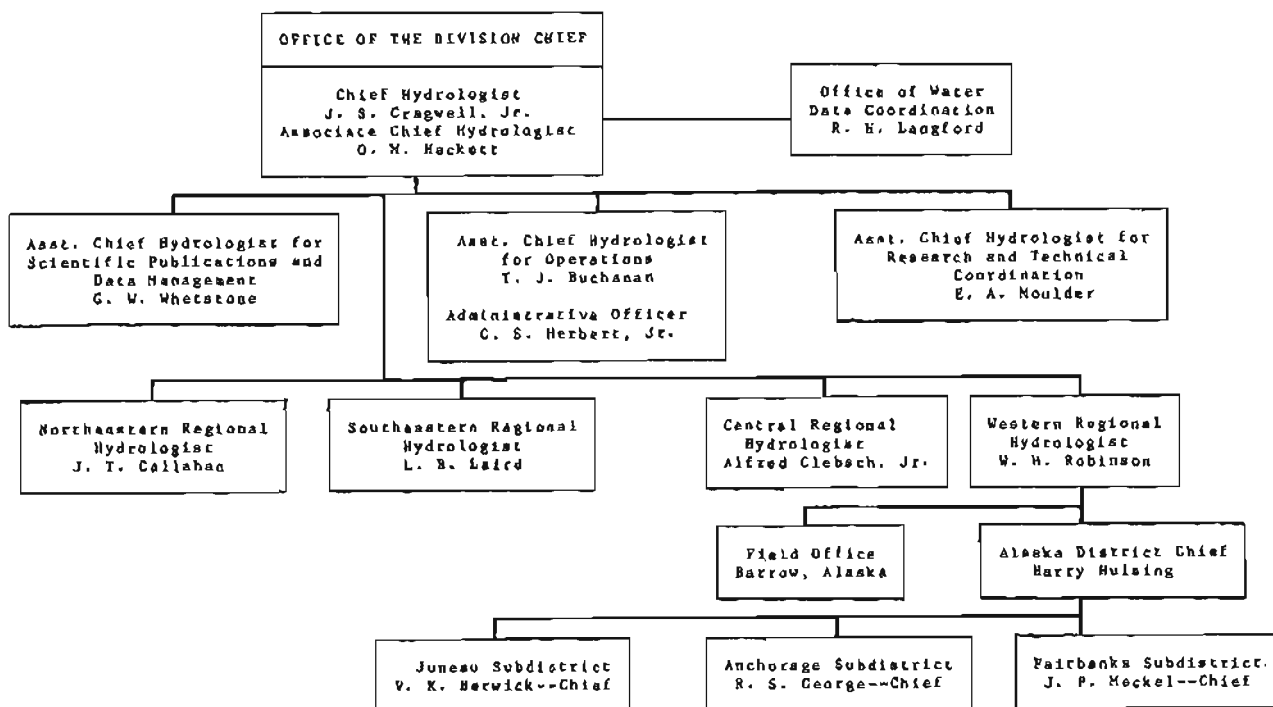


FIGURE 4.—Organization of the Water Resources Division.

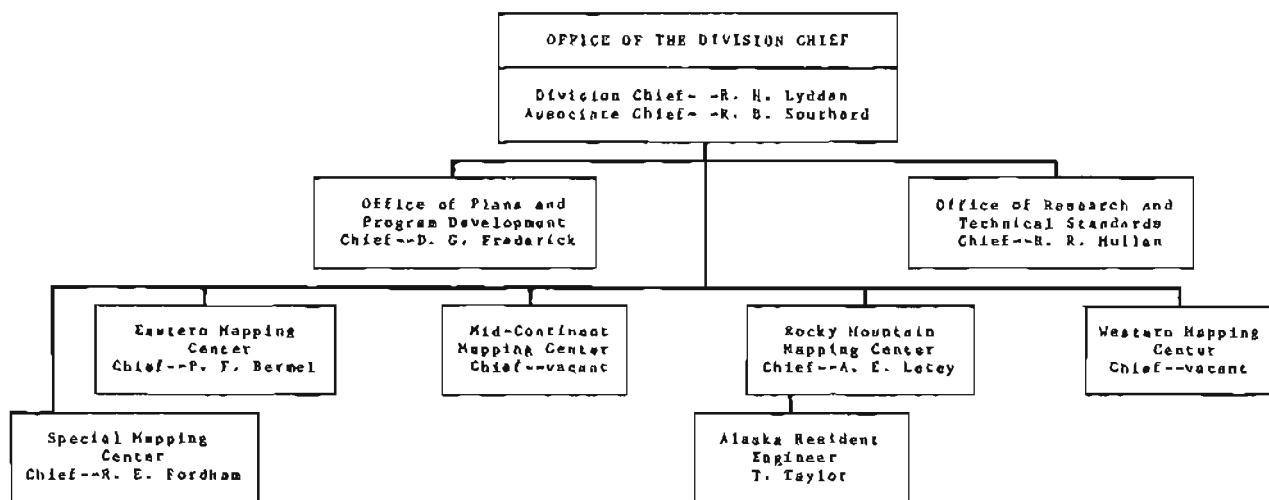


FIGURE 5.—Organization of the Topographic Division.

## WATER RESOURCES DIVISION

The Alaskan water resources program includes the collection, analysis, and interpretation of data on the availability and quality of surface and ground water and includes special studies and research that seek to evaluate and increase the effective use of water resources data in the State. These basic water data provide a broad base to support the proper management of the State's water and related land resources.

Investigations in the western United States, including Alaska, are under the jurisdiction of the Western Region office and are the responsibility of W. H. Robinson, Regional Hydrologist, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2337. The Anchorage District office is in the Skyline Building, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526, under the supervision of Harry Hulsing, District Chief. This office is operated on a year-round basis and is responsible for planning and supervising Alaskan activities.

The field activities of the Alaska District are a function of the three Subdistrict offices: Anchorage, Fairbanks, and Juneau. The Anchorage Subdistrict office is responsible for operations in south-central and western Alaska and is under the supervision of Raymond S. George. It is located at 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563. The Juneau Subdistrict office, which is responsible for operations in southeastern Alaska, is under the supervision of Vernon K. Berwick, and is located at 441 Federal Building, P.O. Box 1568, Juneau, Alaska 99801; (907) 586-7216. The Fairbanks Subdistrict office is responsible for operations in northern Alaska and is under the supervision of James P. Meckel. It is located at 310 First Avenue, Fairbanks, Alaska 99701; (907) 452-1951, ext. 176.

## PUBLICATIONS DIVISION

The Publications Division edits manuscripts of scientific papers and technical reports; reproduces topographic, geologic, and other maps; prepares exhibits and visual aids; disseminates general Survey program and publications information and distributes maps to the public. The Division maintains two offices in Alaska for the customers' convenience in obtaining maps, book reports, and other material prepared by the U.S. Geological Survey.

The Alaska Distribution Section at 310 First Ave., Fairbanks, Alaska 99701 (907) 452-1951, ext. 174, supervised by Natalie A. Cornforth under the direction of the Publications Division, Western Region, Menlo Park, Calif., distributes maps and map-related publications by mail and over the counter to the public, to 27 commercial dealers in Alaska, and to Federal and State agencies. A schedule of map prices and discounts is available on request.

A Public Inquiries Office, at 108 Skyline Building, 508 Second Ave., Anchorage, Alaska 99501; (907) 277-0577, supervised by Margaret I. Erwin under the direction of the Office of Public Inquiries, Publications Division, National Center, Reston, Va., maintains a stock of Alaska topographic and geologic maps for over-the-counter sale, and, as an agent of the Superintendent of Documents, sells Geological Survey book reports on Alaska. It serves as a public contact point for Survey activities in the State and has a complete library of all Survey publications. The office is a depository for Alaska open-file reports and maintains a browse file containing microfilms of LANDSAT (satellite) images. Itineraries and personnel lists of all field parties are prepared as early in each year as possible and are available at the Public Inquiries Office for consultation.

## ADMINISTRATIVE DIVISION

The Alaska Field Office of the Administrative Division is located at 204 Skyline Building, 218 E Street, Anchorage, Alaska 99501. This office, supervised by Betty J. McIntire, provides service and supply support to U.S. Geological Survey offices and personnel in Alaska; telephone number is FTS 265-4494, -5297 or commercial (907) 277-0569. A warehouse at Anchorage under the immediate supervision of Harvey Haynes is located about 5 miles east of downtown Anchorage, just inside the boundary of Elmendorf Air Force Base, telephone (907) 752-3834. The address is: 5500 Oilwell Road, Elmendorf Air Force Base, Anchorage, Alaska 99506. A warehouse for the Fairbanks area located at Ft. Wainwright is staffed only if warranted by the level of field activity. The telephone number at Ft. Wainwright is (907) 353-4219.

## EMERGENCY SEARCH AND RESCUE

To initiate search and rescue in cases of

emergency, contact the Air Rescue Coordination Center at Anchorage at any time during the day or night. Communications can be made directly to the center, telephone (907) 277-2131, 752-2426, 752-3437, through the Alaska Field Office, either telephone or radio (see section on "Radio Network"), nearest FAA Flight Service Station, military installation, or State Troopers. To the extent possible, specify location and nature of emergency, time of the accident, number of people involved, and the nature of the possible injuries.

For the purpose of notifying headquarters and family of any emergency as soon as possible, contact Betty McIntire at FTS 285-4494 or commercial (907) 277-0569. Outside of office hours contact her at (907) 272-5398.

#### ALASKA SURVEY COMMITTEE

The Alaska Survey Committee provides a means for discussion and coordination of Alaska activities; all divisions of the Geological Survey operating in Alaska are represented on the Committee. Joe Jones, Conservation Division, chairs the group for 1977; other members are Harry Hulsing, Water Resources Division; Thomas E. Taylor, Topographic Division; Margaret I. Erwin, Publications Division; Thomas P. Miller, Geologic Division; and Betty J. McIntire, Administrative Division.

#### RADIO NETWORK

Radio officer for Alaska is Florence Weber, Geologic Division, Fairbanks, Alaska 99708 (907) 479-7245. Two frequencies 5380 (5381.5) kHz and 3211.0 (3212.5) kHz (both upper SSB) are the official frequencies for U.S.G.S. personnel. For the 1977 field season, the U.S.G.S. base station in Anchorage, KWA 351, will monitor the above two frequencies during working hours. Alaska Public Fixed 5167.5 (5168.9) kHz will be monitored by commercial stations WKD 22 in Anchorage and KGA 85 "Broadmoor" in Fairbanks from 6:00 a.m. through 9:00 p.m. and 7:00 a.m. through 10:00 p.m., respectively.

During the present sunspot cycle, operators in Alaska will probably continue to find 3211 kHz the most reliable frequency for daytime use within 200 miles of a base station and 5380 kHz most reliable at greater distances. After dark, 3211 kHz will be the best all-distance frequency when skip is too long on 5380 kHz.

#### ALASKA CORE LIBRARY

In August and September 1976, the Geological Survey moved its collection of oil well samples from Fairbanks to Anchorage, as part of a long-range plan to develop a conveniently located and usable Alaska Core Library.

The nucleus of the Survey's Alaskan well archives is about 100 tons of cores taken in the late 1940's and early 1950's during exploration of Naval Petroleum Reserve No. 4 (NPR-4). In subsequent years some additional cores and larger holdings in cuttings were acquired from exploration wells on Federal land throughout the State, especially in the Cook Inlet, Alaska Peninsula and Gulf of Alaska basins. North Slope cores and cuttings should increase considerably during the next few years because of the transfer of NPR-4 to the Department of Interior on June 1, 1977.

The Alaska Core Library's new home is in three ex-military buildings located near the crest of Government Hill in Anchorage. The buildings were acquired from General Services Administration in the spring of 1976. Mrs. Betty J. McIntire, Administrative Division, directed a refurbishment program that was completed by mid-summer and included an architectural survey, repairs to heating, electrical and plumbing systems, and exterior painting and cleanup. Funds for the refurbishment were contributed by both Geologic and Conservation Divisions.

Windsor L. "Doc" Adkison, on loan from the Branch of Oil and Gas Resources, organized and directed the massive shipment of samples from Fairbanks to Anchorage. Steps involved in the move included repacking the NPR-4 cores in 3-foot cardboard boxes (from the original 5-foot wooden boxes), assembling the boxes on pallets, and loading them into vans for shipment on The Alaska Railroad. The core racks at Fairbanks were disassembled and shipped to Anchorage where they were modified to fit 3-foot boxes prior to being set up in the Government Hill facility.

The Branch of Alaskan Geology manages the Alaska Core Library on behalf of a user board whose members are: Branch of Alaska Geology, Branch of Oil and Gas Resources, Conservation Division, and Office of National Petroleum Reserve in Alaska.

It will be several months before the Library is able to accommodate general Survey or public usage. Much reorganization and consolidation of samples remain to be accomplished, two of the

buildings lack plumbing and heating, and a permanent curatorial staff will not be assembled until mid-1977. Perhaps by mid-summer, the Alaska Core Library will be open for business.

#### LAND INFORMATION AND ANALYSIS OFFICE EROS PROGRAM

The EROS (Earth Resources Observation Systems) Program was established by the U.S. Department of the Interior in 1966 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 remote-sensing data acquired by aircraft and space craft, particularly in LANDSAT Satellite. The EROS Program is managed by the U.S. Geological Survey and directed by John N. Denoyer, with headquarters at EROS Program, U.S. Geological Survey, 1925 Isaac Newton Square East, Reston, Va. 22090; (703) 860-7881 to -7885.

EROS Data Center, Sioux Falls, S. Dak. 57198; (605) 594-6511, is responsible for distributing LANDSAT imagery and other remote-sensing data to users throughout the world as well as developing techniques of application of remote sensing to various resource problems and assisting users in employing these techniques. A large staff of specialists in a variety of disciplines is available to assist in the development of new applications. Inquiries on specific problems or other matters, including future training opportunities, may be directed to the Applications Assistance Branch of the Data Center.

In November 1974, an EROS Applications Assistance Facility was established in Alaska to improve the availability of technical assistance to Alaskan users. This facility, located at the Geophysical Institute, University of Alaska, Fairbanks, Alaska 99708; (907) 479-7487, was initially established by NASA to provide assistance to Alaskan ERTS-1 investigators and is now being operated under contract to the EROS Program to provide assistance to the entire Alaskan user community. The facility is supervised by Albert E. Belon, under the general direction of John M. Miller. Both standard and sophisticated interpretation equipment, including a color additive viewer and minicomputer enhancer, are available. In addition, files are maintained on selected LANDSAT imagery, NASA and other aerial photography, and other remote-sensing data on various parts of Alaska.

A LANDSAT browse file is maintained at the University of Alaska's Arctic Environmental Information and Data Center (AEIDC), located at 707 A Street, Anchorage, Alaska 99501; (907) 279-4528. Visitors may look at black and white imagery (scale 1:1,000,000) which represents all areas covered in Alaska. Complete U.S. and non-U.S. coverage is available on microfilm.

Alaskan LANDSAT imagery is also available for inspection at the Public Inquiries Office, U.S. Geological Survey, Rm. 108, Skyline Building, 508 Second Ave., Anchorage, Alaska 99501.

#### GEOGRAPHY PROGRAM

As part of the Geography Program, the U.S. Geological Survey plans to provide land-use and land-cover maps for the entire United States on a systematic and comprehensive basis. A classification system has been developed by the Geological Survey in conjunction with other Federal and State agencies (Anderson, J. R., Hardy, E. E., Roach, J. T., and Witmer, R. E., 1976, A land-use and land-cover classification system for use with remote sensor data: U.S. Geol. Survey Prof. Paper 964, 28 p.). In Alaska, mapping of the Fairbanks ( $1^{\circ}\times 3^{\circ}$ ) quadrangle has been completed, and the map will be released to open file in early 1977 at 1:250,000 scale.

Research efforts are underway in the Geography Program to develop techniques for producing land-use and land-cover data and maps from LANDSAT computer-compatible tape digital data. LANDSAT data are first classified by computer processing. Sites of typical land-use and land-cover are identified in the field and then spectrally and geographically related to the LANDSAT data. The necessary preliminary fieldwork has been accomplished for applying such techniques to the Anchorage-Kenai region, and several  $1^{\circ}\times 3^{\circ}$  1:250,000-scale quadrangles are planned for production in 1977.

In another Geography Program research project, the onshore land-use and land-cover impact of offshore oil and gas development in three separate test sites is being evaluated by Harry F. Lins. The Cook Inlet area is one of these sites. Aerial photography is being analyzed to document land-use and land-cover changes resulting from offshore development. Commercial, residential, and institutional development in the town of Kenai was documented and studied, as well as the industrial development of Nikiski. The Cook Inlet

area was chosen as a test site because it was a frontier area with respect to energy development, and the land-use and land-cover changes that occurred in Kenai were almost entirely a result of the offshore oil and gas industry activity. Research results will be submitted to the U.S.G.S. Journal of Research.

For information on these programs, contact James R. Anderson, Chief, Geography Program, U.S. Geological Survey, 710 National Center, Reston, Va. 22092.

## ALASKAN PROJECTS OF THE U.S. GEOLOGICAL SURVEY

Much of the work of the Geological Survey is organized and accomplished in projects in which the investigations of one or more scientists, engineers, and technicians are directed by a project chief. Some of the projects are statewide in scope, but most focus on one or more aspects of topography, hydrology, or geology in particular parts of Alaska. The regions into which Alaska is divided for this report are shown in figure 6; project locations are shown in figures 7-15. This chapter summarizes statewide and regional Survey projects active during 1976. Summarized in a later part are projects undertaken in cooperation with various other Federal, State of Alaska, and local agencies. Projects in more than one region, but not statewide in scope, are shown on maps and tables for all regions covered, with a summary given in the primary region.

### STATEWIDE PROJECTS

*Project:* Mineral resources of Alaska.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Edward H. Cobb, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2213.

*Project objectives:* As a continuing project, office studies of mineral occurrence data are to be kept current and special-purpose maps, reports, and reference lists to be prepared whenever the need becomes apparent. Data are to be so organized that they can be entered into computerized storage and retrieval banks by the Alaskan Branch information processing project (Elizabeth Young, project chief).

*Project status:* As this is a continuing project, no percentage-of-completion data are applicable. Records are now current as of December 31, 1975, and will be current as of December 31, 1976, early in 1977.

*Project:* Technical Data Unit.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Mary E. Tailleux, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2342.

*Project objectives:* The Technical Data Unit aims to provide prompt, complete, and up-to-date listings of all geologic data published on Alaska by the U.S. Geological Survey, the U.S. Bureau of Mines, and the State of Alaska Division of Geological and Geophysical Surveys and to fill requests for copies of open-file reports of the Alaskan Geology Branch and other Menlo Park U.S. Geological Survey Branches doing research in Alaska.

*Project status:* As this is a continuing project, no percentage-of-completion data are applicable. Requests for information are filled as received.

*Project:* Alaskan Branch information processing.  
*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Elizabeth Yount, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2477.

*Project objectives:* This is an ongoing project aimed at providing computer-based technical data files, maintaining contact with other agencies that compile or create files of Alaskan geologic or resource data, and providing training, assistance, and documentation when needed. This year special emphasis is being given to the computer files of Alaskan geochemical analyses. Stored in Denver using a file system called RASS, the files are being updated and augmented to provide a better tool for the current mineral resource assessment of Alaskan lands. Methods of access and manipulation of data in these files are being improved.

*Project status:* The updating of RASS geochemical files is well underway in Menlo Park as well

TABLE 1.—Statewide projects

Name of project; map key	Personnel	Type of work	Area
Mineral resources of Alaska	E.W. Cobb	Office studies, compilation	Statewide
Technical Data Unit	M.E. Tailleux, Elias Xendajas	Supply data to Geological Survey personnel and to general public	Statewide
Alaskan Branch information processing	Elizabeth Young	Creation, maintenance and promulgation of computer banks of geologic data	Statewide
Alaska Mineral Resource Assessment Program (AMRAP); fig. 8	H.C. Berg and other Geologic Division personnel	Appraisal of mineral resources through geologic mapping and geophysical and geochemical analyses	Statewide
Landuse imagery and applications in Alaska (AMRAP)	W.R.D. Albert, W.C. Steele, J.R. LeCompte, and Topographic Division personnel	Interpretation of Landuse imagery in support of AMRAP systematic and synoptic objectives	Statewide
Geochronology and geochemistry of igneous rocks and related ore deposits	M.L. Silberman	Study mineralized and unmineralized plutons, stocks and related volcanic rocks	Statewide
Southeastern Alaska geochronology	J.C. Smith	K-Ar dating of igneous rocks	Southeastern Alaska and Talkeetna Mountains, Tansboro, Goodnews, and Big Delta quadrangles
Arctic environmental studies program; fig. 9 (area 7), (17), fig. 10 (3), (6), fig. 13 (14)	O.J. Ferraro, Jr. and other Geologic and Water Resources Division personnel	Field and office collection and use of geotechnical data related to transportation corridors and other areas of development	Statewide
Pipeline environmental and geotechnical resources (Arctic environmental studies program)	K.M. Blean	Collection, storage and retrieval of geotechnical data	Statewide
Arctic engineering geology (TAPS); fig. 7 (1)	A.T. Owenshine and other Geologic and Water Resources Division personnel	Collection of basic data and report preparation	Trans-Alaska pipeline corridor, Prudhoe Bay to Valdez
Hydrologic environment of the trans-Alaska pipeline system (TAPS); fig. 7 (1)	J.M. Childers	Operation of basic-data network of stream-gages and water-quality monitoring sites, studies of hydrologic hazards such as glaciers, icings, floods, and channel erosion, assessment of impact on hydrology	Trans-Alaska pipeline corridor, Prudhoe Bay to Valdez
Alaska earthquake hazards; fig. 7 (2)	George Plafker	Evaluation of risk from tectonic displacement, seismic shaking and secondary geologic effects	Statewide, especially southern and southwestern Alaska
Geologic/tectonic map of the Arctic	Michael Charlin, Jr.	Map compilation	All areas bordering Arctic Ocean
Alaska geothermal	T.F. Miller, R.L. Smith	Geologic mapping, geochemical and geophysical studies	Interior Alaska, Aleutian Islands, Alaska Peninsula, Wrangell Mountains



TABLE 1.—Statewide projects—Continued

Name of project; map key	Personnel	Type of Work	Area
Tin, tungsten, and molybdenum deposits in Alaska; fig. 7 (area 3), (4)	Travis Hudson	Geologic mapping, geochemical analysis	Statewide, especially Healy and Ketchikan quadrangles
Precambrian of Alaska	C.O. Sberleis, H.A. Lanphere	Map compilation	Statewide
Environmental geology of Alaska coal lands	H.R. Schmitt, L.A. Yehle, R.A. Farrow	Literature research, field and aerial-photographic mapping, primarily of surficial deposits, with environmental interpretations	Statewide, with emphasis in Susitna Valley
Alaska gravity surveys	D.F. Barnes	Gravity surveys in support of AMRAP and Glacier Bay projects	Statewide
Potential uranium resources in Tertiary basins in Alaska	K.A. Dickinson	Stratigraphic studies, geochemical analyses	Statewide, with present emphasis in Cook Inlet area
Glaciology studies; fig. 7 (5), (6), (7), (8)	L.R. Mayo	Studies of ice physics, motion, balance, aerial monitoring	Columbia, Gulkana, Black Rapids, Wolverine Glaciers, statewide photography
Alaska ground-water appraisal	Chester Zedeno	Summary of State's ground-water resource	Statewide
Arctic water resources and environmental studies	J.M. Childers	Investigations of arctic Alaska water resources, hydrologic hazards to development and potential impacts on water resources resulting from potential development	Arctic and subarctic Alaska

as Denver. Priority is being given to updating records of stream sediment analyses from central Alaska, including the Yukon-Kuskokwim delta region. By April, it is expected that the files will be reasonably complete for that region, in time to provide data for the 1:1,000,000-scale mineral appraisal being conducted for AMRAP. Updating and augmenting will expand subsequently to the files covering the rest of Alaska. It is anticipated that the entire process can be completed in slightly more than a year.

**Project:** Alaska Mineral Resource Assessment Program (AMRAP).

**Region:** Statewide.

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Program manager:** Henry C. Berg, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2266.

**Project objectives:** In 1976 public and private concern about the classification, allocation, and development of Alaska's vast lands and natural resources burgeoned. In response to this concern, the Alaska Mineral Resource Assessment Program (AMRAP) in 1976 set two closely coordinated and interdependent objectives designed specifically to furnish information for decisions about Alaska's lands (table 2; figure 8). One objective, based on a 1:250,000-scale quadrangle format, is a systematic statewide assessment of terranes having high economic mineral potential. The other objective, based on a 1:1,000,000-scale map format, is a synoptic mineral appraisal of the 83.47 million acres proposed for classification as National Interest (d-2) lands under the Alaska Native Claims Settlement Act (ANCSA). This objective, informally termed "RAMRAP" (Regional AMRAP), is scheduled for completion by early 1978, about a year in advance of the December 1978 deadline for final Congressional action on ANCSA.

