1982 Annual Report on Alaska's Mineral Resources

GEOLOGICAL SURVEY CIRCULAR 884

Contributors to the report:

David Carnes, Bureau of Mines
Fred Chiei, Department of Energy
John Cook, National Park Service
Kendell Dickinson, U.S. Geological Survey
Fred Harnisch, Forest Service
Don Hendrickson, Bureau of Land Management
Joseph Jones, Minerals Management Service
Robert McMullin, U.S. Geological Survey
Thomas Miller, U.S. Geological Survey
John Mulligan, Bureau of Mines
Katherine Reed, U.S. Geological Survey (compiler)
Wayne Roberts, Department of Energy
Keith Schreiner, U.S. Fish and Wildlife Service
Richard Stenmark, National Park Service
Gary Stricker, U.S. Geological Survey
Gary Winkler, U.S. Geological Survey
Donovan Yingst, Bureau of Land Management

1982 Annual Report on Alaska's Mineral Resources

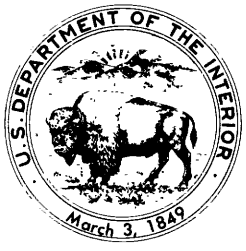
GEOLOGICAL SURVEY CIRCULAR 884

Prepared in cooperation with the Bureau of Mines, the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service, the Minerals Management Service, the Department of Agriculture—Forest Service, and the Department of Energy

As mandated by Section 1011 of the Alaska National Interest Lands Conservation Act, Public Law 96–487, of December 2, 1980

1982

United States Department of the Interior
JAMES G. WATT, *Secretary*



Geological Survey
Dallas L. Peck, *Director*

Free on application to Distribution Branch, Text Products Section,
U. S. Geological Survey, 604 South Pickett Street, Alexandria, VA 22304

CONTENTS

ILLUSTRATIONS

TABLES

1982 Annual Report on Alaska's Mineral Resources, As Mandated by Section 1011 of the Alaska National Interest Lands Conservation Act, Public Law 96-487, of December 2, 1980

Prepared by the U.S. Geological Survey, in cooperation with the Bureau of Mines, the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service, the Minerals Management Service, the Department of Agriculture—Forest Service, and the Department of Energy

EXECUTIVE SUMMARY

Section 1011 of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980 requires that "On or before October 1, 1982, and annually thereafter, the President shall transmit to the Congress all pertinent public information relating to minerals in Alaska gathered by the United States Geological Survey, Bureau of Mines, and any other Federal agency." This report has been prepared in response to that requirement.

The U.S. Geological Survey and the Bureau of Mines are the principal Federal agencies that publish information about mineral resources in Alaska. Their information is commonly used by other Federal agencies to make decisions about access, land use, environmental impacts, or claim evaluations. The greater part of the information used in this report therefore has come from the Geological Survey and the Bureau of Mines. Because of the time required for sample analysis and data synthesis and because of the publication process, reports are generally issued a year or more after the sample and data collection. Thus, this report provided information chiefly about projects current in 1980 and 1981. In addition to Federal and State publications, trade and professional journals, symposia proceedings, public meetings and hearings, press releases, and newspaper and magazine articles have been sources of the information presented.

The report addresses only onshore areas of Alaska and provides information on minerals of current interest in two broad categories: energy resources and nonfuel, critical, and strategic minerals.

OIL AND GAS

The Cook Inlet area and the Arctic North Slope were the primary areas of oil and gas exploration, development, and production activities in 1980 and 1981. At the end of 1981, oil production from Alaska was approximately 1.68 million barrels per day or about 19.5 percent of the total production of the United States. About 1.6 million barrels per day were produced from the North Slope, and about 9,000 barrels per day from onshore fields in the Cook Inlet area. The U.S. Geological Survey estimates that approximately 87 percent of the Alaskan onshore undiscovered recoverable oil and gas resources are in the North Slope, particularly in the producing provinces, and 9 percent are in the Cook Inlet area.