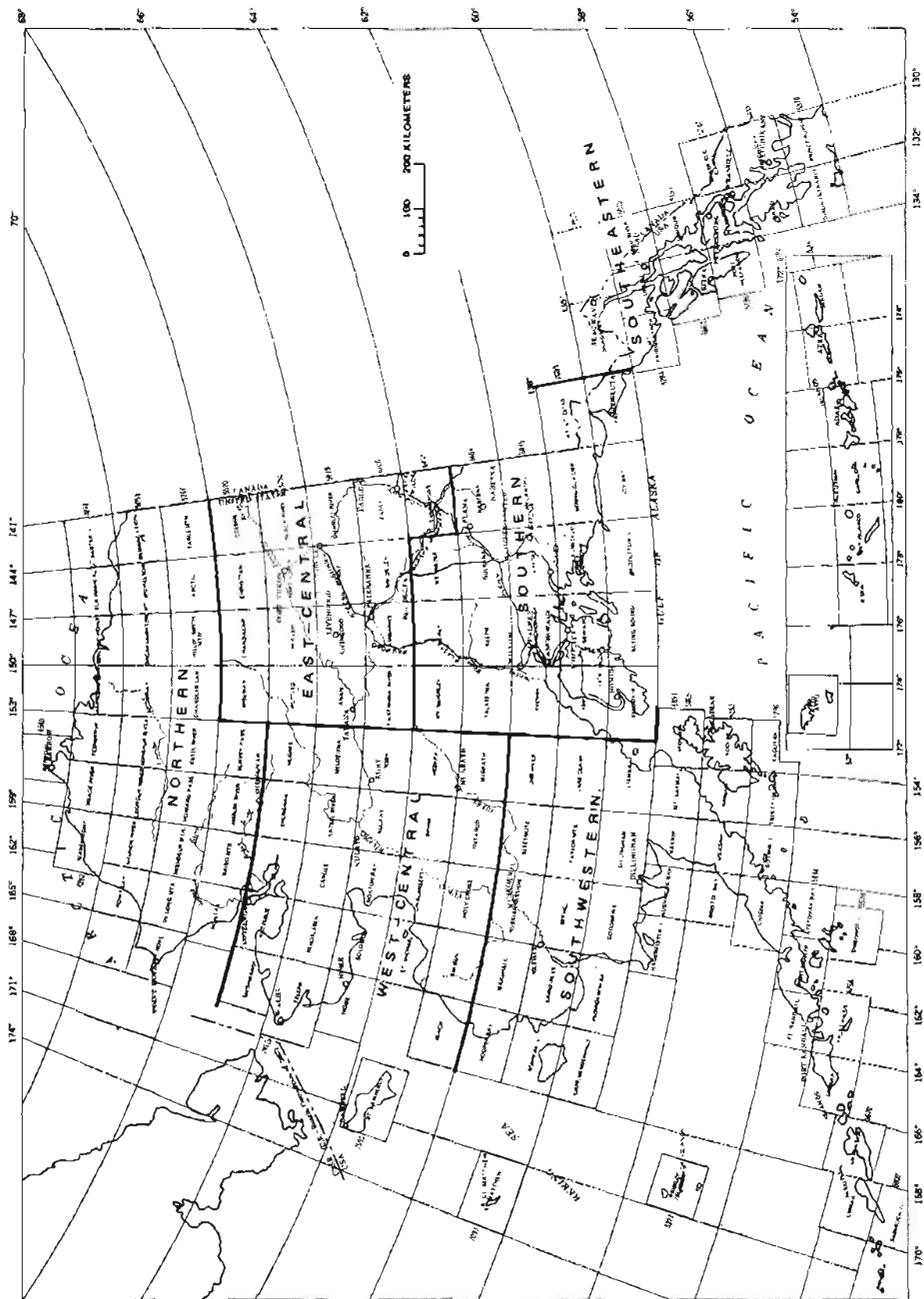


FIGURE 6.—Regions of Alaska used in this report.

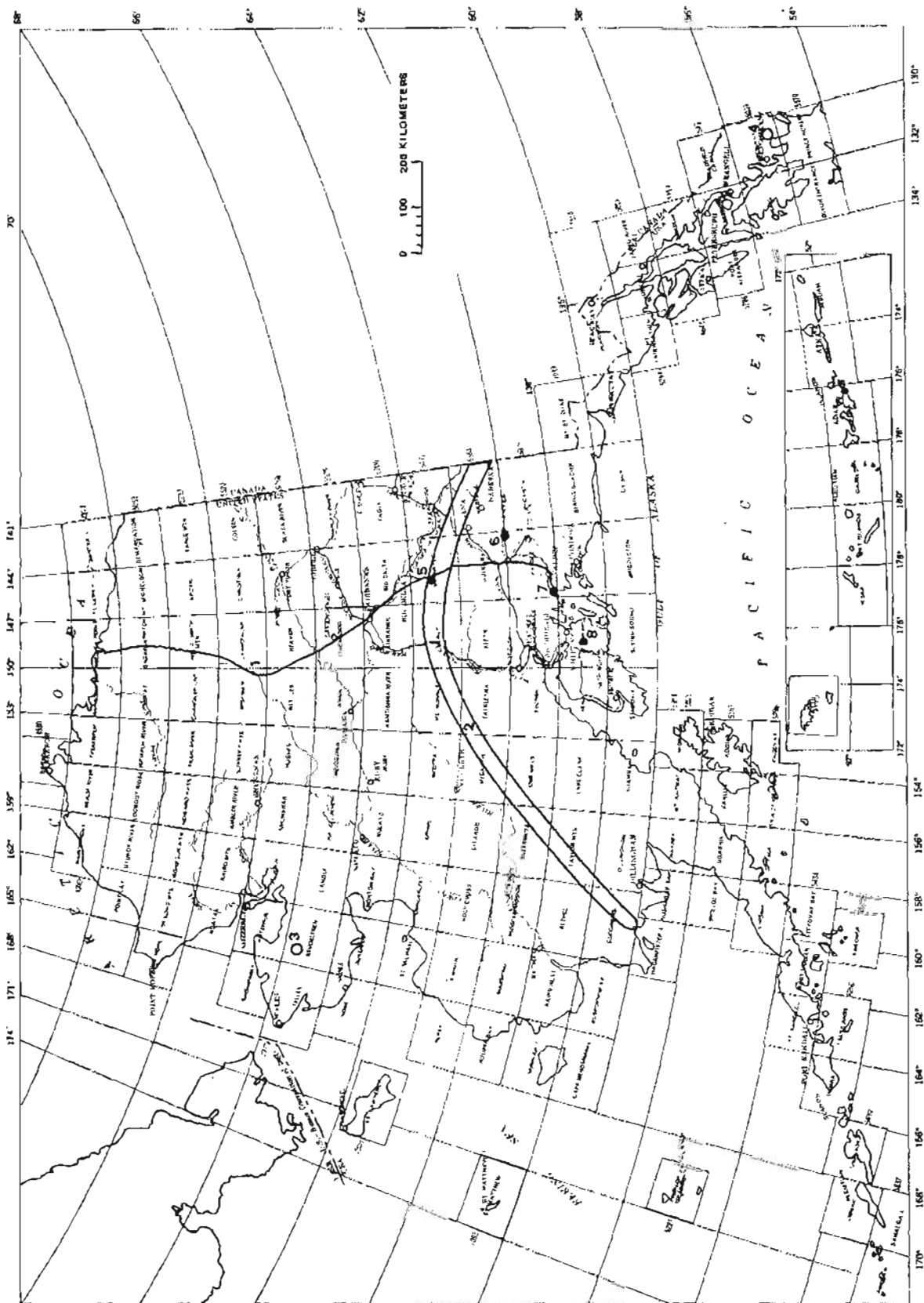


FIGURE 7.—Locations of statewide projects.

TABLE 2.—Alaska Mineral Resource Assessment Program (AMRAP)

	Quadrangles	Regions
Objective	Systematic statewide mineral resource assessment (MRA)	Synoptic mineral resource assessment of proposed National Interest (d-2) lands ("RAMRAP")
Area (million acres)	375 (86.3 in the quadrangles listed on figure 8)	83.47
Deadline	Indefinite	Early 1978
Adequacy <sup>1/</sup>	Level II	>Level I, <Level III
Method Scope & staff	Systematic assessment of Alaskan lands having high mineral resource potential; multidisciplinary MRA teams; 25 quads scheduled 1974-1978	Synoptic; d-2 intensive; Regional coordinators + assistants + appropriate consulting specialists for the designated regions: N. Alaska, C. Alaska, S. Alaska, Seward Peninsula
Scale	1:250,000	1:1,000,000
Activity	Field and laboratory studies in all research components	Phase I: Compilation of available information Integration of new information from current Alaskan field and laboratory investigations Acquisition of Landsat imagery Acquisition of selected geophysical surveys Phase II: Interpretation and synthesis
Research components	Geology, geochemistry, geophysics (aeromagnetics, gravity), telegeology, economic geology, mineral economics	Economic geology, geophysics, telegeology, geochemistry, mineral economics
Products	For each quadrangle, a folio of 1:250,000-scale maps and report (Circular) giving background information and summary of results	Phase I: Basic Data Package: For each region, a folio of 1:1,000,000-scale maps and Landsat image, and a pamphlet giving background information Phase II: Interpretation and synthesis: For each region, a report assessing the mineral resources of proposed National Interest (d-2) lands
Uses	Develop technique for synoptic (d-2 intensive) mineral resource assessment. High d-2 impact Provide nuclear areas of intensive studies for extension into adjacent areas of reconnaissance studies. High d-2 impact New information for incorporation into synoptic (d-2 intensive) MRA. High d-2 impact Resource information for governmental decisions on classification and allocation of Alaskan lands having high potential for undiscovered mineral resources Mineral inventory for planning national minerals policy Information for state, business, and native interests to plan orderly and efficient development of a mineral industry in Alaska Publicize new mineral exploration technology that might result from AMRAP	Information for Department of Interior and for Congressional action on classification and allocation of National Interest (d-2) lands proposed under ANCSA

<sup>1/</sup> Adequacy levels are defined in U.S. Geol. Survey Prof. Paper 940, p. 18-19. Level I studies include compilation of published and unpublished references and records to provide enough data to delineate areas that are known to have promising mineral potential. Level II studies include reconnaissance mapping, remote sensing, and sampling of broad areas and provide results adequate for making land-use decisions regarding mineral potential. Potential targets for detailed studies or exploration for future development may be designated.

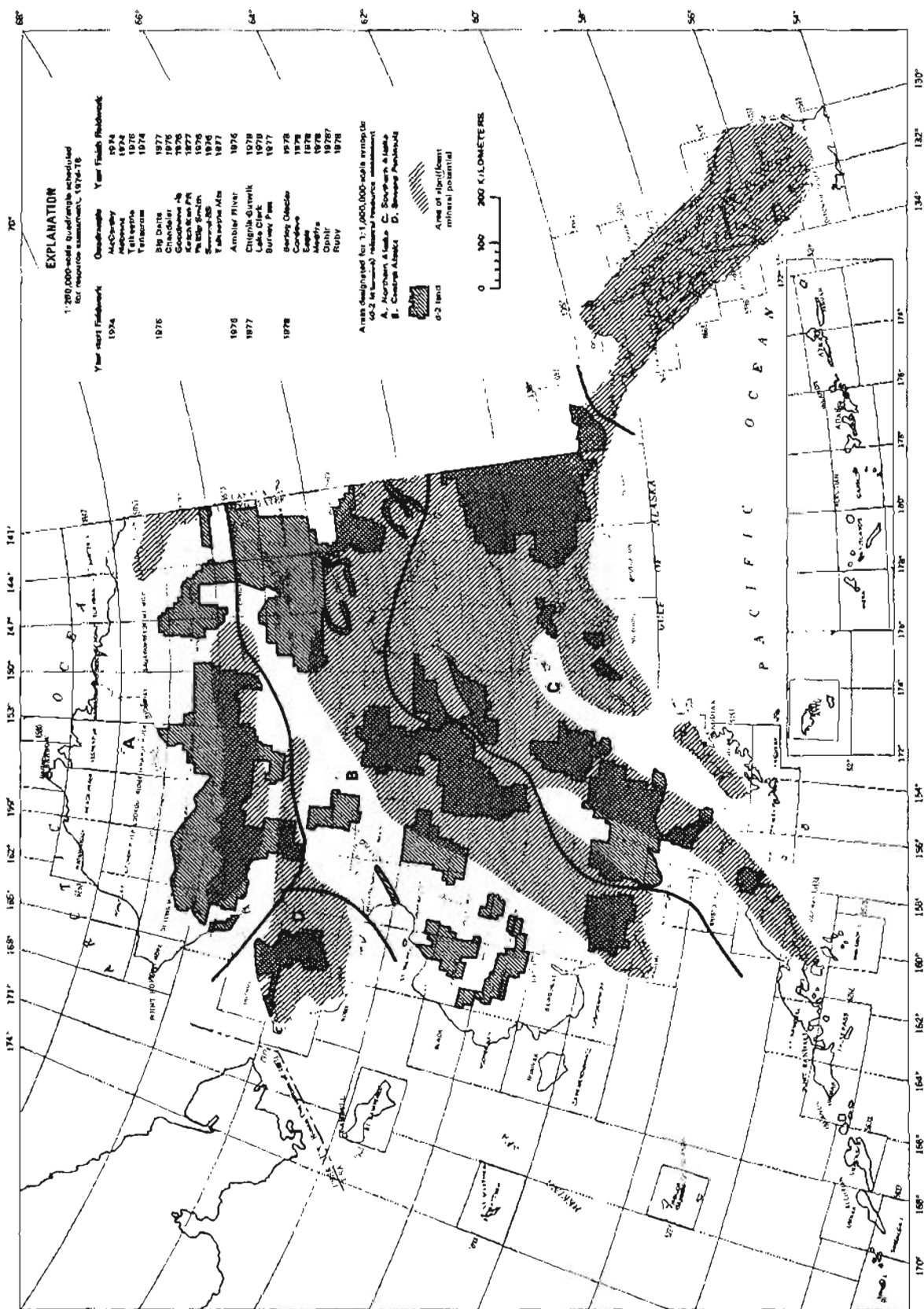
This multidisciplinary program is being carried out mainly by geologists and subprofessionals in the Branch of Alaskan Geology, in collaboration with specialists from other branches in the Geologic Division. In addition, several geoscientists from the Alaska Division of Geological and Geophysical Surveys, the

University of Alaska, and the Bureau of Mines also are participants.

#### Project status:

##### Systematic objective:

1. Field and laboratory studies leading to resource assessment are completed in eight 1:250,000-scale (1°×3°) quadrangles.



gles and underway in five others. These quadrangles total approximately 36.7 million acres, of which 8.3 million acres has been proposed for classification as National Interest (d-2) lands.

2. Mineral resource assessment (MRA) folios are published or in press for Tanacross and McCarthy quadrangles. They encompass about 8.8 million acres, of which 3.4 million is proposed as d-2.
3. More than 20 other AMRAP-sponsored topical research reports on the geology, geochemistry, geophysics, and mineral resources of Alaska are published (see, for example, U.S. Geological Survey Circulars 733 (1976) and 751-B (1977)).
4. New potential resources of molybdenum, chromite, gold, and tin were discovered in the Talkeetna quadrangle.
5. Significant increases were recognized in size of resources of copper in the Ketchikan and Talkeetna Mountains quadrangles.
6. A potentially economic porphyry molybdenum deposit was discovered near Burroughs Bay in the Ketchikan quadrangle. This deposit was staked by commercial interests in 1976.
7. Other important results of mineral resource investigations carried out under AMRAP are summarized in descriptions of individual quadrangles and of other AMRAP activities elsewhere in this report.

**Synoptic objective:**

Plans include compilation and synthesis (Phase I on table 2) of basic geologic, geophysical, geochemical, and Earth satellite data for resource assessment of the 83.47 million acres of proposed National Interest (d-2) lands. About half of Phase I was completed as of January 1, 1977.

**Project:** LANDSAT imagery and applications in Alaska (AMRAP).

**Region:** Statewide.

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project Chief:** N.R.D. Albert, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2025.

**Project objectives:** The principal objectives of this project are: (1) to furnish AMRAP team leaders and principal investigators with LANDSAT materials for reconnaissance purposes; (2) to provide unique geologic, structural, and tectonic information relevant to mineral resource assessment for each AMRAP quadrangle; (3) to construct a controlled 1:1,000,000-scale Lambert conformal false-color LANDSAT mosaic for each of the synoptic mineral-resource assessment areas (RAMRAP); and (4) to provide additional geologic, structural, and tectonic information for each RAMRAP area that may not be obtained by other methods. The types of LANDSAT products used are: (1) black and white, single-band LANDSAT mosaic of Alaska; (2) computer-enhanced false color, color ratio, simulated color and first-derivative black and white images; and (3) interactive computer displays allowing detailed analysis of specific areas.

**Project status:** The Nabesna and McCarthy quadrangle studies have been completed and published. The Tanacross quadrangle manuscript is in review. Computer-compatible tapes for 10 other quadrangles are being processed at the Center for Astrogeology, Flagstaff, Arizona. Images for Talkeetna quadrangle have been processed and are undergoing analysis. Analysis of images for the Chandalar quadrangle will commence upon completion of computer processing.

Over 130 Landsat images have been selected for use in the 1:1,000,000-scale false-color mosaic. Mockup mosaics of the RAMRAP areas have been constructed. Photogrammetric control has been established for all images; rectification of images in the northern region will be necessary. Color image production will be handled by one of several commercial photographic laboratories presently conducting tests to determine optimum techniques.

**Project:** Geochronology and geochemistry of igneous rocks and related ore deposits in Alaska.

**Region:** Statewide.

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** M.L. Silberman, U.S. Geological Survey, 345 Middlefield Road, Menlo Park,

Calif. 94025; (415) 323-8111, ext. 2675.

*Project objectives:* The objective is to study, within Alaska, both mineralized and unmineralized plutons, stocks, and related volcanic rocks in mining districts and AMRAP project areas to ascertain: (1) the chemical and mineralogic nature of the igneous rocks; (2) the origin of the igneous rocks; (3) the relationships in space and time between the igneous rocks and associated ore deposits that bear on the genesis of the ore deposits; and (4) the regional history of Paleozoic, Mesozoic, Cenozoic, and magmatism. Accomplishment of these basic objectives will lead to development of criteria for exploration to locate new ore deposits. Recognition of areas favorable for location of new ore deposits and evaluation of mineral potential of areas known to have them are hampered by lack of knowledge of how and why ore deposits form. Knowledge of the role of igneous rocks in ore-forming processes is vital to understanding ore genesis. Spatial association alone suggests an important causative relationship which should be evaluated.

*Project status:* The project officially became active in October 1976, but the project leader has worked on these objectives for 3 years under the AMRAP program. Accomplishments in 1976 include: (1) location of an area of possible subsurface porphyry copper mineralization in the Willow Creek mining district, in the southern Talkeetna Mountains; (2) completion of a geochronological study of porphyry copper and molybdenum mineralization in granitic rocks of the Nabesna and Klein Creek batholiths; (3) completion of a stable isotope and geochronological study of the Kennecott massive sulfide deposits; and (4) refinement of ages of plutonic rocks of granitic to gabbroic composition in the McCarthy quadrangle.

*Project:* Southeastern Alaska geochronology.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* James G. Smith, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2484.

*Project objectives:* The principal objectives of this project are: (1) to use K-Ar dating techniques to help unravel the geologic history of the Coast

Range plutonic metamorphic complex and the age of ore deposits in southeastern Alaska, and (2) to assist other geologists in solving their geochronology problems. This help includes advice as well as determination of K-Ar ages on minerals and rocks from all of Alaska on a limited service basis. For this year, more than half of the project's dates were from areas outside southeastern Alaska, chiefly AMRAP quadrangles.

*Project status:* Fieldwork in southern southeastern Alaska is largely complete. A report on the intrusive and metamorphic history of the Coast Range in the Ketchikan area, based on the K-Ar data, is in preparation. Other problems currently under study include: age of Tertiary volcanic rocks in the Talkeetna Mountains; age of plutonic intrusions in Tanacross and Big Delta quadrangles; time of emplacement of ultramafic rocks in Big Delta quadrangle and Tracy Arm area; and timing of latest movement on the Togiak-Tikchik fault.

*Project:* Arctic Environmental Studies Program.

*Region and map keys:* Statewide; fig. 9 (7), (17); fig. 10 (5), (6); fig. 13 (14).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Program manager:* Oscar J. Ferrians, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2247.

*Project objectives:* Objectives are: (1) to investigate energy-related transportation corridors and other areas of development in Alaska in order to obtain base-line geotechnical data needed to aid in planning, designing, operating, and maintaining engineering structures so that adverse environmental impacts will be minimized; to evaluate feasibility of proposed engineering projects; and to prepare comprehensive Environmental Impact Statements; (2) to collect and synthesize pertinent engineering-geologic data made available during construction of the trans-Alaska oil pipeline with special emphasis being given to the character and distribution of surficial deposits and permafrost, Pleistocene and Holocene stratigraphy, glacial chronology, periglacial features, seismic phenomena, and

geologic processes that are either unique to or especially active in the arctic environment; and (3) 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.

*Project status:* This program includes the following activities: (1) reconnaissance engineering-geologic investigations of the Arctic Coastal Plain between Prudhoe Bay and the Canadian border; (2) reconnaissance surficial and engineering-geologic mapping of the central Brooks Range; (3) 2-year seismic study of northeastern Alaska; (4) exchange program with Soviet scientists and engineers in regard to pipelines, permafrost, and environmental protection; (5) reconnaissance surficial and engineering-geologic mapping of the transportation-development corridor between Fairbanks and the Canadian border along the Tanana Valley; and (6) collection of pertinent geotechnical data made available during construction of the trans-Alaska oil pipeline. This program is scheduled for completion in 1982.

*Project:* Pipeline Environmental and Geotechnical Resources (Arctic Environmental Studies).

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Kathleen M. Blean, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2832.

*Project objectives:* The primary objective is to collect engineering-geologic data that have been and continue to be made available during the development of transportation corridors throughout the state of Alaska. A second objective includes development of methods of storage and retrieval of these data to allow quick recovery of specific information for evaluation. Immediate access to this type of data is invaluable

in planning for development of new transportation corridors, as well as in observations of operations and maintenance phases of already existing corridors and facilities.

*Project status:* The primary emphasis in the first year of this project has been on collection and organization of reference materials used in preparation of environmental impact statements for the trans-Alaska oil pipeline and the proposed natural gas pipelines. These materials have been moved to a central location, in Menlo Park, and a computer-based bibliography has been prepared. Continuing efforts include acquisition of all available new materials, including published and unpublished books and maps, air photographs, and soil boring logs, and development of a data base for storage and retrieval of all available engineering-geologic data from Alaska and other arctic and subarctic areas.

*Project:* Arctic Engineering Geology (TAPS).

*Region and map key:* Statewide; fig. 8 (1).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* A. T. Ovenshine, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2231.

*Project objectives:* The principal objectives of this project include: (1) for the Technical Advisory Board to the Department of the Interior Task Force on Oil Development and for the Federal Task Force on Alaskan Oil Development, review reports and proposals concerning the trans-Alaska Pipe System (TAPS) in terms of their accuracy and merit, prepare (in collaboration with other government agencies) an Environmental Impact Statement, prepare and review environmental and technical stipulations controlling the planning, construction, and operation of the proposed pipeline, and make recommendations in regard to possible alignment changes and special engineering-geologic problems; (2) collect, synthesize, and prepare for publication engineering-geologic data that will aid in determining the proper route, design, construction, and maintenance of TAPS and that will provide similar aid to other engineering activities generated by the petroleum-related development of northern Alaska; (3) collect and synthesize basic geologic data concerning the character and distribution



of permafrost, surficial deposits, and bedrock along the pipeline route; (4) evaluate new techniques, such as remote sensing, that will aid in the rapid determination of the distribution and character of permafrost and other geologic-environmental features and consequently will facilitate solving engineering-geologic problems.

*Project status:* Most of the objectives of this project have been accomplished. More than 50 reports have been published including the Environmental Impact Statement, Environmental and Technical Stipulations, and preliminary engineering-geologic maps of the entire pipeline route. Current activities emphasize the collection of basic geologic, seismic, and hydrologic data that are important to the proper construction and safe operation of the pipeline.

*Project:* Hydrologic environment of the trans-Alaska pipeline system (TAPS).

*Region and map key:* Statewide, Prudhoe Bay to Valdez; fig. 8 (1).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* J. M. Childers, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Project objectives:* This project assesses the hydrologic impact of the trans-Alaska pipeline system (TAPS). A basic-data network of stream-gaging and water-quality monitoring stations will be maintained and operated to provide records of hydrologic conditions along the TAPS route throughout the life of the pipeline. Hydrologic hazards including floods, icings, glaciers, and channel erosion and their interactions with TAPS will be studied. Stream, lake, spring, and aquifer characteristics will be evaluated for assessing potential development impacts associated with TAPS. The studies will provide technical information on interactions of hydrologic processes, some of which are identified by the National Academy of Sciences, Committee on Permafrost and reported in "Opportunities for Permafrost-related Research Associated with the Trans-Alaska Pipeline System," published in 1975.

*Project status:* This project, begun in 1970, is planned for continuation through the construction and early operation phases of TAPS. Basic

water data are published in the Alaska District annual basic-data reports. The project has begun 31 additional reports, 23 of which have been published (1 in 1976).

*Project:* Alaska earthquake hazards.

*Region and map key:* Statewide; fig. 8 (2).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* George Plafker, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2201.

*Project objectives:* The overall objective of this project is 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.

*Project status:* The project is a 5-year program; fieldwork to be completed by September 1977 and final reports prepared by 1978. The 1976 fieldwork focused on the study of surficial features associated with all parts of the Totschunda and Denali fault systems in southern and southwestern Alaska. In addition, the McGinnis Glacier, Donnelly Dome, Granite Mountain, Shaw Creek, Healy Creek, and Pass Creek faults were also examined. The primary objective of the fieldwork was to determine the nature, amount, and age of recent displacements, if any, on these structures. These studies complete major project field investigations in southern Alaska. Remaining fieldwork is to be completed during the 1977 field season and is to include reconnaissance study of faults with known or suspected recent displacement in east-central Alaska, the southern Brooks Range, and Seward Peninsula. Several maps and reports have been completed, and others are being prepared.

*Project:* Geologic-tectonic map of the Arctic.

*Region:* Statewide and other areas bordering Arctic Ocean Basin.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Michael Churkin, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2256.

*Project objectives:* The objective is to compile a geologic-tectonic map of the Arctic region at the scale of 1:5,000,000. The map will emphasize features critical to understanding the plate-tectonic history of the Arctic and will provide a comprehensive view of the entire Arctic so that detailed studies of specific areas in Alaska underway or contemplated can be placed in perspective.

*Project status:* A preliminary tectonic map of Alaska showing age and type of basement rocks has been compiled. Work on areas of the Arctic outside the United States is awaiting receipt of papers for an internationally authored new book on the Geology of the Arctic Ocean Basin.

*Project:* Alaska geothermal.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Thomas P. Miller, U.S. Geological Survey, 1209 Orca St., Anchorage, Alaska 99501; (907) 272-8228.

*Project objective:* The objective is to evaluate the geothermal resources of Alaska through geologic, geochemical, and geophysical studies of hot springs and areas of recent volcanism.

*Project status:* Fieldwork is complete, and the final reports are in preparation.

*Project:* Tin, tungsten, and molybdenum deposits in Alaska.

*Region and map keys:* Statewide; fig. 8 (3), (4).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Travis Hudson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2134.

*Project objectives:* The primary objectives of this project are to determine the age, petrology, geochemistry, and origin of the tin-granite complex of the Serpentine Hot Springs area, Seward Peninsula, Alaska and its relationship to associated mineralization. In addition, the project is to identify the general nature of tungsten and molybdenum deposits throughout Alaska.

*Project status:* The project is to be completed by January 1978. A report on the results of a detailed study of the tin-granite complex of the

Serpentine Hot Springs area (Seward Peninsula) has been prepared; strontium and stable isotope studies of this complex are continuing and several additional reports are planned. Intrusive rocks associated with the Wilson Arm molybdenite deposit, southeastern Alaska, were examined and sampled during the 1976 field season in order to identify their general petrology and geologic setting. Laboratory studies of these rocks are continuing, and a preliminary report has been prepared.

*Project:* Precambrian of Alaska.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology, and Office of Geochemistry and Geophysics, Branch of Isotope Geology.

*Co-Leaders:* G. Donald Eberlein and Marvin A. Lanphere, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2210 and 2649, respectively.

*Project objectives:* In response to the growing public demand for 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 Subcommittee on Precambrian Stratigraphy of the International Union of Geological Sciences' Commission on Stratigraphy, has requested that Working Groups be established in all parts of the world where Precambrian rocks form a significant part of the geology of the region. This activity, with particular concern for Alaska, is one of seven that constitute the Working Group for the United States and Mexico. The immediate objective is preparation of publishable chronometric geologic charts, with interpretative text, for each Precambrian region of Alaska. These charts, together with similar compilations by other segments of the U.S. and Mexico Working Group will serve as a key first step to intercontinental and intracontinental comparisons of Precambrian rocks and events and also will help identify critical problems for future geologic and chronologic research.

*Project status:* Initial evaluation of definite and probable Alaskan Precambrian terranes has been completed, and preliminary geologic chronometric charts have been compiled. These

charts and accompanying explanatory text will probably be published in about 1 year.

*Project:* Environmental geology of Alaska coal lands.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Environmental Geology, Engineering Geology Branch.

*Project chiefs:* Henry R. Schmoll and Lynn A. Yehle, U.S. Geological Survey, Box 25046, Mail Stop 903 KCG, Denver, Colo. 80225; (303) 234-3290 and 234-2999, respectively.

*Project objectives:* The objectives of the project are to provide an understanding of the nature, location, and extent of general environmental concerns and potential problems caused by response of geologic materials, both surficial deposits and bedrock, to surface and underground coal mining, energy conversion, facility siting, and accompanying land utilization for associated development (including transportation routes and urban development) throughout Alaska. There are two phases of the project: (1) an overview to delineate all areas of the State where there is a reasonable potential for coal-mining activity or intense exploration, and to outline in general terms the environmental-geologic aspects of each; and (2) more detailed studies in selected areas most likely to be sites of major development in the foreseeable future.

*Project status:* 1977 is the first year of this project. The overview is being compiled from existing literature, including statewide maps of bedrock geology, surficial deposits, permafrost, and other elements, with field checking at selected sites; more detailed field investigations in the Susitna River valley are being initiated. Some work on completing the adjoining Anchorage Borough project will continue as part of this project.

*Project:* Alaskan gravity surveys.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Geochemistry and Geophysics, Branch of Regional Geophysics.

*Project chief:* David F. Barnes, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2249.

*Project objectives:* In the past the prime objectives of Alaskan gravity surveys have been the

completion of a 1:2,500,000-scale map of the State and the location of basins of sedimentary rocks beneath large areas of alluvial cover. Now the emphasis is shifting to provide data suitable for a few 1:250,000-scale maps to study some of the anomalies that seem to be associated with mineralization and to provide background data for land-use decisions in cooperation with the Alaska Mineral Resources Assessment Program (AMRAP) and the Glacier Bay National Monument Wilderness Study.

*Project status:* The release in early 1976 of a preliminary version of the first state gravity map at a scale of 1:2,500,000 ended a period in which small-boat transportation provided most of the skeletal network of gravity data that made the map possible. The same data set has been used to provide 1:1,000,000-scale compilations to satisfy the synoptic objectives of the Alaskan Mineral Resource Assessment Program (RAMRAP). In addition, aircraft support obtained through cooperation of geochemical and geological field parties is providing denser coverage of 100 to 600 stations in a few 1:250,000 quadrangles that are being systematically studied as areas of high economic mineral potential. Station density is good enough in a few of these quadrangles to justify terrain corrections and the preparation of complete Bouguer anomaly maps. In some quadrangles the preparation of such complete Bouguer anomaly maps has been greatly aided by receipt of digital terrain data on magnetic tapes supplied by the Department of Defense. These data provided the basis for such a map of the lower elevation part of the McCarthy quadrangle, which is now in preparation. During the past summer, field gravity data to support equivalent or better maps were obtained for the Mt. Fairweather (Glacier Bay Monument area), Talkeetna, Seward, Goodnews, Hagemeister Island, Ambler River, and Philip Smith Mountain quadrangles. Complete Bouguer maps and interpretations will probably become available for a few of these quadrangles.

*Project:* Potential uranium resources in Tertiary basins in Alaska.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Energy Resources and Marine Geol-

ogy, Branch of Uranium and Thorium Research and Resources.

*Project chief:* Kendell A. Dickinson, U.S. Geological Survey, P.O. Box 25046, Mail stop 976, Lakewood, Colo. 80225; (303) 234-5667.

*Project objectives:* Project objectives are to evaluate the possibility of epigenetic uranium deposits in selected Tertiary basins in Alaska and to delineate areas for prospective drilling. Emphasis is placed on sandstone-type deposits. Source rocks, host rocks, and geochemistry or uranium will be evaluated.

*Project status:* Cook Inlet, including parts of the Susitna and Matanuska River valleys, is the first area to be studied. Samples were collected from the Beluga and Sterling Formations on the Kenai Peninsula, the Beluga Formation near Peters Creek in the Susitna Valley and the Chickaloon Formation in the Matanuska Valley. Stratigraphic sections were measured on the Kenai Peninsula. The samples have been analyzed for thorium, uranium, and other elements and a preliminary report is being prepared.

*Project:* Glaciology studies.

*Region and map keys:* Statewide (mainly southern Alaska); fig. 8 (5), (6), (7), (8).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* Lawrence R. Mayo, 310 First Avenue, Fairbanks, Alaska 99701; (907) 452-1951, ext. 176.

*Project objectives:* Objectives are: (1) long-term monitoring of the interactions between general climate, mass balance, runoff, and ice motion of Gulkana and Wolverine Glaciers. Data obtained are used to guide the analysis of glacier activity throughout Alaska, which is monitored by aerial photographic reconnaissance; (2) monitoring of specific potential hazards: outburst floods from glacier-dammed lakes and volcanoes, glacier advances and surges, and tidal glacier activity; and (3) addressing specific questions about glacial activity and potential hazards related to glaciers and other surface ice forms.

*Project status:* Continuing activities are: year-round fieldwork on Gulkana and Wolverine Glaciers on mass balance, ice motion, and the collection of high-altitude air-temperature and precipitation data; studies on the mechanism of

surging and photographic documentation of glacier surges in Alaska; aerial observations of changes and potential hazards on Mount Wrangell where volcanic activity is increasing; monitoring of aufeis activity and unusual aufeis events in the State; increased aerial photographic reconnaissance of glaciers, glacier-dammed lakes, glacier-clad volcanoes, and aufeis deposits; and intensified field and aerial monitoring of Columbia Glacier. Radar depth soundings have been made on Black Rapids Glacier to calculate the volume of ice involved in the next surge. Radar soundings of Gulkana, Wolverine, and Snow Glaciers are being made to aid understanding of ice dynamics. Analysis of ongoing climatic changes is in progress.

*Project:* Summary appraisal of Alaska's ground-water resources.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* Chester Zenone, U.S. Geological Survey, 1209 Orca St., Anchorage, Alaska 99501; (907) 279-1563.

*Project objectives:* This study will develop a broad-perspective analysis of Alaska's ground-water resources that will (1) serve as a guide to water-resource development as the various Federal, State, and local government land-use plans are implemented; (2) identify present and potential water-resource problems and the need for expanded programs of ground-water data acquisition and processing; (3) propose and evaluate alternatives for additional ground-water development; and (4) examine the role of ground water in helping to alleviate water-resource problems.

*Project status:* A first draft of a report was completed in December 1976. Publication of a report in the Professional Paper series is scheduled for 1977.

*Project:* Arctic water resources and environmental studies.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* J. M. Childers, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Project objectives:* The project studies arctic Alaskan water resources to provide information for planning, design, and operation of development in Alaska. Hydrologic hazards including floods, icing, glaciers, and channel erosion are being evaluated in development areas. Stream, lake, spring, and aquifer characteristics are examined in order to assess potential development impacts. Selected sites are studied to determine causes, processes, and effects of development impacts on water resources. These studies include water-quality evaluation and attention to icings and acceleration of erosion. This project is designed to help develop Alaska's resources for the national need and concurrently to protect the environment in Alaska.

*Project status:* This study, begun in 1974, is a continuing project. Accomplishments include work along the trans-Alaska pipeline system (TAPS) route as well as on the central and eastern North Slope of Alaska. Several technical reports have been or are being prepared. Most information from the project has been made available through open-file release for timely use in design and review of the TAPS oil pipeline and the proposed gas pipelines.

#### REGIONAL PROJECTS

A large part of the Geological Survey's Alaskan program consists of regional projects of less than statewide scope. Many projects are intensive investigations that require several years to complete. As with most technical studies, final formulation and publication of results are accomplished at the end of the investigation. For some projects, interim results and findings are compiled and presented in "Summary of Important Results," part of a companion circular (751-B). Interim accounts of continuing hydrologic investigations are prepared and separately published by the Water Resources Division. Inquiries on the status of the various projects should be directed to the project chiefs at the addresses listed in the project summaries.

#### NORTHERN ALASKA

*Project:* Southeastern Brooks Range geology.

*Region and map key:* Northern Alaska; fig. 9 (1).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* William P. Brosgé, U.S. Geological

Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2316.

*Project objectives:* Objectives are: (1) geologic field mapping at 1:250,000 scale of the unmapped two-thirds of Arctic and Table Mountain quadrangles; (2) biostratigraphic and lithofacies studies of the Carboniferous Lisburne and Permian and Triassic Sadlerochit Groups; (3) reconnaissance geochemical sampling and study of mineralized areas for resource assessment.

*Project status:* The southern part of the Arctic quadrangle and all four margins of the Table Mountain quadrangle have been mapped in the course of several previous investigations from 1911 to 1972. A preliminary geologic map of the Table Mountain quadrangle based on the available field data and photointerpretation was placed on open file in 1976. Some geochemical sampling and mineral investigation near the igneous rocks have also been done previously; the results have been outlined in a preliminary report on the mineral resource potential of the Arctic National Wildlife Range, placed on open file in 1976. An area of lead mineralization was reexamined briefly in 1976 in connection with a geochemical reconnaissance of the southeastern part of the Table Mountain quadrangle by James Barker, U.S. Bureau of Mines.

*Project:* Philip Smith Mountains quadrangle (AMRAP).

*Region and map key:* Northern Alaska; fig. 9 (2).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology and Branch of Exploration Research.

*Project chiefs:* John B. Cathrall (party chief), U.S. Geological Survey, Building 53, Federal Center, Denver, Colo. 80225; (303) 234-3131, ext. 4813; Hillard N. Reiser and William P. Brosgé (team leaders), U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2387 and 2316, respectively.

*Project objectives:* Reconnaissance geologic, geochemical, geophysical, and telegeologic mapping for rapid assessment of mineral resources. Planned fieldwork includes: (1) geologic mapping at 1:250,000 scale, study of the Sadlerochit Group, and reconnaissance study of the Devonian rocks; (2) a geochemical

TABLE 3.—Regional projects, northern Alaska

Name of Project; map key	Personnel	Type of work	Area
Southeastern Brooks Range; fig. 9 (area 1)	W.P. Brongé, H.N. Reiser, R.L. Detterman, J.T. Dutro, Jr.	Geologic mapping, geochemical sampling	Arctic and Table Mountain quadrangles
Philip Smith Mountains quadrangle (AMRAP); fig. 9 (2)	H.N. Reiser, W.P. Brongé, J.H. Cathrell, S.P. Marsh, R.L. Detterman, J.T. Dutro, Jr., K.J. Bird, D.F. Barnes, and other Geologic Division personnel	Geologic mapping, geochemical sampling, geophysical survey, mineral-resource assessment	Philip Smith Mountains quadrangle
Survey Pass quadrangle (AMRAP); fig. 9 (3)	Donald Grybeck	Geologic mapping, geochemical sampling, mineral-resource assessment	Survey Pass quadrangle
Ambler River quadrangle (AMRAP); fig. 9 (4)	I.L. Tailleux, C.H. Mayfield, I.P. Ellersieck, S.H. Hackett, N.R.D. Albart	Geologic, geochemical, geophysical, and radiologic surveys, mineral-resource assessment	Ambler River quadrangle
Cobik Formation (western Alaska Cretaceous); fig. 9 (5)	L.D. Carter, D.M. Hopkins	Stratigraphic analysis, including paleomagnetic and paleontologic studies	Unit to Prudhoe Bay
Ipewik-Kukpuk; fig. 9 (6)	I.L. Tailleux, C.H. Mayfield	Geologic mapping, stratigraphic, tectonic, and paleontologic synthesis	Western North Slope
Arctic Coastal Plain (Arctic environmental studies program); fig. 9 (7)	O.J. Friis, Jr.	Reconnaissance engineering geologic studies, geologic mapping	Northeastern Alaska
North Slope Petroleum Program	R.D. Carter and other Geologic Division personnel	Appraisal of petroleum potential by means of surface and subsurface geological, geophysical and geochemical studies	North Slope
Geophysical investigations (North Slope Petroleum Program); fig. 9 (8)	B.A. Kosowski	Acquisition of data through fieldwork and interpreta- tion thereof	Eastern North Slope
Lower Cretaceous depositional environment project (North Slope Petroleum Program); fig. 9 (9)	W.L. Adkinson	Well core studies	North Slope
Outcrop investigations (North Slope Petroleum Program); fig. 9 (10)	C.C. Mull and other Geologic Division personnel	Outcrop observations to determine structure, facies relationships, reservoir potential; sampling for geochemical and paleomagnetic analysis	Northern Alaska
Reservoir study of Lisburne group; structural and stratigraphic studies (North Slope Petroleum Program); fig. 9 (11)	K.J. Bird	Petrographic studies of cores and samples; detailed well-log correlations; structural/stratigraphic profiles integrating geologic and geophysical data	Eastern part of North Slope
Geologic-geophysical profile across the Brooks Range Front; fig. 9 (12)	K.J. Bird	Gravity and magnetic surveys, data reduction and compilation	Northeastern Alaska
Barrow Observatory; fig. 9 (13)	J.E. Townsend	Geomagnetic observatory	Barrow

TABLE 3.—Regional Projects, northern Alaska—Continued

Name of Project; map key	Personnel	Type of work	Area
National Petroleum Reserve; fig. 9 (area 14)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Unmapped part of National Petroleum Reserve
Alaska Pipeline Revision; fig. 9 (15), fig. 10 (6)	R.E. Fordham and Topographic Division personnel	Updating of topographic mapping	Pipeline route from Prudhoe Bay to Fairbanks
Eastern Brooks Range; fig. 9 (16), fig. 10 (9)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Eastern Brooks Range
Surficial geology, central Brooks Range (Arctic Environmental Studies); fig. 9 (17), fig. 10 (6)	See table 4 and section entitled "Regional projects, east-central Alaska."		
Hughes-Shungnak area; fig. 9 (18), fig. 11 (5)	See table 5 and section entitled "Regional projects, west-central Alaska."		

survey; (3) completion of the regional gravity survey; (4) an aeromagnetic survey; and (5) analysis of hydrocarbon potential of shales.

**Project status:** All fieldwork and analyses for metals have been completed. The geologic mapping was done in 1975 and 1976 by Reiser, Brosgé, Robert L. Detterman and J. T. Dutro, Jr.; a Saderochit Group fence diagram by Detterman was published in 1976 (MF-744). Kenneth J. Bird is studying the hydrocarbon reservoir potential of the Lisburne Group and the source rock potential of shales. In 1976 Cathrall, Sherman P. Marsh, and four assistants collected geochemical samples at about 750 localities and gravity data at about 300; the stream sediment data will be published early in 1977. A National Geodetic Survey gravity profile will supplement the gravity data; data reduction by David F. Barnes will probably include terrain corrections. The aeromagnetic survey began in October 1976, and preliminary study of LANDSAT imagery has been done by J. R. LeCompte.

**Project:** Survey Pass quadrangle (AMRAP).

**Region and map key:** Northern Alaska; fig. 9 (3).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Donald Grybeck, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 272-8228.

**Project objectives:** Reconnaissance geologic, geochemical, geophysical, and telegeologic mapping to provide the data for a rapid assessment of the mineral resources of the quadrangle. Fieldwork is to include: (1) geologic mapping at 1:250,000 scale, with detailed studies of mineral deposits (2) geochemical sample survey primarily through use of stream sediments and altered or mineralized rocks with detailed investigations of selected mineral deposits; (3) sampling mineralized areas for age determinations and for trace-elements and stable-isotope studies; (4) an aeromagnetic interpretation; (5) regional gravity study; and (6) investigation of potential for radioactive energy resources.

**Project status:** The project is planned for one field season. Fieldwork in 1977 will consist of geologic mapping, geochemical sampling, gravity measurements, and detailed investigations of mineralized areas. Preliminary maps and reports are scheduled for publication in 1978.

**Project:** Ambler River quadrangle (AMRAP).

**Region and map key:** Northern Alaska; fig. 9 (4).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chiefs:** I. L. Tailleux (party chief) and C. H. Mayfield (team leader), U.S. Geological Survey, 345 Middlefield Road, Menlo Park,



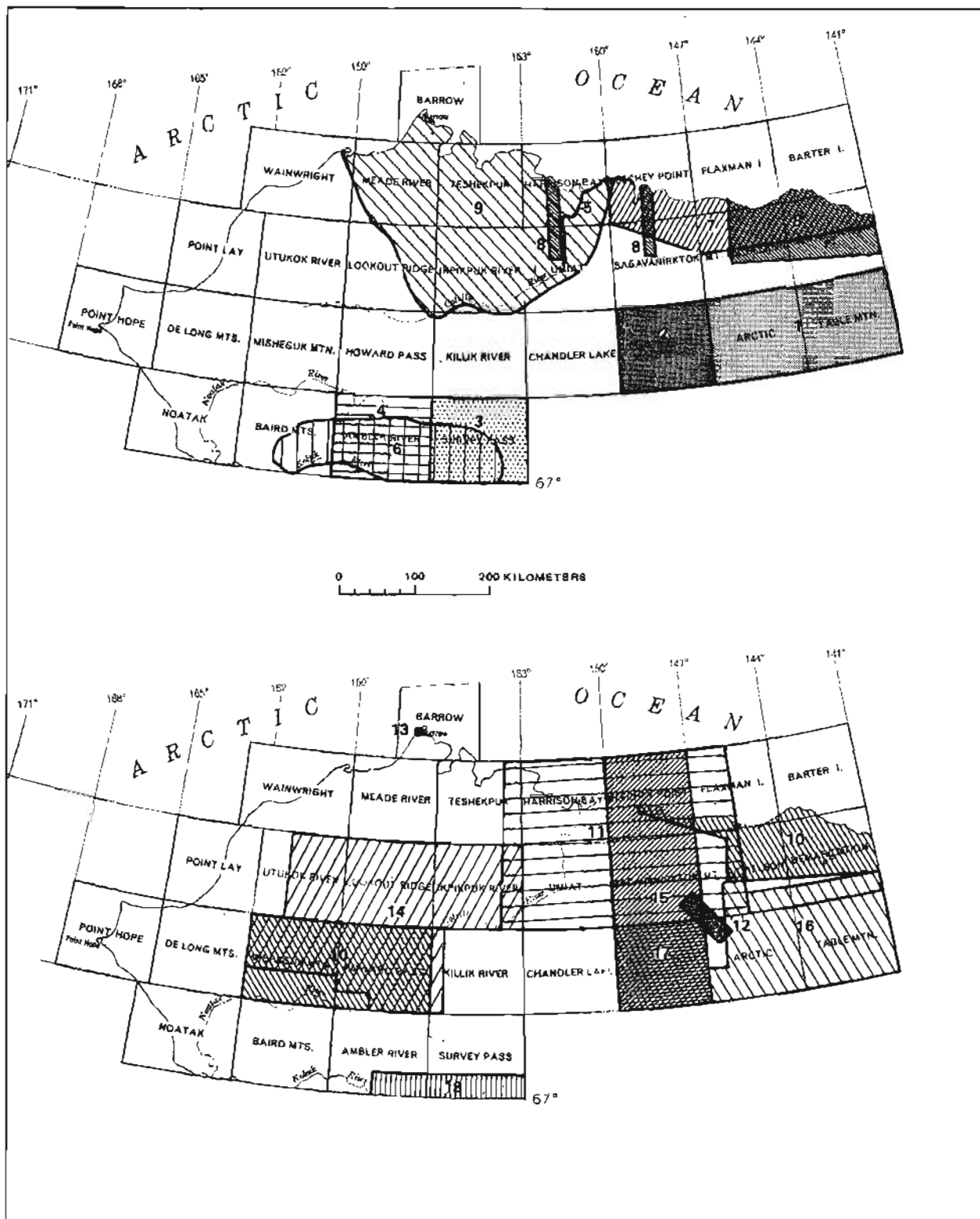


FIGURE 9.—Locations of projects, northern Alaska.



Calif. 94025; (415) 323-8111, ext. 2254 and 2147, respectively.

*Project objectives:* Reconnaissance geologic, geochemical, geophysical, and telegeologic mapping for rapid assessment of mineral resources. Fieldwork included completion of geologic, geochemical, and gravity surveys at 1:250,000 scale of quadrangle that contains most of the known southwest Brooks Range mineral belt.

*Project status:* Data have been collected and are being compiled for folio release June 1977. The Alaska Division of Geology and Geophysics (DOGG) has released in open file geologic and stream-sediment surveys of the southeastern part of the quadrangle done in 1972, cooperative stream-sediment surveys of the south-central and southwestern part of the quadrangle done in 1973 and 1974, and 1:63,360- and 1:250,000-scale aeromagnetic maps of the whole quadrangle. G. H. Pessel (DOGG) and W. P. Brosge have compiled, for immediate release, a preliminary geologic map based on 1955, 1966, and 1972-74 studies. Mayfield has integrated 1976 mapping of the north part of the quadrangle with earlier work to produce a geologic base for other maps in the folio. I. Eilersieck has assembled analyses of all geochemical samples for release and is preparing geochemical maps for mineral-resource assessment. S. Hackett (DOGG) will derive geophysical maps based on available aeromagnetic, gravity, and geologic data. N. R. D. Albert has begun telegeologic maps, based in part on ground-to-LANDSAT-image correlations made in the field.