Development continued at the Kuparuk River field just west of the Prudhoe Bay field, where production began at an initial rate of 50,000 barrels per day in December 1981. In 1986, when development is complete, the Kuparuk field may rank second in daily production for the United States, surpassed only by Prudhoe Bay. Permits have been secured for a waterflooding project at the Prudhoe Bay field to increase oil recovery there by 5 to 9 percent.

Sponsors of the Alaska Natural Gas Transportation System continued efforts to finance construction

of a pipeline to provide an outlet for the Prudhoe Bay natural gas reserves. In mid-December 1981, President Reagan signed into a law a waiver package designed to liberalize the rules for financing and constructing the gas pipeline; however, the project has been delayed now for 2 additional years.

Most industry oil and gas exploration and development drilling took place on State leases along the Beaufort Sea coast between the National Petroleum Reserve in Alaska (NPRA) and the Arctic National Wildlife Refuge (ANWR). Two industry wells were drilled on Native lands in the southern part of the North Slope. Three delineation wells and four exploration wells were drilled in the Cook Inlet area. Only three other onshore exploration wells were drilled, all on Native lands.

The Department of the Interior's 1981 appropriation act called for competitive leasing of oil and gas on NPRA to private industry. In 1980 and 1981, the Geological Survey drilled 16 wells in NPRA, but at the end of 1981 it closed out its exploration program. The Bureau of Land Management and the Geological Survey's Conservation Division (now part of the Minerals Management Service) selected 1.5 million acres for the first lease sale, scheduled for December 1981 but held January 27, 1982. The sale brought in more than $61 million in high bids for 29 of the 59 tracts offered.

Federal agencies were active in oil and gas programs in three areas, as required by ANILCA. (1) The Bureau of Land Management and the Geological Survey initiated a study of oil and gas resources, wilderness characteristics, and the wildlife resources in the area between NPRA and ANWR, north of 68° north latitude. (2) The Bureau of Land Management has started a systematic analysis of land south of 68° latitude for mineral leasing, including oil and gas. Plans are to accept applications for the Minchumina area in central Alaska in early 1982. In support of this program, the Minerals Management Service classified three areas as "favorable petroleum geologic provinces," for which competitive leasing is required. (3) The U.S. Fish and Wildlife Service and the Geological Survey began to prepare an environmental impact statement for geological and geophysical exploration of the northwestern coastal plain of the ANWR.

The State of Alaska held three oil and gas lease sales in 1980 and 1981, and five such sales are planned for 1982.

URANIUM

Interest in uranium exploration has declined recently because of decreasing prices and weakening demand projections. Only one lode uranium deposit in Alaska, at Bokan Mountain in southeastern Alaska, has produced commercial quantities of ore. However, subcommercial deposits have been found in several sedimentary formations in central, south-central, and southeastern Alaska. The Geological Survey is examining uranium anomalies northwest of Eagle and near Cordova. Federal studies also show that favorable host rocks occur on the North Slope but that there is little indication of uranium enrichment.

Uraniferous igneous rocks near Mount Prindle east of Fairbanks appear to have more potential as a source of rare earth and thorium minerals than of uranium. Uranium-rich granites on the west flank of the Alaska Range and evidence of uranium remobilization there combine as a favorable indicator of possible uranuim deposits. Uranium-rich igneous rocks also have been found on the Seward Peninsula, in the Medfra quadrangle of interior Alaska, and in southeastern Alaska where studies are still in progress.

The Department of Energy has nearly completed its National Uranium Resource Evaluation studies. In 1980 and 1981 it released more than 100 reports on spectrometer and magnetometer surveys and hydrogeochemical and other studies in Alaska.

Industry activity recently has been largely reconnaissance-level work, claim assessment, or geologic work in conjunction with Native corporations.

COAL AND PEAT

The 10 or more large coal fields in Alaska represent a very large coal resource that is virtually untapped. One coal mine is in operation, the Usibelli mine at Healy, south of Fairbanks adjacent to the Alaska Railroad. Three of the largest fields contain subbituminous to bituminous coal. Moisture, ash, and sulfur contents and heating values of these coals are comparable to those of Wyoming's Powder River coals.