*Project:* Western Alaska Cenozoic Gubik Formation Study.

*Region and map key:* Northern Alaska; fig. 9 (5).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project Chiefs:* L. D. Carter and D. M. Hopkins, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2682 and 2659 respectively.

*Project objective:* The project objective is to determine the history of sea level fluctuations and erosion and deposition recorded by landforms and unconsolidated deposits of the western Arc-

tic Slope of Alaska. Emphasis is on detailed stratigraphic analysis of selected areas, primarily along the Colville River and its tributaries, and along the Arctic coast. Sampling for foraminifers, ostracods and mollusks should expand the known fauna and may allow zonation of the marine deposits. In conjunction with the faunal data, paleomagnetic analysis of thin-bedded silt and fine sand may permit correlation of the deposits with established transgressions in western Alaska. Examination of pollen and fossil wood will provide a basis for interpretation of paleoclimate. The project operates in cooperation with the Arctic nearshore studies of Erk Reimnitz and Peter Barnes, providing knowledge of the onshore stratigraphy that will assist in interpretation of seismic records and information obtained during offshore drilling. Information gathered during this study regarding the nature and distribution of surficial deposits will be needed for future development of the western Arctic Slope and coastal zone of Alaska.

*Project status:* Samples gathered during the summer of 1975 have been examined for foraminifers, ostracods and mollusks, and fossil wood has been identified. Pollen studies and grain size analyses are in progress. An open-file report detailing the results of the investigation is in preparation.

*Project:* Ipewik-Kukpuk (western North Slope).

*Region and map key:* Northern Alaska; fig. 9 (6).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* I. L. Tailleux, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2254.

*Project objectives:* Mapping and interpretation of the geology of the western Brooks Range orogen and the northern Alaska petroleum province.

*Project status:* G. H. Pessel (Alaska Division of Geological and Geophysical Surveys) and Tailleux assembled and synthesized publicly accessible information from the Colville-Canning Rivers petroleum exploration regions into a multisheet folio of subsurface isopach and structure maps; the folio is in review for publication in the Miscellaneous Field Investigations Map series. Unpublished geologic map-

ping of the northern De Long Mountains and Misheguk Mountain quadrangles by E. G. Sable and others during 1949 to 1951 has been compiled into 1:63,360-scale bases and is also being reviewed for release. Observations of Sinnektanayak Mountain in the west-central Brooks Range in 1976 included detailed sampling of the easternmost synform of allochthonous, ophiolitelike rocks.

*Project:* Arctic Coastal Plain (Arctic Environmental Studies Program).

*Region and map key:* Northern Alaska; fig. 9 (7).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Oscar J. Ferrians, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2247.

*Project objectives:* The major objective is to complete reconnaissance engineering-geologic investigations that will provide base-line geotechnical data needed to aid in planning, designing, operating, and maintaining engineering structures in this region (for example, the proposed Arctic Gas Pipeline). Planned fieldwork includes engineering-geologic mapping at a scale of 1:125,000. Studies of permafrost conditions, geomorphic features permafrost-related processes, and other 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.

*Project status:* Enough data have been collected during 5 weeks of helicopter-supported fieldwork to prepare preliminary engineering-geologic maps of the entire region. After these maps have been prepared, 3 to 4 weeks of fieldwork will be required to prepare the final maps. Preliminary engineering-geologic maps will be completed for open files or the Miscellaneous Field Studies Map Series in 1977.

*Project:* North Slope Petroleum Program.

*Region:* Northern Alaska.

*Organizational designation:* Geologic Division,

Office of Energy Resources, Branch of Oil and Gas Resources.

*Program Manager:* Robert D. Carter, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2116.

*Project objectives:* Objectives are to determine, map, and describe, on the surface and in the subsurface, by geologic, geophysical and geochemical methods: (1) Brooks Range and North Slope structural framework and regional structural trends; (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 relation of extracted hydrocarbons to known North Slope oils; and (6) geologic history of the basin related to potential reservoirs, source and seal rocks, hydrocarbon formation and migration, and present structural trends.

*Project status:* Individual projects include a reservoir study of the Lisburne Group, K. J. Bird; a subsurface seismic, gravity and well data study of the structural style of the eastern Brooks Range foothills, K. J. Bird, D. M. Giovannetti, R. D. Carter; interpretation of a north-south seismic record integrating gravity and well data, R. D. Carter, B. A. Kososki; gravity and magnetic studies of the Arctic National Wildlife Range, B. A. Kososki, C. D. Cavit, D. M. Giovannetti; geochemical and paleomagnetic analyses of eastern North Slope and western Brooks Range outcrop samples and shallow cores, C. G. Mull, G. W. Newman; transfer and organization of surface and subsurface rock material from Fairbanks to Anchorage, W. L. Adkison; general field investigations, Arctic National Wildlife Range and western Brooks Range, C. G. Mull; and helium "sniffer" surveys, eastern North Slope, C. G. Mull.

*Project:* Geophysical investigations (North Slope Petroleum Program).

*Region and map key:* Northern Alaska; fig. 9 (8).

*Organizational designation:* Geologic Division, Office of Energy Resources, Branch of Oil and Gas Resources.

*Project chief:* Bruce A. Kososki, U.S. Geological

Survey, Box 25046, MS 934, Denver Federal Center, Denver, Colo. 80225; (303) 234-4750.

*Project objectives:* The primary objective is to gain knowledge of the general subsurface stratigraphy of the North Slope sedimentary basin through utilization of geophysical data.

*Project status:* Gravity and magnetic surveys were conducted during the summer of 1976 in the Arctic National Wildlife Range and in the Shaviovik area. A U.S.G.S Bulletin describing the gravity field and rock densities of the Arctic National Wildlife Range along with a generalized geologic map of that area will be published in 1977. Seismic digital data processing by the U.S.G.S. Phoenix system of a sample NPR-4 seismic line has been completed and the highly satisfactory results described in an open-file report. Synthetic seismograms have been produced from five digitized sonic logs by the same system and will be used in the interpretation of a north-south seismic line across the North Slope.

*Project:* Lower Cretaceous depositional environment project (North Slope Petroleum Program).

*Region and map key:* Northern Alaska; fig. 9 (9).

*Organizational designation:* Geologic Division, Office of Energy Resources, Branch of Oil and Gas Resources.

*Project chief:* W. L. Adkison, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2116.

*Project objectives:* The objective is to determine depositional environments, facies trends, hydrocarbon reservoir, and source potential of the Nanushuk Group in NPR-4 through the study of well cores. This project is carried out in conjunction with a similar study of outcrops of the Nanushuk.

*Project status:* Project will begin early in 1977. As a forerunner to this project all the rock material in U.S.G.S. storage in Fairbanks was moved to Anchorage. When storage facilities are complete and the material has been cataloged, it will be available for inspection in Anchorage.

*Project:* Outcrop investigations project (North Slope Petroleum Program).

*Region and map key:* Northern Alaska; fig. 9 (10).

*Organizational status:* Geologic Division, Office

of Energy Resources, Branch of Oil and Gas Resources.

*Project chief:* C. G. Mull, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2116.

*Project objectives:* Project studies are focused on assessment of the hydrocarbon potential of the North Slope. Studies of the Brooks Range to clarify its structural style and history and to show its relation to rocks underlying the Arctic Foothills and Coastal Plain are being carried out in conjunction with the Branch of Alaskan Geology. Study of the hydrocarbon reservoir and source potential of various stratigraphic horizons is an important aspect of assessment of the hydrocarbon resource potential of the unexplored part of the North Slope, including NPR-4 and the Arctic National Wildlife Range.

*Project status:* Eastern North Slope fieldwork in 1976 included outcrop mapping and collection of samples for organic geochemical analysis, porosity and permeability determinations in potential hydrocarbon reservoir horizons, and paleontological study. Samples were also collected for a pilot study to determine the applicability of helium geochemistry as a remote hydrocarbon detection tool in permafrost terrain. These data, along with gravity and magnetic data obtained by B. A. Kososki, will be used in a preliminary report assessing the petroleum potential of various parts of the Arctic National Wildlife Range. G. W. Newman and others sampled several sections of Paleozoic rocks as part of a paleomagnetic study of the Brooks Range; the results of this study will be reported separately. Fieldwork was also carried out in the area of the upper Noatak River in the Schwatka and Endicott Mountains as part of a continuing study of the structural style and extent of major allochthonous sequences in the Brooks Range.

*Project:* Reservoir study of Lisburne Group and structural and stratigraphic studies in the eastern foothills of the Brooks Range (North Slope Petroleum Program).

*Region and map key:* Northern Alaska; fig. 9 (11).

*Organizational designation:* Geologic Division, Office of Energy Resources, Branch of Oil and Gas Resources.

*Project chief:* Kenneth J. Bird, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2116.

*Project objectives:* The goal is to map reservoir trends indirectly by first determining the relation of reservoir characteristics to lithofacies, then constructing a series of lithofacies maps. Analysis of Lisburne well logs and selective study of well samples and thin sections are designed to determine reservoir characteristics and lithofacies. Study of well, geophysical, and surface data in the foothills of the eastern Brooks Range (Shaviovik area) is designed to provide a better understanding of the Cretaceous and Tertiary depositional setting and stratigraphic relations and to document further the tectonic style of the Brooks Range front.

*Project status:* A comprehensive report on the reservoir properties of the Lisburne Group has been released in open file and will appear in the American Association of Petroleum Geologists Bulletin. Additional study of well and outcrop data will allow extension of the study area and the construction of maps based on a correlation network and definition of the lithofacies. Gravity, magnetic, and other field data gathered during the past field season are being processed and will be combined with seismic and well information for structural and stratigraphic studies in the eastern foothills.

*Project:* Geologic-geophysical profile across the Brooks Range front, northeastern Alaska.

*Region and map key:* Northern Alaska; fig. 9 (12).

*Organizational designation:* Geologic Division, Office of Energy Resources, Branch of Oil and Gas Resources.

*Project chief:* Kenneth J. Bird, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2116.

*Project objectives:* The objective is to determine the structural style of the Brooks Range front and its relation to the petroleum potential of this area by studying a strip about 10 miles wide by 40 miles long extending from 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, three wells, sev-

eral seismic lines, gravity and magnetic measurements, and rock samples.

*Project status:* Gravity and magnetic data from 50 stations were collected along this profile last summer by Dennis Giovannetti and Bruce Kososki. Data reduction by Giovannetti is nearly complete. Measurements of magnetic susceptibility of surface and subsurface samples are in progress, as are terrain corrections for some gravity stations. A stratigraphic summary of data from three wells and numerous outcrop sections along the profile is nearly complete. Acoustic logs from the wells have been digitized, and work is in progress on construction of synthetic seismograms. Review and updating of the surface geology by means of aerial photographs are also in progress. Data will be released by open file as soon as each phase of the study is completed. The stratigraphic summary, gravity data, and magnetic data are scheduled for release sometime in early 1977. Final publication will be as a Bulletin.

*Project:* Barrow observatory.

*Region and map key:* Northern Alaska; fig. 9 (13).

*Organizational designation:* Geologic Division, Office of Geochemistry and Geophysics, Branch of Electromagnetism and Geomagnetism.

*Project chief:* John B. Townshend, College Observatory, Yukon Drive on West Ridge, Fairbanks, Alaska 99701; (907) 479-6146.

*Project objectives:* The project entails continuous monitoring of the variations of the geomagnetic field and making absolute observations at regular intervals.

*Project status:* The Barrow Observatory has been in operation since 1949 in cooperation with the Naval Arctic Research Laboratory.

*Project:* National Petroleum Reserve.

*Region and map key:* Northern Alaska; fig. 9 (14).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The project aims to provide new 1:63,360-scale maps for that part of the National Petroleum Reserve (NPR-4) presently unmapped at that scale.

**Project status:** There are 82 1:63,360-scale quadrangles to be mapped. The feasibility of generating control using special aerotriangulation procedures is currently being investigated. If successful, no field operations will be necessary, and map compilation will begin in FY 1977.

**Project:** Alaska pipeline revision.

**Region and map keys:** Northern and east-central Alaska; fig. 9 (15); fig. 10 (8).

**Organizational designation:** Topographic Division, Special Mapping Center.

**Project chief:** Roy E. Fordham, Chief, Special Mapping Center, 1925 Newton Square East, Reston, Va. 22090; (703) 471-1711.

**Project objectives:** The objective is to revise 40 1:63,360-scale maps and 9 1:250,000-scale maps from Prudhoe Bay to the vicinity of Fairbanks to show the trans-Alaska pipeline, service roads, and other related features.

**Project status:** The revision of the 1:63,360-scale maps will be completed in FY 1977. The 1:250,000-scale revision is expected to be completed in FY 1978.

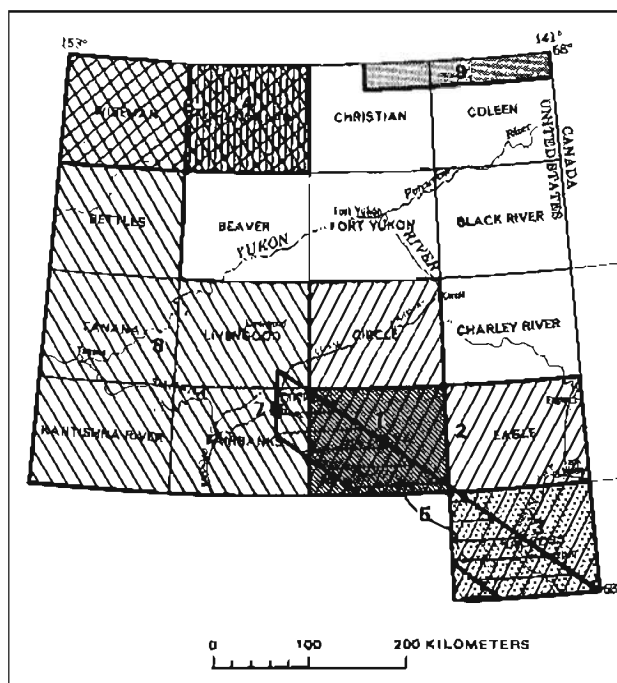


FIGURE 10.—Locations of projects, east-central Alaska.

**Project:** Eastern Brooks Range.

**Region and map keys:** Northern and east-central Alaska; fig. 9 (16); fig. 10 (9).

**Organizational designation:** Topographic Division, Rocky Mountain Mapping Center.

**Project chief:** A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

**Project objectives:** The project will provide new 1:63,360-scale topographic maps in an area previously unmapped at this scale. The project area consists of 57 1:63,360-scale quadrangles.

**Project status:** Twenty-three quadrangles have been published, with one additional quadrangle awaiting publication. Complete aerial photography coverage has now been obtained for the remaining 33 quadrangles. Advance manuscript copy for these quadrangles should be available by 1978.

#### EAST-CENTRAL ALASKA

**Project:** Big Delta quadrangle (AMRAP).

**Region and map key:** East-central Alaska; fig. 10 (1).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Helen L. Foster, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2331.

**Project objectives:** Primary objectives are to complete reconnaissance geologic mapping of the Big Delta quadrangle at a scale of 1:250,000; complete a reconnaissance geochemical sampling program; and evaluate the mineral resource potential of the area using geologic, geochemical, geophysical, and LANDSAT data.

**Project status:** Reconnaissance geologic mapping and reconnaissance geochemical sampling will be completed in 1977 by Helen L. Foster, Florence R. Weber, and Terry E. C. Keith. Final reports and maps should be completed by 1980. Preliminary geologic maps at a scale of 1:63,360 have been published for the A-1 and B-1 quadrangles (MF-676), are compiled for publication of the A-2 and A-3 quadrangles, and are being compiled for the C-4 and other quadrangles. About 415 rock samples and 430 stream-sediment samples from the Big Delta quadrangle have been analyzed by semiquantitative spectrographic analysis. Additional geochemical sampling will be done in 1977. Rocks from several localities have been dated by the K-Ar method by James G. Smith and Frederic H. Wilson.

TABLE 4.—Regional projects, east-central Alaska

Name of project; map key	Personnel	Type of work	Area
Big Delta quadrangle (AMRAP); fig. 10 (1)	H.L. Foster, F.R. Weber, T.R.C. Keith, F.D. Hessin	Geologic mapping, mineral-resource assessment	Big Delta quadrangle
Yukon-Tanana Upland; fig. 10 (2)	H.L. Foster	Geologic mapping, geochemical sampling and special geologic studies	Eagle, Tanacross, Circle, and Big Delta quadrangles
Tanacross quadrangle (AMRAP); fig. 10 (3)	H.L. Foster and other Geologic Division personnel	Geochemical sampling, mineral-resource assessment	Tanacross quadrangle
Chandalar quadrangle (AMRAP); fig. 10 (4)	S.P. Harsh, W.P. Broegg, H.W. Kaiser, D.E. Detra, S.G. Smith, T.A. Dornge, A.J. Medrano, J.H. DeYoung, Jr., J. Cady, D.F. Barua, M.R.D. Albert	Geochemical sampling, geophysical survey, mineral-resource assessment	Chandalar quadrangle
Tanana Valley transportation/development corridor; Fairbanks to Canadian border (Arctic Environmental Studies); fig. 10 (5), fig. 13 (14)	L.D. Carter, J.P. Calloway	Geologic mapping of surficial deposits	Tanana Valley, Fairbanks to Canadian border
Surficial geology, central Brooks Range (Arctic Environmental Studies); fig. 10 (6), fig. 9 (17)	T.D. Hamilton, J.P. McCaig	Surficial geologic mapping, stratigraphic studies	Philip Smith Mountains, Chandalar and Wiseman quadrangles
College Observatory; fig. 10 (7)	J.B. Townsend	Geomagnetic and seismic observatory	Fairbanks
Alaska Pipeline Revision; fig. 10 (8), fig. 9 (15)	See table 3 and section entitled "Regional projects, northern Alaska."		
Eastern Brooks Range; fig. 10 (9), fig. 9 (16)	See table 3 and section entitled "Regional projects, northern Alaska."		

**Project:** Yukon-Tanana Upland.

**Region and map keys:** East-central and southern Alaska; fig. 10 (2); fig. 13 (17).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Helen L. Foster, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2331.

**Project objectives:** Objectives include geologic mapping, geochemical sampling, and special geologic studies in the Yukon-Tanana Upland.

**Project status:** A full-color geologic map (scale 1:250,000) of the Eagle quadrangle (Map I-922) is completed (1976). Work is continuing on the granitic rocks, but most of the activity of this project is now incorporated in the Big Delta AMRAP project.

**Project:** Tanacross quadrangle (AMRAP).

**Region and map key:** East-central Alaska; fig. 10 (3).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Helen L. Foster, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2331.

**Project objectives:** Primary objectives are: (1) mineral resource evaluation of a poorly exposed geologically complex area using geologic, geochemical, geophysical, and LANDSAT data; and (2) presentation of the basic data used along with its interpretation.

**Project status:** The project is nearly finished and will be completed by the end of 1976 or early in 1977. An aeromagnetic map and interpretation

(MF-767-A) and 10 geochemical maps (MF-767F-0) were completed in 1976. Interpretations of LANDSAT data, a mineral resource evaluation, and a gravity map are in preparation. Circular 734 (1976) describes the results of this project.

*Project:* Chandalar quadrangle (AMRAP).

*Region and map key:* East-central Alaska; fig. 10 (4).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology and Branch of Exploration Research.

*Project chiefs:* Sherman P. Marsh (party chief), U.S. Geological Survey, Building 25, Federal Center, Denver, Colo. 80225; (303) 234-3131, ext. 3283; William P. Brosgé and Hillard N. Reiser (team leaders), U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2316, 2387, respectively.

*Project objectives:* Geochemical, geophysical, telegeologic and mineral-deposit mapping will be combined with the available geologic reconnaissance map and aeromagnetic survey to provide the data for a rapid assessment of the mineral resources. Planned fieldwork includes (1) a geochemical sample survey, (2) study of selected mining claims, (3) one or two gravity profiles to augment the existing regional survey.

*Project status:* In 1975, Sherman P. Marsh and four assistants completed the geochemical sampling, and Milton A. Wiltse, M. W. Henning, and J. W. Buza, Alaska Division of Geological and Geophysical Surveys, mapped and sampled copper mineral deposits. All analyses of stream sediments, rocks, and panned concentrates have been completed. The stream-sediment data were placed in open file in 1976, and production of computer-generated maps and statistical data is in progress. The mineral-resource map is being prepared by John H. DeYoung, Jr., and an aeromagnetic interpretation map by John Cady. A detailed gravity profile made by the National Geodetic Survey across half the quadrangle in 1975 will supplement the nearly 150 measurements previously made. David F. Barnes will compile a map showing the regional gravity field, but

scarcity of data will probably limit specific geologic interpretation. Preliminary study of LANDSAT imagery has been done by Nairn R. D. Albert.

*Project:* Tanana Valley transportation-development corridor; Fairbanks to the Canadian border (Arctic Environmental Studies Program).

*Region and map keys:* East-central and southern Alaska; fig. 10 (5); fig. 14 (14).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* L. D. Carter, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2682.

*Project objectives:* The project objective is to compile a map showing the distribution of unconsolidated surficial deposits within the transportation-development corridor that extends southeastward up the Tanana 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. Planned fieldwork includes geologic mapping at a scale of 1:125,000 in parts of the Fairbanks, Big Delta, Mt. Hayes, Tanacross, and Nabesna quadrangles.

*Project status:* Existing geologic mapping has been compiled at a scale of 1:125,000. Field checking and additional geologic mapping were undertaken in 1976 and will be completed in 1977. A preliminary geologic map will be prepared in 1978.

*Project:* Surficial geology of the central Brooks Range (Arctic Environmental Studies Program).

*Region and map key:* Northern and east-central Alaska; fig. 10 (6); fig. 9 (17).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Thomas D. Hamilton, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2156.

*Project objectives:* The major objective is to provide data essential for investigations of



energy-related transportation corridors across the central Brooks Range and for other studies involving land-use analysis and 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 geologic hazards. The maps also will be of value to programs involving geochemical studies or resource assessments of unconsolidated sediments. A general stratigraphic framework, based on measured sections, radiocarbon dates, soil analyses, and geomorphic age criteria, also is being developed for the region. This framework, which will tie together glacial and nonglacial deposits of the northern and southern Brooks Range, will provide a basic structure to which other Quaternary events in northern Alaska can be related.

*Project status:* Field mapping and ancillary studies of the Philip Smith Mountains and Chandalar quadrangles were completed during the summer of 1976. Final 1:250,000-scale maps of these two quadrangles will be submitted for publication in 1977. Field mapping during the summer of 1977 will be carried out in the Wiseman quadrangle. A 1:250,000-scale surficial geologic map for the Wiseman quadrangle should be submitted for publication during the winter of 1977-78.

*Project:* College Observatory.

*Region and map key:* East-central Alaska; fig. 10 (7).

*Organizational designation:* Geologic Division, Office of Geochemistry and Geophysics, Branch of Electromagnetism and Geomagnetism.

*Project chief:* John B. Townshend, College Observatory, Yukon Drive on West Ridge, Fairbanks, Alaska 99701; (907) 479-6146.

*Project objectives:* The general mission of the observatory is to produce accurate and comprehensive data in the field of geomagnetism and seismology and to cooperate with other scientists and organizations in making studies in various scientific disciplines within the capability of personnel and facilities. The observatory monitors seismic and magnetic activity 24 hours a day. The facility plays a major part in keeping the people of Interior Alaska informed

of current earthquake activity and informing scientists and organizations of the occurrence of major world magnetic events. The observatory is responsible for operation of the Barrow Observatory at Point Barrow in cooperation with the University of Alaska's Naval Arctic Research Laboratory.

#### WEST-CENTRAL ALASKA

*Project:* Nixon Fork stratigraphic studies (Hughes-Shungnak).

*Region and map key:* West-central Alaska; fig. 11 (1).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* William W. Patton, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2248.

*Project objectives:* The primary objective is a detailed stratigraphic study of the Precambrian to Cenozoic sedimentary, metamorphic, and volcanic rocks of the northern Kuskokwim Mountains. These studies are needed to provide a basic geologic framework for assessing the mineral potential of the Ruby geanticline and the petroleum possibilities of the Minchumina basin. The Nixon Fork region was selected for these initial investigations because it is one of the few areas with good bedrock exposures within the densely vegetated terrain of the Ruby geanticline. In addition to the stratigraphic studies, fieldwork will include reconnaissance mapping of the Medfra quadrangle and structural investigations of the Nixon Fork-Iditarod fault zone.

*Project status:* The project is planned for three field seasons. Field stratigraphic studies were completed during 3 weeks in 1975 and 2 weeks in 1976 by W. W. Patton, Jr., J. T. Dutro, Jr., and R. M. Chapman. In 1977 field efforts will be focused on compilation of a regional geologic map of the Medfra quadrangle. Completion of final reports is planned for 1978.

*Project:* Arctic mineral resources (Ruby quadrangle).

*Region and map key:* West-central Alaska; fig. 11 (2).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan



TABLE 5.—Regional projects, west-central Alaska

Name of Project; map key	Personnel	Type of work	Area
Nixon Fork stratigraphic studies (Hughes-Shungnak); fig. 11 (area 1)	W.W. Patton, Jr., J.T. Dutro, Jr., R.M. Chapman	Stratigraphic studies, reconnaissance geologic mapping	Medfra quadrangle
Arctic mineral resources (Ruby quadrangle); fig. 11 (2)	R.M. Chapman, W.W. Patton, Jr.	Reconnaissance geologic mapping, geochemical sampling	Ruby quadrangle
Nome investigations; fig. 11 (3)	C.L. Hummel	Geologic mapping, geochemical and geophysical studies, mineral-resource assessment	Nome area
Western Alaska uranium; fig. 11 (4)	T.P. Miller, R.L. Elliot	Geologic mapping, detailed petrologic studies	Seward Peninsula; parts of Selawik, Shungnak, Hughes, Candle, Melozinta quadrangles
Hughes-Shungnak area; fig. 11 (5), fig. 9 (18)	A.R. Loney and Topographic Division personnel	Topographic mapping	Mostly in Hughes and Shungnak quadrangles
Environmental studies of the northern Bering Sea; fig. 11 (6), fig. 12 (7), fig. 15 (7)	See table 9 and section entitled "Regional projects, offshore Alaska."		

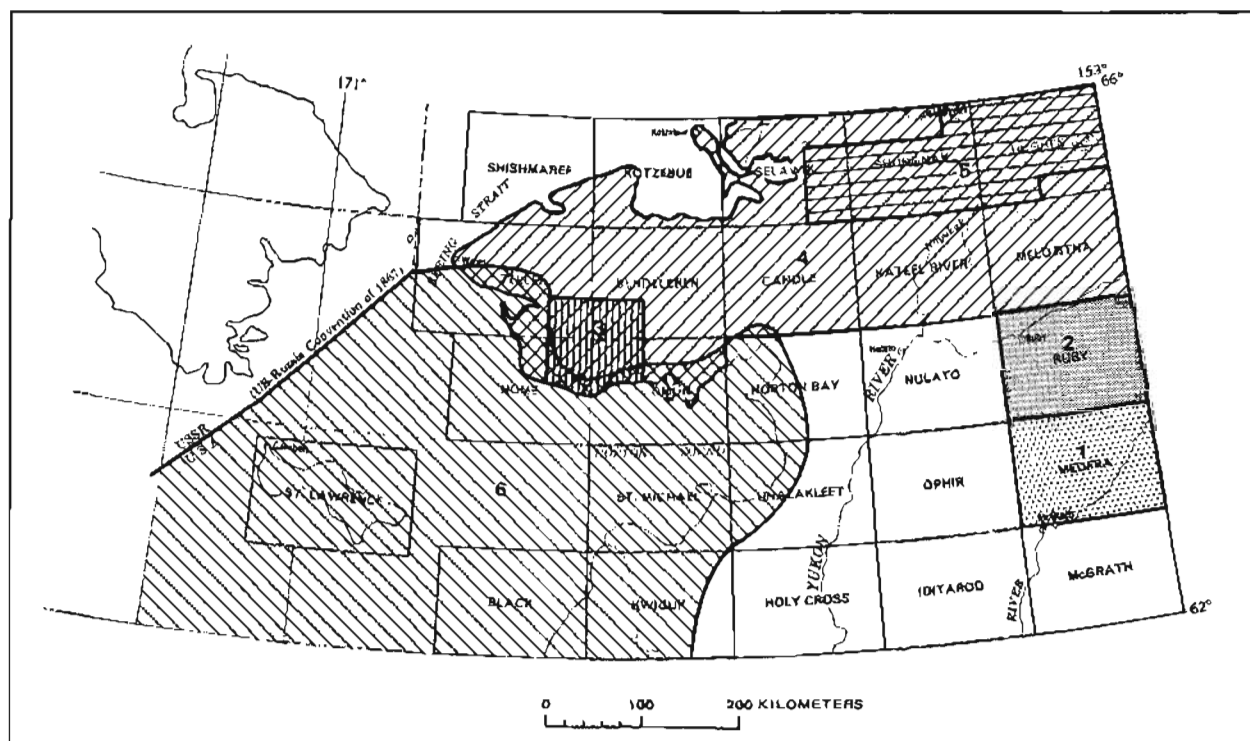


FIGURE 11.—Locations of projects, west-central Alaska.

**Geology.**

**Project chief:** Robert M. Chapman, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2670.

**Project objectives:** The overall objective is to provide an adequate geologic base for assessments of mineral-resource potential, regional geologic interpretations, and land-use evaluations in

central Alaska. The Ruby quadrangle includes a critical and previously largely unmapped area of the Ruby geanticline, one of the major geologic features in interior Alaska. The specific objectives of this project are to delineate the major rock units, their ages, and structural and geochemical characteristics and to identify the relations between these units and those mapped elsewhere along the Ruby geanticline.

*Project status:* Reconnaissance geologic mapping and some bedrock geochemical sampling of about 85 percent of the Ruby quadrangle were done in a total of 21 days by R. M. Chapman and W. W. Patton, Jr., in 1975 and by Chapman, Patton, and J. T. Dutro, Jr., in 1976. Extensive vegetation cover and lack of time generally precluded detailed examinations, but further field studies are warranted in some parts of this area. Most of the 15 percent of the quadrangle that remains to be mapped is north of the Yukon River in the northwest part of the quadrangle. Completion of the geologic mapping and compilation of geologic and geochemical maps are planned for 1977.

*Project:* Nome investigations.

*Region and map key:* West-central Alaska; fig. 11 (3).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* C. L. Hummel, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2606.

*Project objectives:* The purpose of the project is to evaluate the mineral-resource potential of a part of southwest Seward Peninsula. It comprises geological, geochemical, and geophysical investigations in a 5,000-km<sup>2</sup> region where the metamorphic complex that forms the bedrock of most of the peninsula is well exposed. Other objectives include determination of the regional stratigraphy, structure, and controls of mineralization.

*Project status:* Fieldwork has been completed, and data sufficient to depict the geology and mineral deposits at 1:125,000 scale are available for all of the region. The metamorphic complex has been subdivided into several major rock units of regional extent. Although the relations of some units are still uncertain, the units are adequate for delineating gross fea-

tures of the bedrock. Selective sampling of the rocks making up the units, and of detritus derived from them, has been completed, and most of the samples have been analyzed. These analytical results will be used to determine the geochemical character of the individual units and the general background and threshold levels of metals in the complex. A map and report covering the geology and mineral resources of the region are planned for release in 1977.

*Project:* Western Alaska uranium.

*Region and map key:* West-central Alaska; fig. 11 (4).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology, and Office of Energy Resources, Branch of Uranium and Thorium Resources.

*Project chief:* Thomas P. Miller, U.S. Geological Survey, 1209 Orca St., Anchorage, Alaska 99501; (907) 272-8228.

*Project objectives:* The objective is to evaluate the uranium-thorium potential of selected areas in western Alaska. The investigation will include geologic field mapping, together with petrologic and radioactivity studies, in order to determine the nature and scope of mineralized areas.

*Project status:* Approximately 30 percent of the project has been completed. Preliminary results will be released prior to the 1977 field season with final reports to follow.

*Project:* Hughes-Shungnak area.

*Region and map key:* West-central and northern Alaska; fig. 11 (5); fig. 9 (18).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The project will provide new 1:63,360-scale topographic maps in an area presently unmapped at this scale. The project area consists of 55 1:63,360-scale quadrangles.

*Project status:* Recent acquisition of some commercial aerial photography, in addition to existing Air Force photography, gives complete coverage of the area. Geological Survey field parties were in Alaska during the summer of 1976 assisting the Bureau of Land Management to obtain geodetic control for their land

cadastral program and were also able to obtain mapping control for over 50 percent of this project area. A tentative schedule calls for advance manuscript copy to be available in 1979.

#### SOUTHWESTERN ALASKA

**Project:** Goodnews and Hagemester Island quadrangles and parts of Bethel, Dillingham, and Nushagak Bay quadrangles (AMRAP).

**Region and map key:** Southwestern Alaska; fig. 12 (1).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chiefs:** J. M. Hoare, W. L. Coonrad, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2372 and 2608, respectively.

**Project objectives:** The principal objective is to assess the mineral resources using reconnaissance geologic, geochemical, geophysical, and telegeologic mapping. Fieldwork also includes sampling of old metamorphic terrane and intrusive bodies for radiometric dating.

**Project status:** Fieldwork planned for project has been completed with the collection of about 1,200 geochemical samples, additional gravity

data, and additional samples from old metamorphic terrane. Completion of analytical work is scheduled for December 1976. Completion of final reports, scheduled for 1977, depends somewhat upon availability of modern 1:250,000-scale topographic base map.

**Project:** Chignik-Sutwik Island quadrangles (AMRAP).

**Region and map key:** Southwestern Alaska; fig. 12 (2).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Robert L. Detterman, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2244.

**Project objectives:** Reconnaissance geologic, geochemical, geophysical, and telegeologic mapping will provide the data for a rapid assessment of the mineral resources of the quadrangles. Fieldwork is to include: (1) geologic mapping at 1:250,000 scale, with detailed studies of the Chignik and Naknek Formations; (2) geochemical sample survey primarily through use of stream sediments and altered or mineralized rocks with a detailed investigation

TABLE 6.—Regional projects, southwestern Alaska

Name of Project; map key	Personnel	Type of work	Area
Goodnews and Hagemester Island quadrangles and parts of Bethel, Dillingham, and Nushagak Bay quadrangles (AMRAP); fig. 12 (area 1)	J. M. Hoare, W. L. Coonrad, T. D. Heaslip and other Geologic Division personnel	Geologic mapping, geochemical sampling, mineral-resource assessment	Goodnews, Hagemester Island, Bethel, Dillingham, and Nushagak Bay quadrangles
Chignik-Sutwik Island quadrangles (AMRAP); fig. 12 (2)	R. L. Detterman	Geologic mapping, geochemical sampling, mineral-resource assessment	Chignik and Sutwik Island quadrangles
Lake Clark quadrangle (AMRAP); fig. 12 (3)	W. H. Nelson	Geologic mapping, geochemical sampling, mineral-resource assessment	Lake Clark quadrangle
Russian Mission-Bethel-Goodnews; fig. 12 (4)	A. E. Lacey and Topographic Division personnel	Topographic mapping	Russian Mission, Bethel and Goodnews quadrangles
Port Moller; fig. 12 (5)	A. E. Lacey and Topographic Division personnel	Topographic mapping	Port Moller and Cold Bay quadrangles
Petroleum geology of Cook Inlet basin; fig. 12 (6), fig. 13 (7)	See table 7 and section entitled "Regional projects, southern Alaska."		
Environmental studies of the northern Kering Sea; fig. 12 (7), fig. 11 (6), fig. 13 (7)	See table 9 and section entitled "Regional projects, offshore Alaska."		

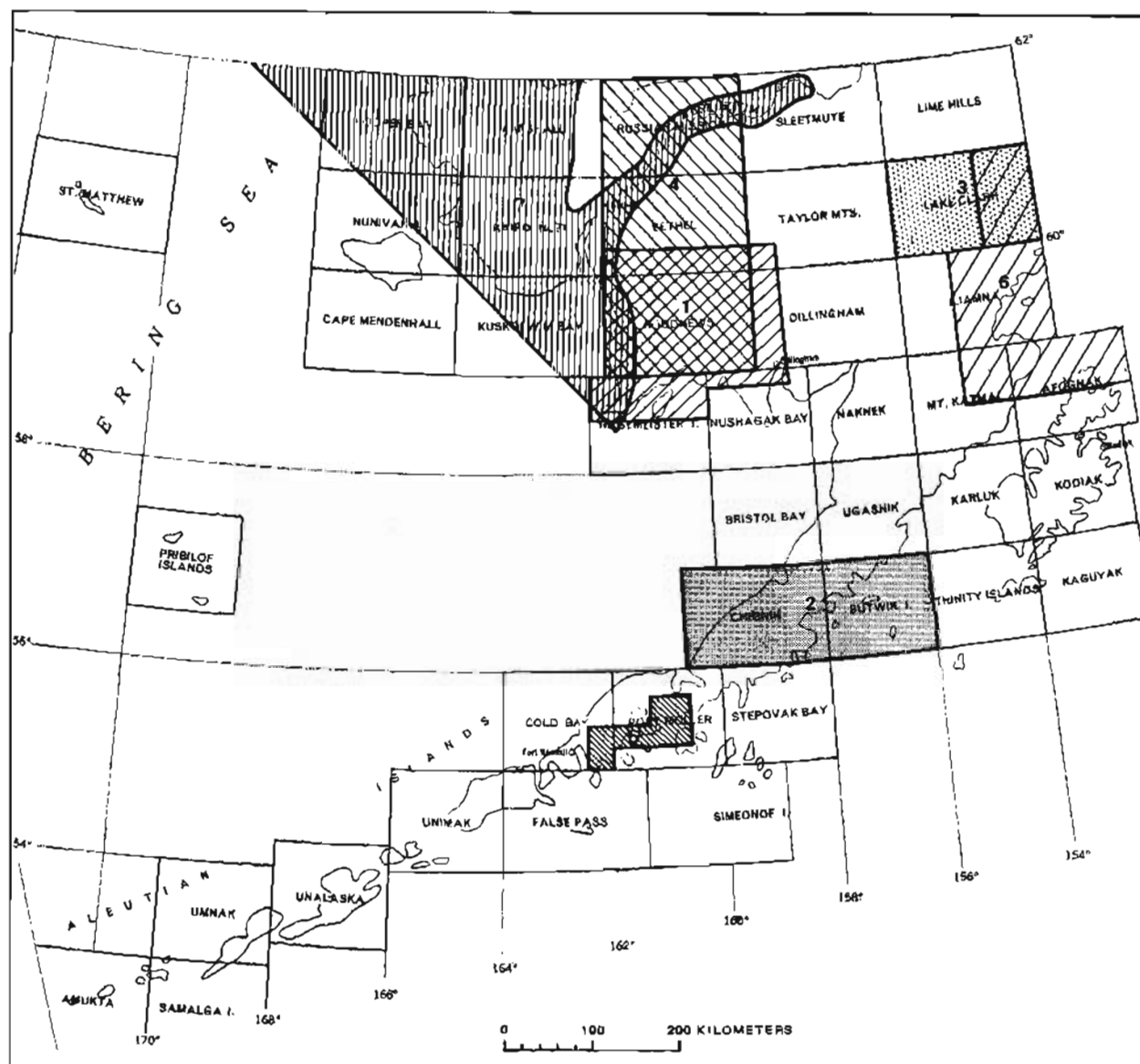


FIGURE 12.—Locations of projects, southwestern Alaska.

of porphyry copper deposits; (3) sampling mineralized areas for age determinations and for trace-element and stable-isotope studies; (4) an aeromagnetic survey and interpretation; (5) regional gravity study; and (6) geothermal investigation of volcanic centers.

**Project status:** The project is planned for two field seasons. Fieldwork in 1977 will consist of geologic mapping, geochemical sampling, gravity measurements, and detailed investigations of mineralized and geothermal areas. Preliminary maps and reports are scheduled for 1978.

**Project:** Lake Clark quadrangle (AMRAP).

**Region and map key:** Southwestern Alaska; fig. 12 (3).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

**Project chief:** Willis H. Nelson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2274.

**Project objectives:** Reconnaissance geologic, geochemical, geophysical, and telegeologic mapping will provide the data for a rapid as-

assessment of the mineral resources of the quadrangle. Fieldwork is to include: (1) geologic mapping at 1:250,000 scale, with detailed studies of the mineral deposits; (2) geochemical sample survey primarily through use of stream sediments and altered or mineralized rocks with detailed investigations of selected mineral deposits; (3) sampling mineralized areas for age determinations and for trace-element and stable-isotope studies; (4) an aeromagnetic survey and interpretation; (5) regional gravity study; (6) investigation of potential for geothermal and radioactive energy resources; and (7) geochronology and isotope investigations of intrusive rocks.

*Project status:* The project is planned for two field seasons. Fieldwork in 1977 will consist of geologic mapping, geochemical sampling, gravity measurements, and detailed investigations of mineralized areas. Preliminary maps and reports are scheduled for 1978.

*Project:* Russian Mission, Bethel, Goodnews quadrangles.

*Region and map key:* Southwestern Alaska; fig. 12 (4).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The objective is to prepare three new 1:250,000-scale maps to replace the reconnaissance maps of that series. This revision was made possible by mapping the remaining 24 1:63,360-scale maps of this area.

*Project status:* Advance manuscript copy is available for the 24 1:63,360-scale maps, with publication scheduled for about 1978. The three new 1:250,000-scale maps are in work and are also scheduled to be published by 1978.

*Project:* Port Moller.

*Region and map key:* Southwestern Alaska; fig. 12 (5).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* This project will prepare eight new 1:63,360-scale quadrangles of the Port Moller area.

*Project status:* Some of these quadrangles had been partially compiled but lack of photographic coverage halted the work. Aerial photography has now been obtained, and map compilation will begin in FY 1977.

#### SOUTHERN ALASKA

*Project:* Seward-Blying Sound quadrangles (AMRAP).

*Region and map key:* Southern Alaska; fig. 13 (1).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Russell G. Tysdal, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2613.

*Project objectives:* The objectives of the project are reconnaissance geologic, geophysical, geochemical, and telegeologic mapping to provide data for rapid assessment of mineral resources of the quadrangles. Fieldwork included: (1) geologic mapping at 1:250,000 scale; (2) geochemical surveying for metals by sampling and analysis of stream sediments and pan concentrates; (3) aeromagnetic survey of the entire quadrangle; (4) obtaining additional gravity data to enhance existing map; (5) telegeologic mapping using LANDSAT (formerly ERTS) imagery; (6) detailed geologic mapping in gold district near Hope, Alaska, including mapping and geochemical sampling in mines; and (7) sampling of greenstones on Resurrection Peninsula and Knight Island for paleomagnetic studies.

*Project status:* Fieldwork was completed during the 1976 field season. Project work is now focusing on preparation of a folio that includes geochemistry, geophysics, telegeology, and mineral economics, in addition to the geologic data. A detailed study of the Hope gold district is being done by P. A. Mitchell. Paleomagnetic study of greenstones is under the direction of C. S. Grommé. The folio and additional reports on stratigraphy, structure, geophysics, and economic geology are scheduled for completion during 1977.

*Project:* Talkeetna quadrangle (AMRAP).

TABLE 7.—Regional projects, southern Alaska

Name of Project; map key	Personnel	Type of work	Area
Seward-Blying Sound quadrangles (AMRAP); fig. 13 (area 1)	R.G. Tyndal, J.E. Cane, G.R. Winkler, F.A. Mitchell, C.S. Gromme, J. Billhouse, R. Tripp, W. Grimm, H.L. Silberman	Geologic mapping, geochemical and geophysical studies, mineral-resource assessment	Seward and Blying Sound quadrangles
Talkeetna quadrangle (AMRAP); fig. 13 (2)	B.L. Reed, S.W. Nelson, R.L. Datterman, A.K. Armstrong, J.T. Dutro, Jr., C.C. Curtin, R. Karlson, I.F. Rittersbach, R. Morin, R. Tripp	Geologic mapping, geochemical and geophysical studies, mineral-resource assessment	Talkeetna quadrangle
Alaska coastal environments; fig. 13 (3)	A.T. Ovenshine, S.R. Sartich-Winkler, Remben Kachadoorian, Jeffrey Rupert	Sedimentology studies, core sampling and interpretation	Turnagain Arm
Anchorage D-3 quadrangle (Earthquake Hazards); fig. 13 (4)	George Plafker, R.L. Datterman	Geologic mapping, stratigraphic studies	Anchorage D-3 quadrangle
Gulf of Alaska Tertiary province; fig. 13 (5), fig. 14 (6)	George Plafker, G.R. Winkler, Travis Hudson, R.G. Tyndal, and other Geologic Division personnel	Fieldwork nearly complete, office compilation	Yakutat, Mount Saint Elias, Berling Glacier, Icy Bay, Cordova, and Middletown Island quadrangles
Talkeetna Mountains quadrangle (AMRAP); fig. 13 (6)	Seis Coe-Joy, Jr., R.L. Miller, W.H. Nelson, H.L. Silberman	Geologic mapping, geochemical sampling	Talkeetna Mountains quadrangle and adjacent areas (mainly in Anchorage quadrangle)
Petroleum geology of Cook Inlet basin; fig. 13 (7), fig. 12 (6)	L.B. Hagood	Framework and petroleum geology	Cook Inlet region
Earthquake induced structures in sediments; fig. 13 (8)	J.D. Sims, M.J. Rymer, Richard Espinosa	Bathymetric and limnologic surveys, coring of lake bottom; assessment of earthquake recurrence intervals	Katmai Peninsula
Alaska seismic studies	J.C. Lahr, M.E. Blackford, C. Stephens, S.C. Conans and other Office of Earthquake Studies personnel	Assessment of level of seismicity and potential seismic risk, operation of 50 seismic stations	Cook Inlet to Yakutat
Anchorage Borough; fig. 13 (9)	H.R. Schmoll	Surficial geologic mapping with environmental geologic interpretations	Anchorage Borough
Anchorage; fig. 13 (10)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Anchorage area
Bering Glacier-Mount Saint Elias area; fig. 13 (11)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Bering Glacier, Mount Saint Elias, and Yakutat quadrangles
Seward; fig. 13 (12)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Seward area
Valdez; fig. 13 (13)	A.E. Lacey and Topographic Division personnel	Topographic mapping	Valdez area

Region and map key: Southern Alaska; fig. 13 (2).

Organizational designation: Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

Project chief: Bruce L. Reed, U.S. Geological Sur-

vey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 272-8228.

Project objectives: Project objectives are reconnaissance geologic, geochemical, geophysical and telegeologic mapping to provide data for

TABLE 7.—Regional projects, southern Alaska—Continued

Name of Project; map key	Personnel	Type of work	Area
Tanana Valley transportation/development corridor, Fairbanks to Canadian border (Arctic Environmental Studies); fig. 13 (14), fig. 10 (5)	See table 4 and section entitled "Regional projects, east-central Alaska."		
Engineering geology studies, certain coastal communities; fig. 13 (15), fig. 14 (3)	See table 8 and section entitled "Regional projects, southeastern Alaska."		

preliminary assessment of mineral resources in the quadrangle. Fieldwork consists of: (1) geologic mapping at 1:250,000 scale; (2) geochemical investigations, primarily through the use of sediment, pan-concentrate, and altered or mineralized rock samples to delineate areas of metal enrichment; (3) an aeromagnetic survey and interpretation to support the geologic mapping and aid in mineral-resource assessment; (4) regional gravity survey; and (5) mapping selected areas of Tertiary sedimentary rocks to assess their coal potential.

*Project status:* Geologic mapping for this 3-year project was begun in 1974 in the northwestern part of the quadrangle by Reed, James C. Ratté

and visiting geologists Donald H. Richter, William P. Sharpe, Warren B. Hamilton, and David L. Jones. In 1975 Reed, Steven W. Nelson, and visiting geologists Ratté and Robert L. Detterman completed geologic mapping in the southwestern part of the quadrangle; Inyo Eilersieck completed studies on Tertiary coal bearing rocks; and Gary Curtin and Richard Karlson undertook 1 month of geochemical studies. In 1976 Reed, Nelson, and visiting geologists Detterman, Augustus K. Armstrong, and J. Thomas Dutro, Jr., completed geologic mapping of the quadrangle. Curtin, Karlson, and Richard Tripp spent 1 month completing a reconnaissance geochemical sampling program

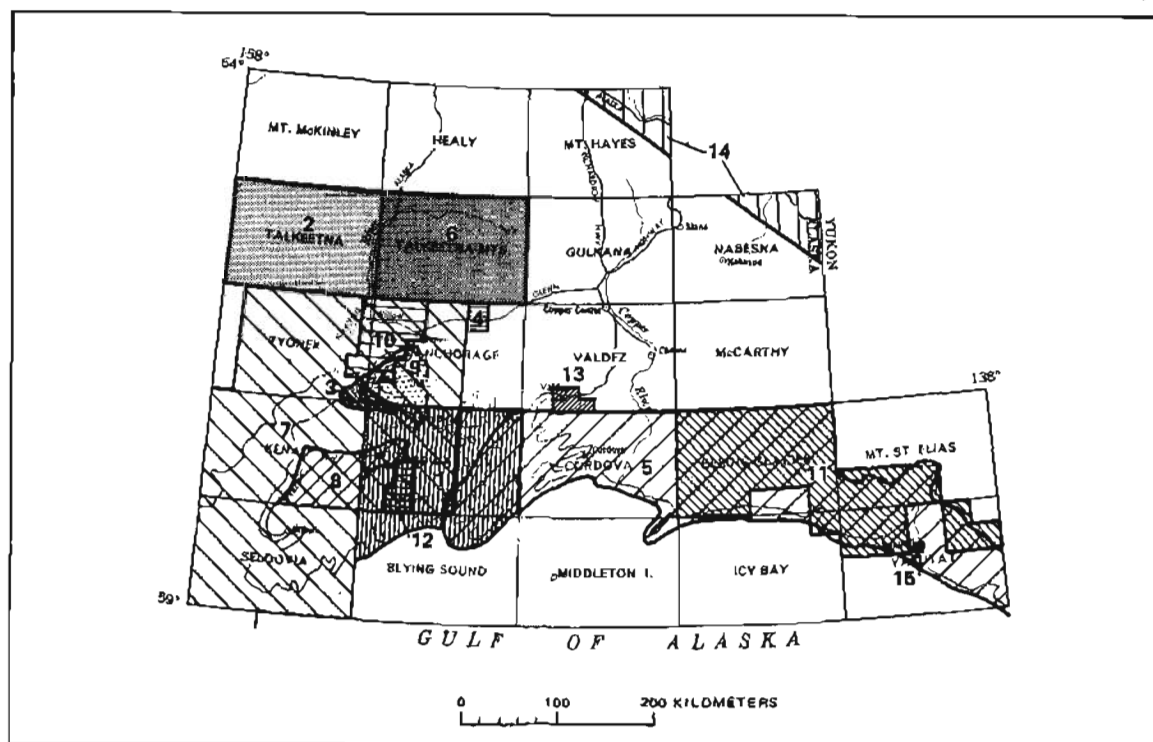


FIGURE 13.—Locations of projects, southern Alaska.

and also provided logistical support for gravity measurements made by Robert Morin. The geologic map and final reports are scheduled for completion in 1977.