The coal of greatest current interest for future development is in fields northwest of Cook Inlet. Coal-bearing rocks underlie about 3,400 square miles there. Much of this coal has little overburden and is amenable to surface mining. Placer-Amex and Cook Inlet Region, Inc., propose to mine 8.5 million tons

of coal per year, to be converted to 54,000 barrels per day of methanol at a tidewater plant. The Diamond Shamrock Company also is studying Cook Inlet coals for a large operation that would furnish coal for export. The Geological Survey has been examing surficial materials in the area as a basis for coal facility siting, transportation routes, and community planning.

The Sun Eel Shipping Company of South Korea has agreed to buy from the Usibelli mine more than 7 million tons of coal over the next 10 years for shipment to Korea.

Geological Survey and State of Alaska studies of peat in surficial deposits near Willow north of Anchorage indicate that the area contains more than 5 million tons of fuel-grade peat. The State plans to request bids for feasibility studies for the construction of plants to produce fuels from the peat near Willow.

GEOTHERMAL RESOURCES

Alaska has major resources of geothermal energy. Some of this potential is for large-scale projects, but more appears suitable for local use. Studies of geothermal resources are continuing at a low to moderate level in several areas of the State.

The Geological Survey is completing studies of the geothermal potential of recent volcanic areas on the Alaska Peninsula and in the Wrangell Mountains. The State of Alaska Division of Geological and Geophysical Surveys has completed assessments of the geothermal potential of selected hot springs in southeastern Alaska, the Aleutian Islands, and the Alaska Peninsula. A summary report about geothermal energy resources of Alaska prepared by the Geophysical Institute of the University of Alaska was published in 1980. The State of Alaska has appropriated funds for preliminary geothermal development, including drilling, on Makushin Volcano on Unalaska Island in the eastern Aleutians and for follow-up test drilling at Pilgrim Springs on the Seward Peninsula.

NONFUEL MINERALS

Mining activities and industry exploration for Alaska's nonfuel minerals have increased dramatically in the past several years, spurred by the resolution of many land status questions, by the discovery of major deposits of copper, molybdenum, zinc, and lead, by large increases in the price of gold, and by increased mineral research by Federal and State agencies. Expenditures for exploration by mineral companies are estimated to have increased from approximately $40 million in 1976 to more than $100 million in 1981. The number of active mining claims also has increased, and more than 43,000 new claims were filed in 1981. Many known mineral deposits are being reevaluated, and announcements of discovery of several major deposits have been made recently.

The Red Dog deposit in the western Brooks Range has been estimated to contain 85 million tons of material averaging 17.1 percent zinc, 5.0 percent lead, and 2.4 ounces per ton silver. Continuing development work at the Quartz Hill molybdenum deposit in southeastern Alaska has led to estimates of 2 billion pounds of molybdenum with a gross value of over $18 billion (1981 prices). Development work at the Greens Creek silver, lead, and zinc deposits on Admiralty Island in southeastern Alaska has delineated 3 million to 4 million tons of high-grade material with an estimated in-place value of over $800 million (1981 prices). Several billion dollars (1981 prices) worth of copper with lead, zinc, and silver have been proven by drilling in the western Brooks Range district.

As part of the Alaska Mineral Resources Assessment Program, the Geological Survey is studying twelve 1:250,000-scale quadrangles in the Brooks Range, the Seward Peninsula, the Alaska Range, the Alaska Peninsula, and southeastern Alaska. Twenty-two such assessments have been completed. A Roadless Area Resource Elevation II Wilderness mineral resource assessment by the Geological Survey and the Bureau of Mines of more than 3 million acres of Chugach National Forest in south-central Alaska is nearing completion. Similar studies by these agencies have been completed on the West Chichagof-Yakobi Wilderness in southeastern Alaska and on the NPRA in northwestern Alaska. The Bureau of Mines continues its land assessment and minerals availability programs.