*Project:* Alaskan coastal environments.

*Region and map key:* Southern Alaska; fig. 13 (3).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* A. Thomas Ovenshine, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2231, 2234.

*Project objectives:* The original objective of the project was to gain an understanding of the sedimentary system of upper Turnagain Arm. The scope of the project is now being broadened to include studies of geologic hazards at selected sites in Alaska's coastal zone. Goals of the Turnagain Arm investigation are: (1) completing a reconnaissance of surface sediments by means of textural, compositional, and facies analysis; (2) preparing detailed sedimentological maps of Girdwood Bar; (3) studying transgressive intertidal deposits at Portage, formed as a result of subsidence accompanying the 1964 Alaska earthquake; (4) evaluating post-1964 erosion of the shoreline at Hope; (5) determining the age of placer gold deposits at Hope; (6) analyzing a 100-m sediment core from Portage; and (7) developing a better understanding of the Quaternary history of the Turnagain Arm area. Objectives of the Pillar Mountain landslide study are to evaluate the landslide and to develop techniques for continuously monitoring it.

*Project status:* The Turnagain Arm part of the project is nearly complete. The first five objectives were met through fieldwork during 1973 to 1976; reports have been published and interpretations have been presented orally at scientific meetings. Core drilling essential to objective 6 was completed in May 1975. Sampling and radiography of the core are complete; textural and mineralogical analyses are nearly complete. The study of foraminifers and diatoms which indicate changes in environment is nearing completion; organic material for carbon-14 dating is being concentrated. In 1977 A. T. Ovenshine, Reuben Kachadoorian, Susan Bartsch-Winkler, and Jeffrey Rupert will continue laboratory studies and will report

on the sedimentary and seismic history at Portage as interpreted from the core. Fieldwork at Pillar Mountain was undertaken in August 1976. Additional studies may be required in 1977. Work during the winter of 1976-77 is concentrating on reporting the conceptual design of monitoring systems.

*Project:* Anchorage D-3 quadrangle (Earthquake hazards).

*Region and map key:* Southern Alaska; fig. 13 (4).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chiefs:* George Plafker and Robert L. Detterman, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2201 and 2244, respectively.

*Project objectives:* Detailed geologic mapping of several areas of possible Holocene offset along the Castle Mountain fault system and investigation of several large potentially dangerous landslides in the Hicks Creek area. Planned fieldwork includes: (1) geologic mapping at 1:63,360 scale of entire quadrangle; (2) detailed geologic mapping of areas of possible Holocene offset along Boulder Creek; (3) detailed investigations of landslide areas to determine time and extent of movement; and (4) stratigraphic studies of the Mesozoic and Tertiary rocks.

*Project status:* Reconnaissance geologic and earthquake hazards mapping was completed along segments of the Castle Mountain and Caribou faults by Plafker, Detterman, Travis Hudson, and R. G. Tysdal in 1973 and 1974. Several areas of possible Holocene offset on the Caribou fault were noted, and numerous landslides were delineated in areas along the Glenn Highway where buildings are currently being constructed. Results of the reconnaissance survey are published, and a geologic quadrangle map is planned.

*Project:* Gulf of Alaska Tertiary province.

*Region and map key:* Southern and southeastern Alaska; fig. 13 (5); fig. 14 (8).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* George Plafker, U.S. Geological Survey, 345 Middlefield Road, Menlo Park,



Calif. 94025; (415) 323-8111, ext. 2201.

*Project objectives:* This is an ongoing project aimed at delineation of the major geologic features of the Tertiary basin, evaluation of its resources, and study of the adjacent pre-Tertiary terranes.

*Project status:* Fieldwork nearly complete during 1975 season. Publications during 1976 include two on intrusive igneous and metamorphic rocks of the Saint Elias Mountains by Hudson and others and a geologic map of the Cordova B-2 and part of A-2 quadrangles by Tysdal and others. Work in preparation includes reconnaissance geologic maps of the Yakutat, Mount Saint Elias, Bering Glacier, Icy Bay, Cordova, and Middleton Island 1:250,000 quadrangles as well as several papers on stratigraphy and paleontology of the province.

*Project:* Talkeetna Mountains quadrangle (AM-RAP).

*Region and map key:* Southern Alaska; fig. 13 (6).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Béla Csejtey, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2277.

*Project objectives:* The principal objectives are the evaluation of the mineral resources of the quadrangle through reconnaissance geologic, geochemical, geophysical, and telegeologic mapping. Fieldwork includes: (1) regional geologic mapping at 1:250,000 scale and detailed mapping of mineralized areas; (2) a geochemical survey utilizing stream-sediment, soil, and mineralized-bedrock samples; (3) sampling mineral deposits for age determinations and for trace-element and stable-isotope studies; and (4) completion of a regional gravity survey.

*Project status:* During June 1976, Csejtey and Willis H. Nelson completed reconnaissance geologic mapping in about 90 percent of the quadrangle. Geochemical sampling was carried out in the western one-third of the quadrangle by Gary C. Curtin in 1975. Fieldwork planned for 1977 includes geochemical sampling, gravity measurements, and some geologic mapping. Preliminary maps and reports are scheduled for completion in 1977. Publication of final reports is planned for late 1978.

*Project:* Petroleum geology of Cook Inlet Basin.

*Region and map key:* Southern and southwestern Alaska; fig. 13 (7); fig. 12 (6).

*Organizational designation:* Geologic Division, Office of Energy Resources and Marine Geology, Branch of Oil and Gas Resources, Branch of Pacific-Arctic Geology.

*Project chief:* Leslie B. Magoon, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2979.

*Project objectives:* The major objectives are concurrent study of the geologic framework and petroleum geology of Lower Cook Inlet for inclusion in the Environmental Impact Statement required by law for the anticipated Federal Outer Continental Shelf (OCS) lease sale. Products of this project include: (1) in the Cape Douglas area, descriptions and samples of stratigraphic sections of Jurassic, Cretaceous, and Tertiary rocks; (2) new geologic maps of the Cape Douglas and Seldovia areas; (3) a geologic map of Cook Inlet at 1:250,000 scale; and (4) 480 km of 3600 % CDP marine seismic data. From this work, the onshore geology will be extended into the subsurface of Lower Cook Inlet. Rock, oil, gas, and water samples were collected and are being analyzed geochemically. These and other data will help determine the origin and general location of new oil and gas reserves.

*Present status:* Additional fieldwork in the Cape Douglas area is being planned for the summer of 1977 to complete the geologic map. A report on the framework geology of Lower Cook Inlet correlating onshore geology to offshore seismic data is being reviewed for publication in 1977. Reports on petroleum geology and sandstone composition are in preparation. This project is approximately 70 percent completed.

*Project:* Earthquake-induced structures in sediments.

*Region and map key:* Southern Alaska; fig. 13 (8).

*Organizational designation:* Geologic Division, Office of Earthquake Studies, Earthquake Hazards Branch.

*Project chief:* John D. Sims, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2252 or 2081.

*Project objectives:* The major objectives are to determine: (1) the existence of earthquake-

induced structures in glaciolacustrine sediments; (2) if such structures are correlative within and between lakes; and (3) the relation between the character and magnitude of structures in sediments of differing grain size. These data will be used to determine an earthquake history for a part of the Kenai Peninsula.

*Project status:* Preliminary investigations were begun in August 1975, with bathymetric surveys of Eklutna, Big, Summit (on Seward Highway), Kenai, Upper Trail, and Skilak Lakes. Piston core samples, as much as 1 m long, were retrieved from all lakes except Eklutna and Trail Lakes. The cores from Skilak Lake were most useful in determining the presence of probable earthquake-induced structures in sediments. Six zones of deformational structures as well as five ash beds were found in cores from Skilak Lake. Zones of structures were dated at 1964, 1911 or 1912, 1901, 1883, 1870 and 1810. Each date corresponds to an earthquake that affected the region. The oldest sediments retrieved were dated by varve counts at about 1785 A.D. In summer of 1976 investigations were concentrated on Skilak, Hidden, Summit, Kenai, and Tustumena Lakes. Cores ranging in length from about 1 m to more than 4 m were collected from all these lakes. Laboratory investigations are now required to determine the contents of the cores.

*Project:* Alaska seismic studies.

*Region:* Southern Alaska.

*Organizational designation:* Geologic Division, Office of Earthquake Studies, Branch of Earthquake Hazards.

*Project chief:* John C. Lahr, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2510.

*Project objectives:* The fundamental goals of this project are to develop an understanding of the current tectonic processes that generate earthquakes and to assess the level of seismicity and the potential seismic risk in populated or developed regions of Alaska. Of particular importance is the search for premonitory phenomena and physical conditions prior to moderate- and large-sized earthquakes.

*Project status:* The Alaska seismic studies project has been in operation since 1971 and currently operates 50 seismic stations in Alaska covering the region from Cook Inlet to Yakutat Bay.

Topics currently under investigation include: review and relocation of the historic seismic events along the eastern Gulf of Alaska; summarization of the data collected to date, including distribution of earthquakes, focal mechanisms, and aftershock studies; and detailed study of earthquakes in the vicinity of Valdez based in part on data from a network of stations that temporarily augments the permanent network. Open-file reports are being prepared with quarterly summaries and maps of the earthquakes located.

*Project:* Anchorage Borough, Alaska.

*Region and map key:* Southern Alaska; fig. 13 (9).

*Organizational designation:* Geologic Division, Office of Environmental Geology, Engineering Geology Branch.

*Project chief:* Henry R. Schmoll, U.S. Geological Survey, Mail Stop 903 KCG, Box 25046, Denver, Colo. 80225; (303) 234-3290 or 234-3721.

*Project objective:* The project objective is to provide the geologic information needed for boroughwide land-use planning. Providing this information involved geologic mapping (primarily of surficial deposits), determining physical properties of selected materials, correlating geologic units, deciphering geologic history, and evaluating geologic processes. The studies were undertaken in response to requests from local government officials; the studies have been coordinated with hydrologic investigations by the Water Resources Division.

*Project status:* Fieldwork, begun in 1965 and continued with major field seasons through 1970 and minor investigations since then, has been completed. Maps at 1:24,000 scale (metropolitan area) and at 1:63,360 scale (remainder of the borough) are being prepared for publication; a final report is contemplated. Several interpretative maps and reports derived from the geologic maps and designed for use by planners and developers have been published. The project is mainly in recessed status at present, but some work will continue under the aegis of a new statewide project, Environmental Geology of Alaska Coal Lands.

*Project:* Anchorage.

*Region and map key:* Southern Alaska; fig. 13 (10).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The Anchorage project, consisting of 31 quadrangles at 1:25,000 scale with contour intervals of 5, 10, or 20 meters, will provide modern large-scale maps of the greater Anchorage area. Sixteen of these maps are standard line maps and 15 quadrangles will be orthophotomaps.

*Project status:* All field operations are complete. Advance manuscript copy is available for the 16 standard line maps and orthophotoquads are available as advance copy for the 15 orthophotomaps. The maps are scheduled to be published in early 1978.

*Project:* Bering Glacier-Mt. St. Elias area.

*Region and map key:* Southern Alaska; fig. 13 (11).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The project will provide new 1:63,360-scale maps in an area previously unmapped at this scale.

*Project status:* This project area consists of 50 1:63,360-scale quadrangles. Five quadrangles have been compiled, and advance manuscript copy is available. The remainder will be compiled by FY 1979. No field operations are scheduled.

*Project:* Seward.

*Region and map key:* Southern Alaska; fig. 13 (12).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The objective is to prepare six new 1:25,000-scale metric maps of Seward and vicinity.

*Project status:* This is a newly authorized project. Aerial photography was obtained by the National Ocean Survey in 1976. Field control will be obtained during 1977.

*Project:* Valdez.

*Region and map key:* Southern Alaska; fig. 13 (13).

*Organizational designation:* Topographic Division, Rocky Mountain Mapping Center.

*Project chief:* A. E. Letey, Chief, Rocky Mountain Mapping Center, Federal Center, Denver, Colo. 80225; (303) 234-2351.

*Project objectives:* The objective is to prepare five new 1:25,000-scale metric maps of Valdez and vicinity.

*Project status:* This is a newly authorized project. Aerial photography was obtained by the National Ocean Survey in 1976. Field control will be obtained in 1977.

#### SOUTHEASTERN ALASKA

*Project:* Ketchikan-Prince Rupert quadrangles (AMRAP).

*Region and map key:* Southeastern Alaska; fig. 14 (1).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chiefs:* Henry C. Berg and Raymond L.

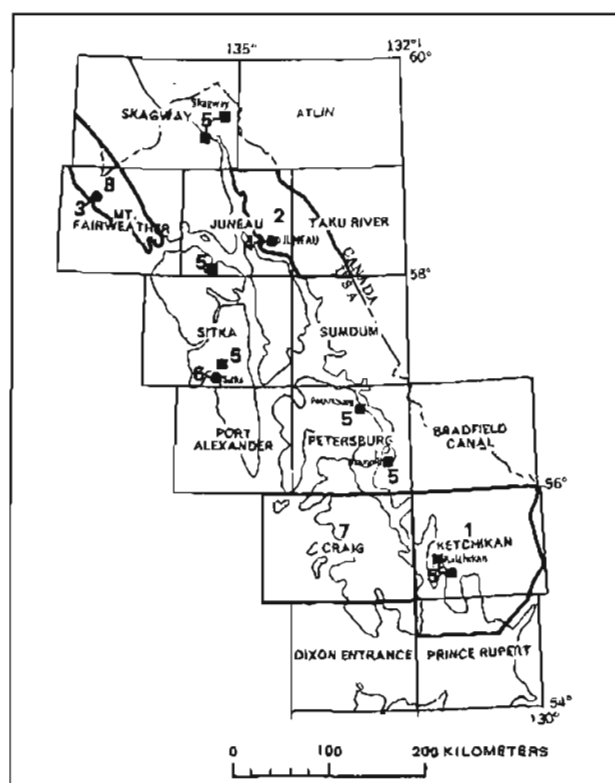


FIGURE 14.—Locations of projects, southeastern Alaska.

TABLE 8.—Regional projects, southeastern Alaska

Name of Project; map key	Personnel	Type of work	Area
Ketchikan-Prince Rupert quadrangles (AMRAP); fig. 14 (area 1)	R.C. Berg, R.L. Elliott, J.G. Smith, R.D. Koch	Geologic mapping, mineral-resource assessment	Ketchikan and Prince Rupert quadrangles
Juneau investigations; fig. 14 (2)	D.A. Brew, A.D. Ford	Geologic and geochemical mapping, mineral-resource assessment	Juneau and Taku River quadrangles
Petrology of La Parouse layered intrusion fig. 14 (3)	R.A. Lonay, G.M. Himmelberg, G.K. Czerwinski	Detailed mapping, laboratory study of samples and cores	Fairweather Range, Glacier Bay National Monument
Surficial geology, Juneau urban area and vicinity; fig. 14 (4)	R.D. Miller	Fieldwork completed; report preparation	Juneau area
Engineering geology studies, certain coastal communities; fig. 14 (5), fig. 13 (15)	L.A. Yehle	Geologic mapping, evaluation of geologic hazards	Yakutat, Moonah, Sitka, Metlakatla, Rainier, Skagway, Petersburg, Wrangell, and Ketchikan quadrangles
Sitka Observatory; fig. 14 (6)	W.E. Ojbakken	Geomagnetic and seismic studies	Sitka
Craig quadrangle; fig. 14 (7)	O.D. Wierlein, Michael Churkin, Jr.	Geologic mapping, stratigraphic, petrologic and structural studies	Craig quadrangle
Gulf of Alaska Tertiary province; fig. 14 (8), fig. 13 (5)	See table 7 and section entitled "Regional projects, southern Alaska."		

Elliott, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2266 and 2614, respectively.

**Project objectives:** The main goal of this project is to assess the mineral-resource potential of the Ketchikan and Prince Rupert 1:250,000-scale (1°×2°) quadrangles. The area is being mapped geologically and surveyed systematically by geochemical and geophysical methods, including interpretation of space-satellite imagery. The project incorporates and extends the results of four recently completed geologic and mineral-resource investigations within the quadrangle.

**Project status:** In September 1976, Berg, Elliott, James G. Smith, and Richard D. Koch completed reconnaissance geologic mapping of the southern tip of Portland Peninsula within the Prince Rupert quadrangle. Travis Hudson joined the field party during this time to lead a 3-day mapping and topical study of the plutons associated with the recently discovered Quartz Hill porphyry molybdenum deposit near Wilson Arm. Mapping activities were then moved to previously unmapped interior areas of southern

Revillagigedo Island. During the past year, complete geochemical data from all pre-1976 sampling in the area were released in open file, and preliminary reports were completed. Two-thirds of the geologic mapping has been completed to date, and reconnaissance geochemical sampling now covers about one-third of the region. A 2-month helicopter-supported field season in 1977 will complete the fieldwork for this project. Principal efforts will include geologic mapping of the remaining unmapped parts of Revillagigedo Island and Cleveland Peninsula, and a geochemical survey of a major part of the quadrangles. Preliminary maps and reports, including a 1:250,000-scale map of Portland Peninsula, are scheduled for completion in 1977. Final project reports are due in 1978.

**Project:** Juneau investigations.

**Region and map key:** Southeastern Alaska; fig. 14 (2).

**Organizational designation:** Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* D. A. Brew, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2178.

*Project objectives:* The major objectives are reconnaissance (in part) and detailed (in part) geologic and geochemical mapping and mineral-resource appraisal of a broad transect across the Coast Range batholithic 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 meta-intrusive rocks to the relatively young intrusive rocks and associated metavolcanic and metaclastic rocks of a low pressure-high temperature facies series along the international boundary. Geochronologic studies of the transect are made in cooperation with the Coast Range geochronology project, J. G. Smith, Chief. This information will provide the regional framework for the Juneau Gold Belt and for mineral occurrences immediately east of the U.S.-Canada boundary.

*Project status:* The project has been active since 1964 with full or near-full seasons devoted to fieldwork in 1964, 1965, 1967, 1968, 1970, and 1973. To date, detailed (1:31,680) mapping of about three quadrangles has been completed; one preliminary 1:31,680 quadrangle map has been published, and the two others have been submitted for publication; three short papers have been published, and three more submitted for publication. Completion of the reconnaissance geologic mapping of the remainder of the Juneau and Taku River 1:250,000 quadrangles will require one more full season with helicopter support, not anticipated for the near future. In the meantime, Brew and A. B. Ford (who are primarily engaged in other projects) continue compilation and petrographic studies in the office and attempt every season to map a few more square miles. Final report completion depends on completion of the field studies.

*Project:* Petrology of La Perouse layered intrusion.

*Region and map key:* Southeastern Alaska; fig. 14 (3).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Robert A. Loney, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2384.

*Project objectives:* The objectives are to determine the petrogenesis, geologic setting, and economic potential of the La Perouse layered intrusion by petrographic, chemical, and structural means. The Ni-Cu sulfide-bearing basal ultramafic zone is largely unexposed, and data concerning it come mostly from drill cores from the Brady Glacier prospect of Newmont Exploration Limited. The predominant upper gabbro zone is well exposed, though difficult of access.

*Project status:* The sampling of the drill cores from the Brady Glacier Cu-Ni prospect is complete. Fieldwork in the La Perouse area was severely limited by bad weather in the summer of 1976. A few weeks' work, planned for the summer of 1977, should complete the field study. Robert A. Loney and Glen R. Himmelberg are continuing the petrographic study of the surface samples of the gabbro. Himmelberg has completed the microprobe analysis of the silicate minerals in the core samples. Gerald Czamanske and Lewis Calk are continuing the petrographic and microprobe study of the sulfide minerals. First reports will probably be submitted in 1978.

*Project:* Surficial geology of the Juneau urban area and vicinity.

*Region and map key:* Southeastern Alaska; fig. 14 (4).

*Organizational designation:* Geologic Division, Office of Environmental Geology, Engineering Geology Branch.

*Project chief:* R. D. Miller, U.S. Geological Survey, Mail Stop 903 KCG, Box 25046, Denver, Colo. 80225; (303) 234-2960 or 234-3721.

*Project objectives:* The project has provided detailed mapping of the surficial deposits in and adjacent to the Juneau urban area and has obtained data regarding distribution and physical properties of geologic materials as aids in evaluating ground motion that might occur in response to major earthquakes in southeastern Alaska.

*Project status:* Fieldwork has been completed. A Miscellaneous Geologic Investigations Map of the surficial geology of the Juneau area was published as I-805 in 1975. Preparation on the final report, to be published as a U.S. Geological

Survey Professional Paper, has been delayed while the project chief is assigned to ground-response studies in the Salt Lake Valley, Utah.

*Project:* Reconnaissance engineering geology of certain coastal communities, Alaska.

*Region and map key:* Southeastern and southern Alaska; fig. 14 (5); fig. 13 (15).

*Organizational designation:* Geologic Division, Office of Environmental Geology, Engineering Geology Branch.

*Project chief:* L. A. Yehle, U.S. Geological Survey, Mail Stop 903 KCG, Box 25046, Denver, Colo. 80225; (303) 234-2999 or 234-3721.

*Project objectives:* Objectives are to evaluate, by reconnaissance field methods, the general and engineering geology of certain Alaskan communities for geologic hazards including earthquakes and to present the results on maps and reports.

*Project status:* Reconnaissance fieldwork has been completed and open-file reports released to the public for Sitka and Yakutat and (under earlier project chief, R. W. Lemke) Haines, Skagway, Wrangell, and Ketchikan. An open-file report on Metlakatla has been submitted for release; formal reports and open-file reports on other communities (and several in southwestern, west-central, and northern Alaska) will be prepared when time is available because the project chief was diverted to another project, Environmental Geology of Alaska coal lands.

*Project:* Sitka Observatory.

*Region and map key:* Southeastern Alaska; fig. 14 (6).

*Organizational designation:* Geologic Division, Office of Geochemistry and Geophysics, Branch of Electromagnetism and Geomagnetism.

*Project chief:* Willis E. Osbakken, U.S. Geological Survey, Box 158, Sitka, Alaska 99835; (907) 747-3332.

*Project objectives:* The observatory operates seismic instruments for acquiring information on the global occurrence of earthquakes; telemeters seismic and the tide station data to the NOAA Tsunami Warning System Observatory at Palmer; and records and measures, on a continuous basis, the various elements of the Earth's magnetic field and distributes these data to scientists either directly or through the

Branch of Electromagnetism and Geomagnetism at Denver.

*Project status:* This project is a continuing one; the station has functioned as a geomagnetic observatory since 1902 and as a seismic station since 1925. The station furnishes seismic recordings to the National Earthquake Information System for epicenter studies. Telemetered data furnished to Palmer are considered vital to the Warning System, as Sitka Observatory is the only data source south of Yakutat. As a geomagnetic observatory, Sitka plays an important role in the international scientific community, being 1 of 13 selected observatories 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. Recently installed digital and analog recording equipment has increased the production of geomagnetic data.

*Project:* Craig quadrangle.

*Region and map key:* Southeastern Alaska; fig. 14 (7).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chiefs:* G. Donald Eberlein and Michael Churkin, Jr., U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2210 and 2256, respectively.

*Project objectives:* The primary objective is to provide the public and other Government agencies with a modern geologic map of the Craig quadrangle at 1:250,000 scale as a frame of reference for resource appraisal, development, and multi-use planning. Secondary objectives relate to developing the stratigraphic, petrologic, and structural data needed to understand, especially in the light of modern plate tectonic concepts, the geologic evolution of a major part of the Alexander Archipelago.

*Project status:* Fieldwork was completed in 1975. Map compilation is underway to formulate a legend that will permit H. C. Berg, A. L. Clark, and A. T. Ovenshine to compile parts of the 1:250,000 quadrangle that are peripheral to the central part of the quadrangle being compiled by G. D. Eberlein and Michael Churkin, Jr.

Open-file compilation is scheduled for 1977. Publication plans also call for releasing Geologic Quadrangle Maps of the Craig C-5 and C-6 subquadrangles (1:63,360) and open-file maps of other subquadrangles where warranted by available control. Reports, mainly in the form of topical papers, are in various stages of completion.

## OFFSHORE ALASKA

*Project:* Eastern Gulf of Alaska continental shelf.  
*Region and map key:* Offshore (southern, south-eastern Alaska); fig. 15 (1).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

Name of Project; map key	Personnel	Type of work	Area
Eastern Gulf of Alaska continental shelf; fig. 15 (area 1)	George Plafker	Evaluation of tectonic framework, petroleum potential, and geologic hazards	Eastern Gulf of Alaska continental shelf
Beaufort and Chukchi Seas resource assessment; fig. 15 (2)	Arthur Cravitz, Gary Boucher, S.L. Eittrheim, O.T. Whitney	Subsea surveys to determine geologic structure and assess mineral-fuel and mineral-resource potential	Beaufort and Chukchi Seas
Environmental geologic studies of the Beaufort and Chukchi Seas; fig. 15 (2)	P.W. Barnes, Erk Reimnitz, D.E. Drake, L.J. Toimil	Arctic shelf sedimentary processes	Beaufort and Chukchi Seas continental shelves
Environmental geologic studies, southern Bering Sea; fig. 15 (3)	T.L. Vallier, J.V. Gardner	Outline and document seafloor instability	Bering Sea
Geologic framework and resource assessment, Aleutian-Bering Sea region; fig. 15 (4)	M.S. Marlow	Marine geological and geophysical survey	Bering Sea
Environmental geologic studies, Eastern Gulf of Alaska; fig. 15 (5)	B.F. Molnia, P.R. Carlson	Evaluation of marine geophysical and sedimentological data	Eastern Gulf of Alaska
Erosion and deposition of shelf sediments, eastern Gulf of Alaska; fig. 15 (5)	B.F. Molnia, P.R. Carlson	Sedimentation and seismic studies	Eastern Gulf of Alaska
Faulting and instability of shelf sediments, eastern Gulf of Alaska; fig. 15 (5)	P.R. Carlson, B.F. Molnia, J.C. Hampson, Jr., S.C. Kittelson, W.P. Levy	Investigation of seafloor sediments for geologic hazards	Eastern Gulf of Alaska
Geologic framework and resource assessment of the western Gulf of Alaska; fig. 15 (6)	Roland von Huene	Evaluation of tectonic framework, petroleum potential, geologic hazards	Western Gulf of Alaska
Environmental studies of the northern Bering Sea; fig. 15 (7), fig. 12 (7), fig. 11 (6)	C.H. Nelson, D.A. Cacchione, A.E. Sallenger, Jr., D.E. Drake, R.H. Hunter	High-resolution profiling, side-scan sonar, vibracoring, bottom camera and TV, current meter/nephelometer tripod, storm-surge wave modeling	Northern Bering Sea, Kuskokwim River drainage
Analyses of well data, Bristol Bay basin, Alaska Peninsula	Hugh McLean	Petrographic, geochemical and paleontologic analyses of cores and cuttings	Bristol Bay basin

TABLE 9.—Regional projects, offshore Alaska



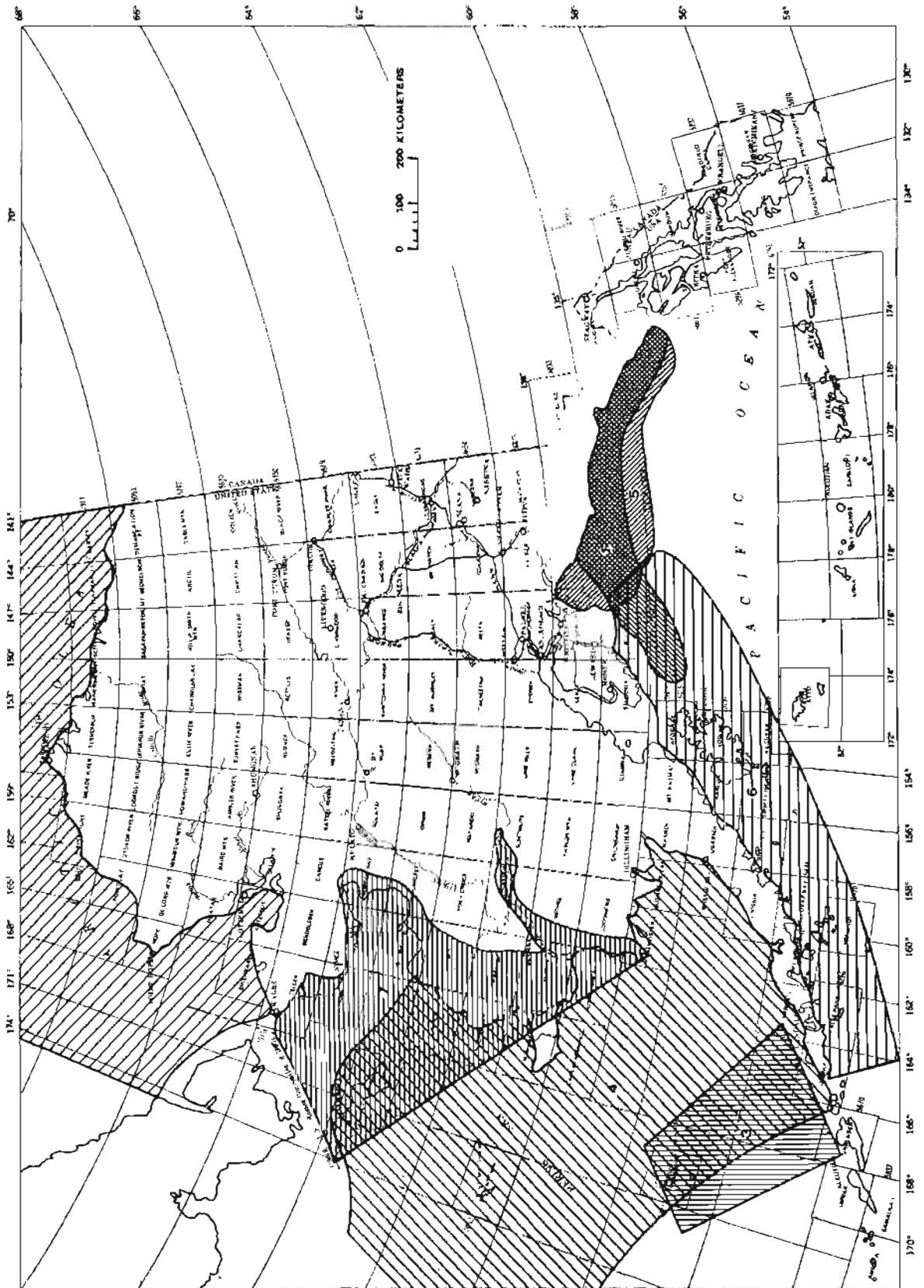


FIGURE 15.—Locations of projects, offshore Alaska.



*Project chief:* George Plafker, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2201.

*Project objectives:* Evaluation of the tectonic framework, petroleum potential, and geologic hazards of the eastern Gulf of Alaska Outer Continental Shelf is the project objective.

*Project status:* Geophysical surveys and bottom sampling were approximately two-thirds completed during 1974 and 1975 field seasons. The scheduled 1976 sampling cruise was cancelled. Tentative plans for 1977 are to collect fill-in multichannel seismic data aboard the R/V S. P. Lee, and to carry out a deep bottom sampling program with the R/V Sea Souther. Reports completed during 1976-77 include a preliminary structural map of the offshore Gulf of Alaska Tertiary province by Terry Bruns and Plafker; a report on refraction profiling on the OCS between Kayak Island and Icy Bay by Ken Bayer and others; an analysis of the reservoir characteristics of Tertiary sandstone by Gary Winkler and others; and a study of the biostratigraphy of the Yakataga Formation by Plafker and Warren Addicott.

*Project:* Beaufort and Chukchi Seas resource assessment.

*Region and map key:* Offshore (northern Alaska); fig. 15 (2).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific Arctic Geology.

*Project chief:* Arthur Grantz, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2259.

*Project objectives:* Objectives are to determine the geologic structure and stratigraphy and to assess the mineral-fuel and mineral-resource potential of the Alaskan continental shelf and slope in the Beaufort and Chukchi Seas of the Arctic Ocean.

*Project status:* The reconnaissance phase of fieldwork on this project was completed during the 1974 field season. Several reports on the reconnaissance geologic framework and petroleum potential of the continental shelf in the Chukchi and Beaufort Seas, and related topical studies, have been released, and others are in preparation. Most of the basic data acquired each field season have been released during the following winter or spring. An intermediate-

scale geophysical program on the Beaufort-Chukchi continental shelf and slope will begin in the 1977 field season. Preliminary plans call for the concurrent acquisition of multichannel seismic reflection, gravity, magnetic, and long-range refraction data from the U.S. Geological Survey R/V S. P. Lee. This vessel will also obtain some deep seismic refraction measurements utilizing ocean-bottom seismometers (OBS). Preliminary plans envision the availability of a U.S. Coast Guard icebreaker to serve as a shooting ship for an extensive OBS-based deep seismic refraction program. This ship would also obtain high-resolution seismic and precision bathymetric profiles and perhaps gravity measurements over the continental shelf and slope.

*Project:* Environmental geologic studies of the Beaufort and Chukchi Seas.

*Region and map key:* Offshore (northern Alaska); fig. 15 (2).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific Arctic Geology.

*Project chiefs:* Peter W. Barnes and Erk Reimnitz, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2114 and 2695, respectively.

*Project objectives:* One objective is to study the present arctic sediment transport regime. Data on river effluents, ice rafting, turbidity, spacecraft imagery, ice gouging, and nearshore and bottom currents are used to provide information on the modern system for comparison with past and future differences in the arctic environment. Other objectives include: definition of the character, mode of transport, source, and physical and chemical composition of bottom materials, including permafrost; historical studies of the geologic record by coring and outcrop examination to provide information concerning the stability or instability of the present-day regime; and study of the sea-ice regime as it affects the geologic processes of arctic shelves.

*Project status:* The project is planned as an ongoing study for which fieldwork has been underway since 1970. Aspects studied in reconnaissance to this time are: river overflow, strudel scour, ice gouging, sediment facies, trace metals, coastal currents, Holocene sediments, sed-

iment temperatures, sediment structures, suspended sediment, and coastline changes. It has been shown that ice plays a significant role in the sedimentary processes of arctic shelves. Critical questions remain as to the fate of river-supplied sediments, nature of offshore permafrost, stability of barrier islands, and seasonal variation of river, ice, and hydrologic processes as they interact with the sediments. Initial reports and maps have been completed, and several more are in progress and contemplated, detailing studies of the sea ice *stamukhi*, rates of ice gouging, coastal oceanography, suspended sediment distribution, river icings, and river overflow. For the open-water periods of 1977, additional fieldwork is planned to include seismic reflection profiling, vibrocoring, diving observations, hydrography, thermoprobes, bathymetry, and suspended-sediment studies, from the U.S.G.S. coastal R/V *Karluk*.

*Project:* Environmental geologic studies of the southern Bering Sea.

*Region and map key:* Offshore (southwestern Alaska); fig. 15 (3).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chiefs:* T. L. Vallier and J. V. Gardner, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2971 and 2972.

*Project objectives:* The project is designed to outline and document problems related to sea-floor instability along the outer continental shelf and upper continental slope of the southern Bering Sea. From collected data, possible geologic hazards to petroleum recovery and transportation, such as faulting and slope failures, can be evaluated.

*Project status:* A 6-week cruise was completed this summer (1976) on the R/V *Sea Sounder*. About 18,000 km of high-resolution single-channel seismic profiles (60KJ sparker, uni-boom, 3.5 kHz) were collected along with 7,000 km of magnetic profiles and 4,000 km of gravity profiles. Eight-five sampling stations were occupied. Data analysis is presently underway.

*Project:* Geologic framework and resource assessment of the Aleutian-Bering Sea region.

*Region and map key:* Offshore (west-central, southwestern Alaska); fig. 15 (4).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chief:* M. S. Marlow, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2656.

*Project objectives:* Current plans are for a 4-week geophysical and geologic survey of the central Bering Sea shelf and adjacent slope and basin on board the R/V *S. P. Lee*. The *Lee* will be equipped to collect 24-channel seismic reflection, gravity, magnetic, bathymetric, and intermediate- and high-resolution seismic reflection data during the summer of 1977. A second 1- or 2-week cruise on the R/V *Sea Sounder* to collect heat flow data in the deep Bering Sea basin is also scheduled for the summer of 1977. The data from both cruises will be used in a regional resource assessment as well as an evaluation of environmental hazards of the Aleutian-Bering Sea region prior to leasing of the area for oil and gas exploration.

*Project status:* A preliminary assessment of oil and gas potential and environmental hazards for the Bering Sea shelf has been published as U.S. Geological Survey open-file report 76-785. This report summarized data collected prior to 1975. Approximately 700 km of 24-channel seismic reflection data collected in 1975 has been published as U.S. Geological Survey open-file report 76-652. These data have been incorporated in a manuscript describing the evolution of St. George basin and the southern Bering Sea shelf. This report is in press and will be published in early 1977 by the American Geophysical Union as part of a monograph on continental margins.

*Project:* Environmental geologic studies of the eastern Gulf of Alaska.

*Region and map key:* Offshore (southern, southeastern Alaska); fig. 15 (5).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chiefs:* Bruce F. Molnia and Paul R. Carlson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025; (415) 323-8111, ext. 2804, 2853, 2612.

*Project objectives:* This project has two primary

objectives: (1) to locate, identify, and study areas of the Gulf of Alaska continental shelf with characteristics that could adversely affect exploration, development, and production of petroleum, minerals and other commodities; and (2) to develop an understanding of the geologic history of the Gulf of Alaska continental shelf through the evaluation of marine geophysical and sedimentological data.

*Project status:* Evaluation of marine geophysical and sedimentological data led to the identification of 54 lease tracts that were either partially or completely affected by submarine slumping, and 70 lease tracts that had either surface or near-surface faults. Stipulations were placed in the leasing arrangements of several tracts, and other tracts were removed from consideration in Gulf of Alaska lease sale #39. This project will continue to evaluate information on environmental hazards and to recommend removal of potentially dangerous areas from consideration for leasing in future offshore sale. Interpretation of the geologic history of the Gulf of Alaska continental shelf will also continue.

*Project:* Erosion and deposition of shelf sediments; eastern Gulf of Alaska.

*Region and map key:* Offshore (southern, southeastern Alaska); fig. 15 (5).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chiefs:* Bruce F. Molnia and Paul R. Carlson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2804, 2853, 2612.

*Project objectives:* The main objective of this project is to locate areas of high erosion, high deposition, and sediment bypassing on the Gulf of Alaska continental shelf. In addition, we are identifying sediment source areas, transportation pathways, and final deposition sites. The methods used in locating the areas of sediment activity are: high-resolution seismic profiling, side-scan sonar, sediment sampling, analyses of aerial photography and satellite imagery, and analysis of suspended material in the water column.

*Project status:* This project originated in September 1974. Since then five geophysical cruises and two sediment sampling cruises

have been conducted in the field area, as well as a river sampling program supported by helicopter and float plane. Over 25,000 km of geophysical profiles and 600 sediment samples have been collected. The profiles and samples are in various stages of analysis, as are the photographic images. To date, we have produced a surface-sediment distribution map, an isopach map of Holocene sediment, and a series of reports. One report documents rapid shoreline erosion and retreat in the Pt. Riou region of Icy Bay, where over 1.3 km of shoreline has been eroded since 1941. The maps have been released in open file. Future products will include: maps of variation in sediment size, maps of primary sediment sources and sinks, maps of surface bedforms and sedimentary structures, and maps of areas of high erosion, deposition, and bypassing.

*Project:* Faulting and instability of shelf sediments, eastern Gulf of Alaska.

*Region and map key:* Offshore (southern, southeastern Alaska); fig. 15 (5).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chiefs:* Paul R. Carlson and Bruce F. Molnia, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2612 and 2804, respectively.

*Project objectives:* The continental shelf of the eastern Gulf of Alaska is tectonically active; therefore, the sea floor must be thoroughly examined before any activities related to petroleum exploration begin. The critical hazards being investigated are: (1) location, magnitude, and age of offshore, near-surface faults; and (2) presence of and potential for ground failures, such as submarine slumps or slides.

*Project status:* Geophysical cruises on the R/V *Thompson* (Sept.-Oct. 1974), the NOAA *Surveyor* (April-May 1975), and M/V *Sea Sounder* (June 1976), the R/V *Acona* (April 1976), and the R/V *Sea Sounder* (June 1976) have provided about 25,000 km of seismic reflection lines from the continental shelf of the eastern Gulf of Alaska. About 50 percent of these profiles have been analyzed, and preliminary maps have been released as open-file reports dealing with (1) submarine slides and near-surface faults, (2) thickness of Holocene sediments, (3) dis-

tribution of sea-floor sedimentary units, and (4) submarine morphology. Surficial sediments have been sampled on a reconnaissance grid and are currently being analyzed for physical properties. Additional seismic and sediment data will be gathered in 1977 to provide more information about the age, sense of motion, and continuity of near-surface faults. Submarine slides and areas of potential slides will be scrutinized with television and bottom cameras and will be selectively sampled with piston and box corers.

*Project:* Geologic framework and resource assessment of the western Gulf of Alaska.

*Region and map key:* Offshore (southern, southeastern Alaska); fig. 15 (6).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chief:* Roland von Huene, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2818.

*Project objectives:* Investigation of the tectonic framework, resource potential, and potential environmental geologic hazards for resource development are the main objectives. This project is closely coordinated with the environmental geologic studies of the western Gulf of Alaska project.

*Project status:* Geologic and geophysical surveys made prior to 1976 have been summarized in U.S. Geological Survey open-file report 76-325. Geophysical fieldwork during the summer of 1976 resulted in the following line miles (nautical miles) of geophysical data:

Multichannel seismic	1,638
Sparker—160 KJ	1,828
Uniboom-mini spark	1,619
Gravity	1,828
Magnetic	1,720
Sonobuoy stations	30
Samples (dart cores)	30

These data are being reduced and analyzed for presentation in open-file reports and papers in scientific journals. Plans for the 1977 field season include additional multichannel work to complete a map of the general tectonic framework of the area and seismic refraction measurements to provide data from greater depths.

*Project:* Environmental geologic studies of the

northern Bering Sea.

*Region and map key:* Offshore, west-central and southwestern Alaska; fig. 15 (7); fig. 11 (6); fig. 12 (7).

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific-Arctic Geology.

*Project chief:* C. Hans Nelson, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2603.

*Project objectives:* The following environmental geologic factors are to be assessed in preparation for the Outer Continental Shelf leasing program: (1) tectonic stability, including active faulting and seismicity; (2) sediment stability, including thickness and engineering properties of recent sediment bodies, regions of active slumping and significant sediment scour by ice, currents, and large mammals; (3) sediment dynamics, including significant sediment transport by strong dynamic currents and storm surges and important sites of deposition off major river sources; and (4) contaminant dispersal by pathways of artificially and naturally introduced materials.

Assessment of the mineral-resource potential of near-surface sedimentary minerals will be completed.

*Project status:* A 1-month cruise to the northern Bering Sea covered 3,500 km of geophysical tracklines and collected 3.5 kHz, Uniboom, side-scan radar, and 60-kilojoule sparker records; 20 vibracores, 25 box cores, 30 Soutar Van Veen, and 10 gravity core sampling stations were completed. Suspended-sediment samples, nephelometry data, and hydrographic measurements were collected at 176 stations. A GEOPROBE instrument was sited in the center of Norton Basin; it gathered current-meter data (at four levels in the first meter above the bottom), took bottom photographs, measured light transmission, and measured wave pressures throughout the month it was on the sea floor. Sediment cores were logged for lithology, photographed, radiographed, and subsampled at sea. Composition and geotechnical properties of cores also were measured at sea. Selected subsamples from cores are presently undergoing laboratory analyses for texture, mineralogy, paleontology, radiocarbon dates, lead-210 dates, carbon content, hydrocarbon fractions, and trace elements. Trace-element analyses have been completed on 300

bottom-surface bulk-sediment samples collected in previous years.

*Project:* Analyses of well data, Bristol Bay Basin, Alaska Peninsula.

*Region:* Offshore and southwestern Alaska.

*Organizational designation:* Geologic Division, Offices of Energy Resources and Marine Geology, Branch of Pacific-Arctic Geology and Branch of Oil and Gas Resources.

*Project chief:* Hugh McLean, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2802.

*Project objectives:* The project will evaluate the hydrocarbon potential of Mesozoic and Tertiary sedimentary rocks in the Bristol Bay basin. The program will include petrographic, geochemical, and paleontologic analyses of core and cuttings material from exploratory wells drilled along the northern margin of the Alaska Peninsula. Petrographic and X-ray analyses will be used to estimate sandstone reservoir properties. Geochemistry will provide data on petroleum source rock potential and thermal history of the basin. Preliminary results of this study will be published in an open-file report prior to leasing of offshore acreage in the Bristol Bay area. Detailed mapping of selected onshore areas will provide reliable correlation with multichannel seismic lines in the offshore.

*Project status:* The analytical part of the project will be completed by early 1977, with publication of available data scheduled for the summer of 1977. Geochemistry of three wells is currently being funded by the General Crude Corporation, Houston, Tex. Additional geochemistry may be funded by the Conservation Division in Anchorage, Alaska.

### COOPERATIVE PROJECTS WITH OTHER AGENCIES

Certain projects of the Geological Survey are undertaken to meet specific needs of city or State governments or to provide scientific and technical data required by other Federal agencies. These projects are funded jointly and are termed cooperative projects. In addition to joint funding for cooperative projects, members of the participatory agencies may collaborate in the scientific work.

Listed in this section are the cooperative projects of the U.S. Geological Survey. Most coopera-

tive projects concern the hydrology of Alaska and are statewide in scope; others have a regional focus. Project locations are shown in figure 16.

### STATEWIDE PROJECTS

*Project:* Metamorphic facies map of Alaska.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* David A. Brew, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2178. (Chairperson of committee whose other members are Béla Csejty, Jr., A. B. Ford, H. L. Foster, T. P. Miller, and H. N. Reiser.)

*Cooperating agency:* State of Alaska, Division of Geological and Geophysical Surveys.

*Project objectives:* Compilation of a 1:2,500,000-scale metamorphic facies map of Alaska showing metamorphic 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 (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) and as a joint U.S. Geological Survey-State of Alaska Geological Survey publication.

*Project status:* Progress to date includes preliminary compilation and review of regional metamorphic facies maps at 1:1,000,000 scale for all of the state, coding of background metamorphic mineral locality information, and start of the final compilation of the 1:1,000,000 regional maps.

*Project:* Geologic map of Alaska.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Mineral Resources, Branch of Alaskan Geology.

*Project chief:* Helen M. Beikman, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext 2330.

*Cooperating agency:* State of Alaska, Division of Geological and Geophysical Surveys.

TABLE 10.—Statewide cooperative projects

Name of project:map key	Project chief	Type of work	Area(s)	Cooperating Agencies
Metamorphic facies map of Alaska	D.A.Erew, Hela Gnefstay, Jr., A.B.Ford, H.L. Foster, T.P.Miller, H.R.Reisner	Office compilation	Statewide	State of Alaska, Division of Geological and Geophysical Surveys
Geologic map of Alaska	H.M.Baskman	Office compilation	Statewide	State of Alaska, Division of Geological and Geophysical Surveys
Alaska strong-motion instrumentation program	E.C.Etheredge	Seismic monitoring	Statewide	Federal Highway Administration, Lamont-Doherty Geophysical Observatory, University of Alaska, U.S. Army Corps of Engineers
Sediment stations	P.J.Skill	Monitoring a network of sediment-study stations	Statewide	U.S.Forest Service, U.S.Army Corps of Engineers
TAPS construction hydrology: fig. 16 (area 1)	C.E.Sloan	Evaluation of pipeline construction impact on water resources	Statewide	State of Alaska, Alaska State Pipeline Coordinator's Office (APSCO)
Floods from small drainage areas	S.R.Jones	Flood peak data collection from a network of crest-stage gages	Statewide	State of Alaska, Department of Highways, U.S.Forest Service
Surface-water stations	R.D.Lanke	Monitoring a network of stream, lake and estuary gaging stations	Statewide	Alaska Power Administration, U.S. Air Force, U.S. Army Corps of Engineers, U.S. Forest Service, State of Alaska, Department of Fish and Game, Department of Highways, Department of Natural Resources, Municipality of Anchorage, Kenai Peninsula Borough
Water resources studies of coastal zone communities	G.S.Anderson	Evaluate water resources and for development	Statewide (southern and western coastal areas)	State of Alaska, Department of Natural Resources
Ground-water inventory	G.S.Anderson	Ground-water data collection, processing, tabulation and summary of conditions	Statewide	State of Alaska, Department of Natural Resources
Ground-water stations	L.L.Daarborn	Monitoring water levels in a network of observation wells	Statewide	State of Alaska, Department of Natural Resources, Kenai Peninsula Borough, Municipality of Anchorage
Hydrologic studies for fisheries enhancement fig. 16 (2), (3), (4), (5)	O.A.McCoy	Limnological investigations, gas saturation measurements, and water quality data collection	Statewide	State of Alaska, Department of Fish and Game

**Project objectives:** The objective of this project is to prepare a multicolored geologic map of Alaska at a scale of 1:2,500,000. The compilation will be a summary of mapping done by hundreds of geologists who have worked in Alaska at various times since geologic mapping was begun there in the late 1800's. This wall map will serve a nationwide audience by providing a ready visual reference upon which planning for future geologic studies, such as earthquake hazard evaluation, mineral-resource estimates, and exploration programs

for new mineral resources, can be based. The map will be accompanied by a report briefly describing the stratigraphic units shown and will reference the detailed maps of smaller areas used for compilation.