CRITICAL AND STRATEGIC MINERALS

The Geological Survey has begun a study of chromium, cobalt, nickel, and platinum-group metals associated with igneous ultramafic rocks in interior Alaska. Detailed studies of mafic and ultramafic rocks with associated nickel deposits in Glacier Bay National Park and elsewhere in southeastern Alaska have been completed by the Survey. The Bureau of Mines has begun evaluating many known occurrences of critical and strategic minerals in southeastern and southwestern Alaska,

the Kenai Peninsula, central Alaska, the western and eastern Brooks Range, and in interior Alaska.

Industry activity has included the resumption of platinum mining at Goodnews Bay in southwest Alaska and exploration of chromite deposits at Red Mountain on the Kenai Peninsula, of nickel-cobalt-copper deposits on Yakobi and Chicagof Islands in southeastern Alaska, and of copper, platinum, and palladium deposits on Prince of Wales Island, also in southeastern Alaska.

1982 Annual Report on Alaska's Mineral Resources, As Mandated by Section 1011 of the Alaska National Interest Lands Conservation Act, Public Law 96-487, of December 2, 1980

Prepared by the U.S. Geological Survey, in cooperation with the Bureau of Mines, the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service, the Minerals Management Service, the Department of Agriculture—Forest Service, and the Department of Energy

INTRODUCTION

Section 1011 of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980 requires that "On or before October 1, 1982, and annually thereafter, the President shall transmit to the Congress all pertinent public information relating to minerals in Alaska gathered by the United States Geological Survey, Bureau of Mines, and any other Federal agency." In response to this requirement, the Geological Survey, which was delegated the responsibility, has prepared this report.

This report considers only onshore Alaskan areas. No information about Outer Continental Shelf or maritime areas is given, although such information may have been used in studies of mineral occurrences. In keeping with the mandate for "pertinent public information," this report describes recently released material about commodities, or mineral groupings, rather than presenting a region-by-region synopsis of mineral-related activity in Alaska.

The Geological Survey and the Bureau of Mines are the primary Federal agencies generating information about mineral resources in Alaska. Their information is used by other Federal agencies as the basic input for decisions about access, land use, environmental impacts, and, in some instances, claim evaluation. The greater part of the information in this report has come from studies, projects, or programs conducted by the Geological Survey and the Bureau of Mines.

The term "public information" as applied in this report includes the published results of Federal projects and studies, either in government reports or in professional or trade journals. Other sources include talks at symposia or conferences or their proceedings volumes, press releases, newspaper and magazine articles, or other public forums. The result of publication procedures in the Federal agencies that regularly publish their findings is that interpretive information usually appears in the literature a year or more after sample and data collection and analysis. For this reason, this report chiefly consists of material that was made public in 1980 and 1981. A similar lag will affect all Section 1011 annual reports for ANILCA. Information about active projects and programs is available on a more current basis and also is included in the report.

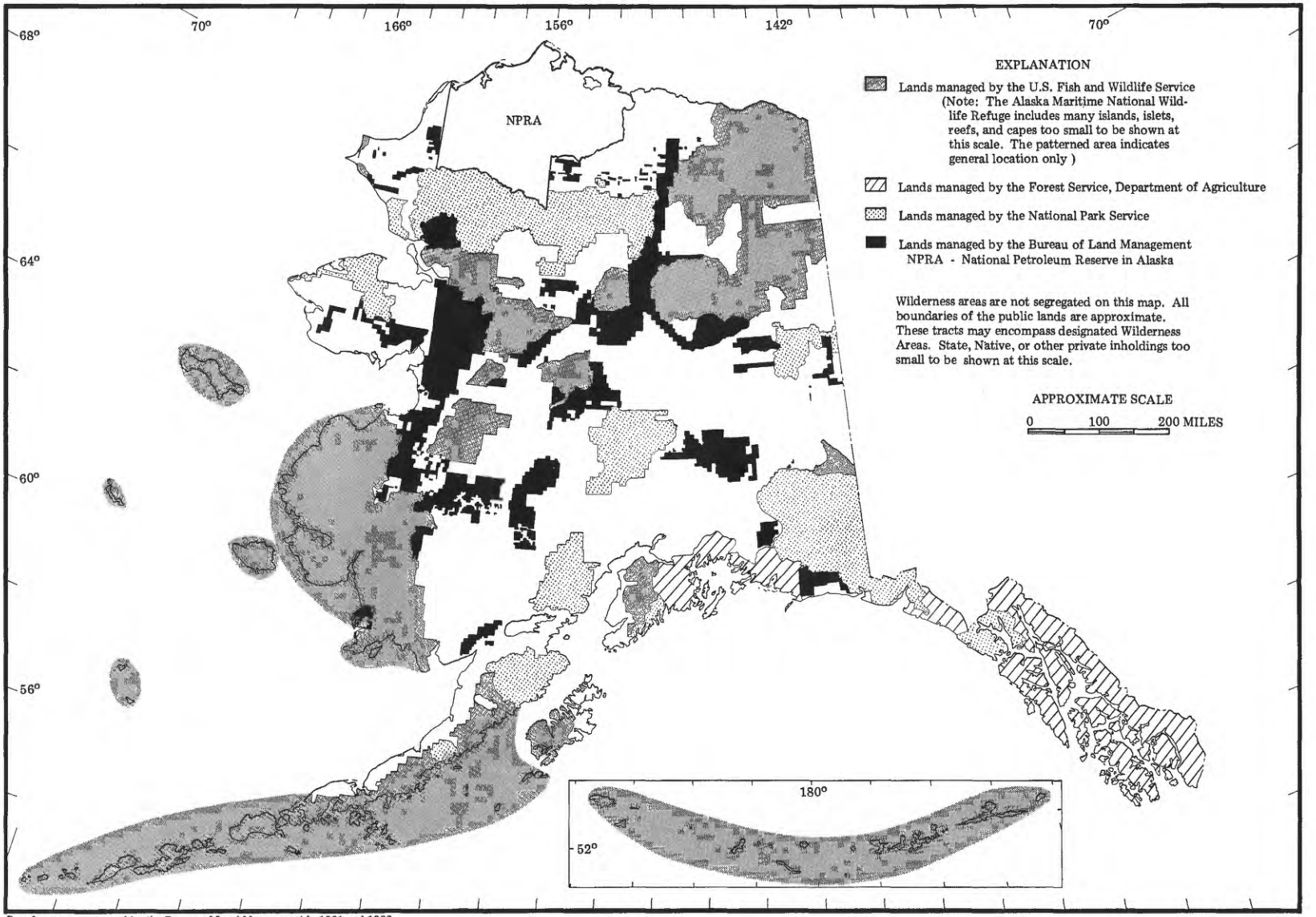
The minerals discussed in this annual report are those of current interest and fall into two broad categories about which the report has been structured—namely, energy resources (oil and gas, uranium, coal and peat, and geothermal resources) and nonfuel, critical, and strategic minerals. Construction materials, such as sand and gravel, are not discussed here.

The following pages describe the roles of land management agencies and other Federal agencies as they relate to mineral information and activities. The distribution of ANILCA conservation units managed by Federal agencies is shown in figure 1.

DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey was established to conduct systematic scientific investigations of the geologic structure and mineral resources of the Nation. The Geological Survey carries out its mission



Base from maps prepared by the Bureau of Land Management in 1981 and 1982.

FIGURE 1.—Distribution of National Interest Lands and conservation units established by the Alaska National Interest Lands Conservation Act of 1980. Boundaries and agency management as of February 1982.

through topographic mapping, geologic, geochemical, and geophysical studies, stream measurements, geohazards research, application of remote-sensing techniques, and participating in multidisciplinary and interdepartmental projects and studies. [The Geological Survey's regulatory, leasing, and accounting functions were taken over by the Minerals Management Service, established in January 1982.]