**Project status:** Five uncolored geologic maps at a scale of 1:1,000,000 covering the entire State, which are preliminary compilations on which the final multicolored map is being based, have been published. These include Miscellaneous Field Studies Maps MF-611, covering the southwestern part of the State; MF-612, cover-

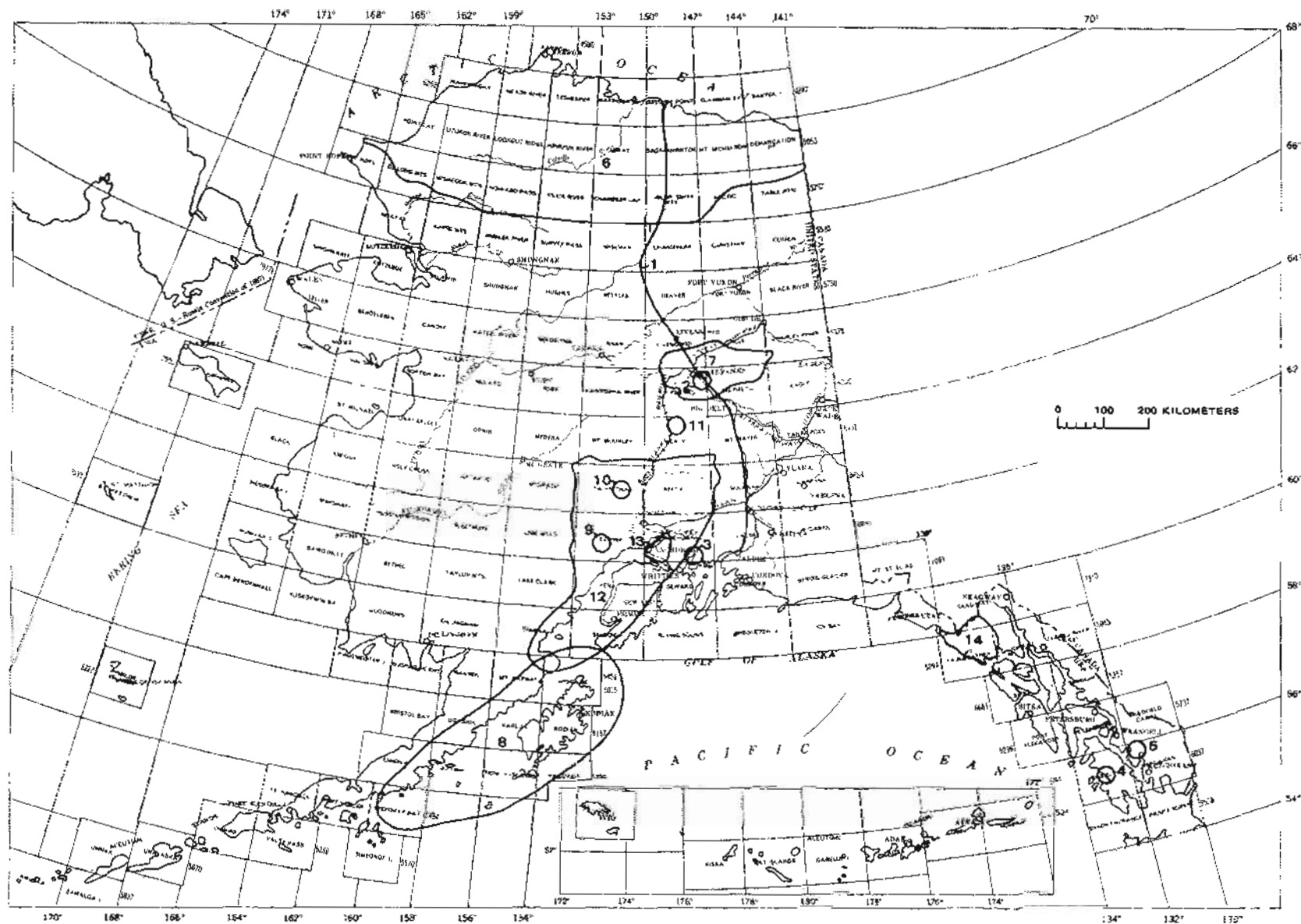


FIGURE 16.—Locations of projects of the U.S. Geological Survey and cooperating agencies.



ing the south-central part; MF-673, covering southeastern Alaska; MF-674 covering the Alaska Peninsula and Aleutian Islands; and MF-789, covering northern Alaska. The entire project will be completed by the end of 1977.

*Project:* Alaska strong-motion instrumentation program.

*Region:* Statewide.

*Organizational designation:* Geologic Division, Office of Earthquake Studies, Seismic Engineering Branch.

*Project chief:* Ed Etheredge, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94026; (415) 323-8111, ext 2881.

*Cooperating agencies:* Federal Highway Works Administration; Lamont-Doherty Geophysical Observatory; University of Alaska; U.S. Army Corps of Engineers.

*Project objectives:* The major objectives are to gather data on potentially damaging seismically generated ground motion and to examine the response of structures, such as buildings, dams, and bridges, to this motion. This information is essential to engineering and seismological studies aimed at the reduction of damage and loss of life due to earthquakes.

*Project status:* The Alaska strong-motion project is a continuing, long-range research program that has been in operation since 1964. The Seismic Engineering Branch (with support by the National Science Foundation) currently operates a network of 34 strong-motion accelerographs located in seismically active areas and in major population centers. The network extends from Ketchikan in the southeast to Adak Island in the Aleutians and north to Fairbanks. The network is undergoing continuous expansion and modernization. Since project inception, more than 30 strong-motion records have been obtained from Alaskan instruments.

*Project:* Sediment stations.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* P. J. Still, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Cooperating agencies:* U.S. Forest Service; U.S. Army Corps of Engineers.

*Project objectives:* A network of sediment stations

is maintained to provide information on sediment in streams, lakes and estuaries by determining: (1) seasonal normal concentrations and particle-size distribution of suspended sediment; (2) sediment yields; (3) particle-size distribution of bed and bank material; (4) bedload transport; and (5) ranges of turbidity.

*Project status:* Continuing.

*Project:* TAPS construction hydrology.

*Region and map key:* Statewide (trans-Alaska pipeline corridor, Prudhoe Bay to Valdez); fig. 16(1).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* C. E. Sloan, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Cooperating agency:* State of Alaska, Alaska State Pipeline Coordinator's Office (APSCO).

*Project objectives:* This project evaluated the impacts of pipeline construction on water resources, particularly regarding the effects on water quality resulting from waste disposal, construction disturbance, and oil spills.

*Project status:* Field data collection of physical and chemical water quality parameters is nearly complete. Benthic invertebrate collections need identification before analysis of impacts can be completed. Reports on impacts resulting from construction disturbance in the Little Tonsina and Salcha Rivers are in preparation.

*Project:* Floods from small drainage areas.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* Stanley H. Jones, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Cooperating agencies:* State of Alaska, Department of Highways; U.S. Forest Service.

*Project objectives:* This project collects and publishes flood-peak data from a network of small-stream crest-gaging stations for the purpose of defining the magnitude and frequency of floods within Alaska.

*Project status:* Continuing; all data are published in the annual series "Water Resources Data for Alaska." The 1975 report will be completed by September 1977. A flood frequency and mag-



nitude analysis by multiple-regression methods will be made to define a set of equations that can be used to estimate flood magnitudes for selected recurrence intervals at any site on ungaged streams in Alaska. The equations will relate floods to drainage-basin characteristics. The flood-frequency analysis will be completed by June 1977. A hydrologic reconnaissance of the TAPS haul road was made during spring breakup in 1975, and a report is being prepared.

*Project:* Surface-water stations.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* R. D. Lamke, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Cooperating agencies:* Alaska Power Administration; U.S. Air Force; U.S. Army Corps of Engineers; U.S. Forest Service; State of Alaska, Department of Fish and Game, Department of Highways, and Department of Natural Resources; Municipality of Anchorage; Kenai Peninsula Borough.

*Project objectives:* The Geological Survey operates a network of gaging stations to provide data on (1) streamflow, (2) flood discharges and stages, (3) lake stage and contents, and (4) estuary flow conditions. This program is part of an ongoing national assessment of the nation's water resources. The data are used in project design and planning of water-supply and waste-disposal systems and of bridges and are useful in the assessment of environmental impact of these and other proposed activities.

*Project status:* Continuing; all data are published in the annual series "Water Resources Data for Alaska." The 1976 report is expected to be completed by September 1977.

*Project:* Water resources studies of coastal zone communities.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. S. Anderson, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 277-1563.

*Cooperating agencies:* Kenai Peninsula Borough; State of Alaska, Department of Natural Re-

sources, Division of Geological and Geophysical Surveys.

*Project objectives:* This project will study and evaluate the availability and quality of the water resources, determine current water-use patterns, monitor critical hydrologic variables, and determine potential for water-resource development in several Alaskan coastal communities that will be affected by anticipated development of offshore petroleum reserves.

*Project status:* A summary of the status of the water-resources information for the various coastal zone communities has been prepared. A priority list for community studies has been established, based on the adequacy of understanding of the hydrologic system to meet the project objectives and the anticipated degree and timing of impact in each of the communities. Water-resources evaluations have begun in the Kenai, North Kenai, and Seward areas.

*Project:* Ground-water inventory.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. S. Anderson, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agencies:* State of Alaska, Department of Natural Resources, Division of Geological and Geophysical Surveys.

*Project objectives:* The purpose of the project is to collect, compile, and publish basic ground-water data and to conduct special studies related to ground-water availability and development in various areas of the State. Work plans include field inventories to acquire newly available data, water-quality sampling, and geophysical logging.

*Project status:* Conversion of existing ground-water data files to the new National Ground-Water Site-Inventory Data Base has begun. Data for the Kenai, North Kenai, Kodiak, Valdez to Copper Center, Cordova, and Yakutat areas were processed within the system. A report entitled "Water resource reconnaissance of St. George Island, Pribilof Islands, Alaska," by G. S. Anderson was published in 1976. A summary of ground-water conditions prepared within this project is included in a report on water resources of the Kodiak-Shelikof area to be published in 1977.

*Project:* Ground-water stations.

*Region:* Statewide.

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* L. L. Dearborn, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agencies:* State of Alaska, Department of Natural Resources, Division of Geological and Geophysical Surveys; Kenai Peninsula Borough; Municipality of Anchorage.

*Project objectives:* This project maintains a network of observation wells to provide data on ground-water levels throughout Alaska. Water-level data indicate the status of ground water in storage or in transit and the availability of water supplies, permit estimation and forecast of base flow of streams, and identify areas where changes in ground-water levels may affect current or planned land-use and water supply development. The core of the monitoring network provides long-term records for regional or watershed studies which in turn serve as a basis for correlation of short-term hydrologic records and data collection activities for specific purposes.

*Project status:* Continuing water-level records for long-term (Federal) observation wells are to be published annually in "Water Resources Data for Alaska." Data from special-purpose or project-oriented water-level networks are processed for use and selected for publication in project reports.

*Project:* Hydrologic studies for fisheries enhancement.

*Region and map keys:* Statewide (east-central, southwestern, southern and southeastern Alaska); fig. 16 (2), (3), (4), (5).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. A. McCoy, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agency:* State of Alaska, Department of Fish and Game.

*Project objectives:* These studies will provide basic hydrologic data for fisheries enhancement practices.

*Project status:* Present plans include site evaluations at four proposed fish hatchery sites in southeastern Alaska, a limnological study of

Cannery Lake in Prince William Sound, water-quality evaluation and gas saturation measurements at existing hatcheries, and continued water quality monitoring of the Salcha River at the crossing of the trans-Alaska oil pipeline.

#### NORTHERN ALASKA

*Project:* North Slope water-resources study.

*Region and map key:* Northern Alaska; fig. 16 (6).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. L. Nelson, U.S. Geological Survey, 310 First Avenue, Fairbanks, Alaska 99701; (907) 452-1951, ext. 176.

*Cooperating agency:* State of Alaska, Department of Environmental Conservation.

*Project objectives:* The program summarizes information from various sources on water use and water-supply development in the North Slope area and evaluates the availability and quality of water. Emphasis is on winter conditions when potable water is scarce and companies operating in the area experience severe water shortages.

*Project status:* The project is in its second year. Survey research and investigations by other agencies indicate that freezing causes both ground-water flow through taliks underlying rivers and surface-water flow to cease during late winter in many areas. Limited research is planned for next year. Efforts will be directed toward completion of a report and monitoring activities of companies engaged in exploration and development of water supplies on the North Slope.

#### EAST-CENTRAL ALASKA

*Project:* Geohydrology of Fairbanks-North Star Borough.

*Region and map key:* East-central Alaska; fig. 16 (7).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. L. Nelson, U.S. Geological Survey, 310 First Avenue, Fairbanks, Alaska 99701; (907) 452-1951, ext. 176.

*Cooperating agencies:* Fairbanks-North Star Borough; U.S. Army Corps of Engineers; U.S. Environmental Protection Agency.

TABLE 11.—Regional cooperative projects

Name of project (map key)	Project chief	Type of work	Area(s)	Cooperating agencies
North Slope water-resources study; fig. 16 (area 6)	G.L. Nelson	Summary and evaluation of water availability and quality, North Slope	Northern Alaska	State of Alaska, Department of Environmental Conservation
Geohydrology of Fairbanks-North Star Borough; fig. 16 (7)	C.L. Nelson	Assessment of water quality and availability, monitoring of urbanization effects	East-central Alaska	Fairbanks-North Star Borough, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency
Water resources of Kodiak-Shelikof area; fig. 16 (8)	S.H. Jones	Data compilation of water-resources information	Southwestern Alaska	State of Alaska, Department of Environmental Conservation
Hydrologic studies related to coal mining; fig. 16 (9), (10), (11)	D.R. Scully	Collection of basic hydrologic data in areas with proven coal reserves and in an area of active coal mining	Upper Cook Inlet and Healy coal field	U.S. Environmental Protection Agency
Petroleum potential of reservoir and source rocks in the eastern Kodiak Island and Lower Cook Inlet areas	I.F. Palmer	Fieldwork completed, report in preparation	Eastern Kodiak Island and Lower Cook Inlet	State of Alaska, Department of Natural Resources, Department of Geological and Geophysical Surveys
Hydrologic compilation for Cook Inlet area; fig. 16 (12)	C.W. Prenzley	Collection and compilation of basic hydrologic data, for agency and public use	Cook Inlet	State of Alaska, Department of Natural Resources, Department of Environmental Conservation, Kenai Peninsula Borough, Municipality of Anchorage
Geohydrology of the Anchorage area; fig. 16 (13)	Chester Zenone	Hydrologic data collection network, water availability studies, and related urban hydrology problems	Anchorage area	Municipality of Anchorage, State of Alaska, Department of Fish and Game
Eastern Gulf of Alaska seismicity	J.C. Lahr	Seismic network to monitor earthquake activity	Prince William Sound to Yakutat	National Oceanic and Atmospheric Administration
Glacier Bay National Monument Wilderness Study Area; fig. 16 (14)	D.A. Brew	Reconnaissance geologic mapping, geochemical and geophysical surveys, mineral-resource assessment	Glacier Bay National Monument	U.S. Bureau of Mines, Alaska Field Operations Center, Juneau
Beach studies of the Gulf of Alaska shoreline in Glacier Bay National Monument	E.F. Holm	Beach profiling, sediment and vegetation sampling	Glacier Bay National Monument	U.S. National Park Service

**Project objectives:** Objectives are to assess water quality and availability and to monitor the effects of urbanization on water resources in the Fairbanks-North Star Borough, particularly the North Pole and Farmer's Loop areas. Data from observation and private wells, drillers' logs, and base flow measurements on many creeks are being incorporated into an analysis of water availability in the uplands. An extensive sampling program is intended to define the extent of arsenic and nitrate contamination in wells of the uplands area. On the flood plain, the hydrographs of rivers and observation wells are being used to define aquifer parameters. These data are being combined with regional

water-table and water-quality information in an analysis of the alluvial aquifer.

**Project status:** Analysis of the alluvial aquifer has been completed, and a report is in preparation. The analysis of the availability and quality of water in the uplands has been hampered by the lack of historical records. Measurements of spring flow and base flow, however, will be combined with well hydrographs to give estimates of regional transmissivity and storage coefficients. The Fairbanks-North Star Borough is utilizing a record of natural ground-water discharge in land-use planning. Arsenic contamination of numerous wells in the Ester Dome-Sheep Creek Road area was

discovered this year, and sampling is continuing to determine its cause and distribution.

#### SOUTHWESTERN ALASKA

*Project:* Water resources of Kodiak-Shelikof area.

*Region and map key:* Southwestern Alaska; fig. 16 (8).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* Stanley H. Jones, U.S. Geological Survey, 218 E Street, Anchorage, Alaska 99501; (907) 277-5526.

*Cooperating agency:* State of Alaska, Department of Environmental Conservation.

*Project objectives:* The program includes compilation and summary of all available water-resources information for the Kodiak-Shelikof area. The water-resources data summary will provide a reduced data base for planning water-resources development, for delineating water problem areas, for making impact evaluations, and for evaluating existing water quality and availability.

*Project status:* All available water-resources information for the Kodiak-Shelikof area has been compiled and summarized. An atlas-type interpretative hydrologic analysis of these data will be published in 1977.

#### SOUTHERN ALASKA

*Project:* Hydrological studies related to coal mining.

*Region and map keys:* Southern Alaska; fig. 16 (9), (10), (11).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* D. R. Scully, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agency:* Environmental Protection Agency.

*Project objectives:* This project is designed 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 concentrations, sedi-

ment load, and turbidity; and (3) stream-basin characteristics.

*Project status:* Field investigations were made in April, May, July, August, and October 1976 at the Beluga, Healy, and Peters Creek coal areas. Similar field investigations are scheduled for the same areas in 1977. Data collection will continue through the 1979 season.

*Project:* Petroleum potential of reservoir and source rocks in the eastern Kodiak Island and lower Cook Inlet areas.

*Region:* Eastern Kodiak Island and lower Cook Inlet.

*Organizational designation:* Conservation Division, Office of the Alaska Area Geologist.

*Project chief:* I. F. Palmer, U.S. Geological Survey, 800 "A" Street, P.O. Box 259, Anchorage, Alaska 99510.

*Cooperating agencies:* State of Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys (co-project chief, W. M. Lyle).

*Project objectives:* This project was initiated to provide quantitative measurements of reservoir and source rock potential of stratigraphic units that may project into offshore areas. These data are needed to facilitate prospect area and tract evaluations.

*Project status:* All fieldwork is complete, and most laboratory analyses have been completed. All drafting of stratigraphic sections has been completed, and draft of report is in progress.

*Project:* Hydrologic data compilation for the Cook Inlet area.

*Region and map key:* Southern and southwestern Alaska; fig. 16 (12).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* G. W. Freethey, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agencies:* State of Alaska, Department of Environmental Conservation and Department of Natural Resources, Division of Geological and Geophysical Surveys; Kenai Peninsula Borough; Municipality of Anchorage.

*Project objectives:* The purpose of the project is to collect, compile, and make available to cooperating agencies existing hydrologic data

for the Cook Inlet area. The information to be compiled encompasses all ground-water, surface-water, and quality-of-water data in files and publications of the U.S. Geological Survey and the State of Alaska, as well as new data to be collected during field inventories of the study area. The amassed data may be used as a foundation for investigations involving: ground-water availability and quality in rapidly developing areas, including landfills; changes in ground-water levels; and surface-water resources of the agricultural, recreational, and developing residential areas.

*Project status:* Data collection and compilation for the Matanuska, Susitna, and Knik drainage basins, and the west shore of Cook Inlet are approximately 75 percent complete. Compilation of hydrologic data in the Kenai Peninsula Borough and Anchorage Municipality areas has been a part of ongoing projects and is approximately 25 percent complete. No formal publications are planned for 1977.

*Project:* Geohydrology of the Anchorage area.

*Region and map key:* Southern Alaska; fig. 16 (13).

*Organizational designation:* Water Resources Division, Alaska District Office.

*Project chief:* Chester Zenone, U.S. Geological Survey, 1209 Orca Street, Anchorage, Alaska 99501; (907) 279-1563.

*Cooperating agencies:* Municipality of Anchorage; State of Alaska, Department of Fish and Game.

*Project objectives:* This project monitors the effects of urban development on water and water-related resources and assesses water availability for increasing demands in Anchorage and vicinity, the major population, commercial, and trading center, for the State's natural resource development activities.

*Project status:* General hydrologic information and potential urban hydrology problems were described early in this 11-year-old project. A series of reports followed on specific water-resource-related problems—water supply and waste-water disposal in a mountain slope area, water level maintenance in lakes in a lowland muskeg terrain undergoing residential development, pollution potential to aquifers from overlying solid waste disposal sites, and feasibility of a conjunctive surface-water and

ground-water supply for a proposed fish hatchery. Under a reduced scope the project now focuses on potential for ground-water supplies for Eagle River and hydrologic model studies of the effects of artificial recharge on ground-water availability and the regional hydrologic system. A reduced data collection network will continue to monitor urbanization effects, provide continuity of long-term records, and serve as a basis for hydrologic analyses as required.

*Project:* Eastern Gulf of Alaska seismicity.

*Region:* Southern Alaska.

*Organizational designation:* Geologic Division, Office of Earthquake Studies, Branch of Earthquake Hazards.

*Project chief:* John C. Lahr, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2510.

*Cooperating agency:* National Ocean and Atmospheric Administration.

*Project objectives:* The objective of this research project is to evaluate the hazards associated with earthquake activity in the eastern Gulf of Alaska and adjacent onshore areas that pose a threat to the safety of petroleum exploration and development.

*Project status:* The network of seismic stations, installed in 1974, was realigned slightly in 1976 in order to improve earthquake detection and hypocenter locations in the Icy Bay vicinity. This area has exhibited a relatively high level of microearthquake activity with respect to the whole project study area. Quarterly reports of the eastern Gulf of Alaska seismicity are submitted to the National Oceanic and Atmospheric Administration within 4 months of the quarter completion date.

#### SOUTHEASTERN ALASKA

*Project:* Glacier Bay National Monument Wilderness Study Area.

*Region and map key:* Southeastern Alaska; fig. 16 (14).

*Organizational designation:* Geologic Division, Office of Mineral Resources, Wilderness Program and Branch of Alaskan Geology.

*Project chief:* D. A. Brew, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2178.

*Cooperating agency:* U.S. Bureau of Mines, Alaska Field Operations Center.

*Project objectives:* The principal objective is an appraisal of 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 (cf. Professional Paper 632); (2) reconnaissance geologic mapping of previously unstudied 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. Geochronologic studies are being done in cooperation with the Branch of Isotope Geology. The appraisal is part of the U.S. National Park Service study of the suitability of the area for inclusion in the National Wilderness Preservation System established by the Wilderness Act of 1964.

*Project status:* The project started in the 1975 field season with the main emphasis on verification testing of geochemical data from the 1966 studies, reconnaissance geologic mapping in previously unmapped areas, and reconnaissance bedrock geochemical sampling. Aeromagnetic, paleomagnetic, and gravity surveys were completed in 1976 as were reconnaissance bedrock geologic and geochemical studies of the westernmost part of the Monument. Manuscript submittal is tentatively scheduled for 1978 but may be postponed if the 1977 studies show the need for continuation into the 1978 field season.

*Project:* Beach studies of the Gulf of Alaska shoreline in Glacier Bay National Monument.

*Region:* Southeastern Alaska.

*Organizational designation:* Geologic Division, Office of Marine Geology, Branch of Pacific Arctic Geology.

*Project chief:* Bruce F. Molnia, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025; (415) 323-8111, ext. 2804, 2853.

*Cooperating agency:* National Park Service.

*Project objectives:* This project, which is partially funded by the National Park Service, began in 1976. Its objectives are: (1) to characterize the beach in Glacier Bay National Monument between Cape Fairweather and Icy Point; and (2) to predict the effects of an oil spill on the studied segment of beach. Beach characterization consists of both aerial and ground reconnaissance and the interpretation of aerial photographs. Qualitative oil-spill evaluation consists of a synthesis of information about beach morphology, tidal conditions, meteorology, vegetative cover, sediment parameters, and similar factors.

*Project status:* Three weeks of fieldwork in July 1976 by B. F. Molnia, T. R. Bruns, J. H. Cudenhofsky, J. C. Hampson, Jr., and S. C. Kittelson established 30 permanent beach profile stations and collected over 70 sediment samples. Profiles at each station site have been constructed and tied into tidal base level. Sediment samples are being analyzed by rapid sediment analyzer. Vegetative samples and tree borings are being analyzed to characterize the age and type of plant cover. The initial group of profiles will serve as a baseline to compare against future beach work. A winter observation program is planned for early 1977, and a reoccupation of the original 30 sites for the summer of 1977.