In recent years the Geological Survey's role in assessing resources has increased, particularly in the area of energy resources. Numerous field and research projects gather information about domestic petroleum, coal, uranium, and geothermal resources. Further, national legislation requires that mineral assessments be made of areas to be set aside as Wilderness and areas to be addressed under ANILCA. The Alaska Mineral Resource Assessment Program (described in the nonfuel minerals section of this report), for example, has as its goals a systematic investigation of the State's minerals. The products of such studies are used to help determine our national mineral and energy endowment and to analyze potential hazards and impacts. They also help industry locate and develop mineral supplies and assist in developing concepts, models, and techniques to identify unusual mineral deposits. Geological Survey publications are a common source of basic data on mineral deposits of interest to industry.

The Geological Survey frequently cooperates with Federal and State agencies in topical or regional studies and is often the lead agency in preparing environmental impact statements for areas where mineral activity is proposed.

BUREAU OF MINES

The national mission of the Bureau of Mines, briefly stated, is to ensure continued viability of the domestic minerals and materials industry and to maintain a minerals base adequate to meet national needs. In Alaska, the Bureau of Mines carries out the mission in five program areas:

(1) Minerals availability—The Bureau of Mines Minerals Availability Program provides a modernized aid to mineral property evaluation. It relies on two computerized data bases, the Minerals Availability System and the Minerals Industry Location System, described further in the nonfuel minerals section. The Bureau of Mines also develops worldwide mineral availability curves by evaluating selected domestic and foreign properties.

(2) Land assessment—In recent years, the Bureau of Mines's Alaska Field Operations Center (AFOC) has concentrated on evaluating the mineral potential of Federal lands to aid Congress and executive agencies in land management decisions.

(3) Mining research—Various Bureau of Mines research centers work with the AFOC on problems unique to Alaska. Current work includes: metallurgical research to determine recoverability of platinum-group and related metals from Alaskan ores, identification of nonsettleable solids in placer discharges, underground placer mining methods, and maintenance of a permafrost research center at Fox, near Fairbanks, in cooperation with the State and the Corps of Engineers.

(4) Critical and strategic minerals—Current emphasis is on cobalt, chromite, and the platinum-group metals, but the program also includes tin and tungsten and is expanding. Mineral deposits are being investigated on Federal land closed to mineral entry or on lands open to entry if the deposits currently are not considered economic.

(5) State minerals specialist—A mining engineer acts as a liaison between the State, industry, and Federal organizations to keep the Bureau of Mines informed of current developments and to provide data for the annual Minerals Yearbook and national publications.

BUREAU OF LAND MANAGEMENT

The Bureau of Land Management is responsible for multiple-use management of the surface and subsurface of 23 million acres of NPRA, 4 million acres of the Central Arctic Management Area, and approximately 39 million acres of public lands south of Alaska's North Slope (fig. 1), as well as for minerals on the Outer Continental Shelf. Additionally, the Bureau of Land Management administers geothermal resources and leasable and locatable minerals on other Federal lands, including acquired lands, and on private lands where the Federal Government has retained mineral rights.

The Bureau of Land Management's administrative mineral responsibilities require close coordination with other surface management agencies. Generally, in the case of upland leases, the Bureau of Land Management issues leases and integrates the leasing with other land uses in cooperation with the surface

management agency. After a lease is issued, the newly established Minerals Management Service (set up in 1982) assumes jurisdiction of exploratory and developmental activities in cooperation with the land manager to assure surface protection. Table 1 and figure 2 describe areas tentatively scheduled for analysis to determine which lands not on the North Slope should be opened to mineral leasing.

TABLE 1.—*Bureau of Land Management 1982 analysis schedule for opening for onshore mineral leasing (schedule subject to annual revision)*

Year	Block name	Estimated acreage	Remarks
1982	Denali[1]	5,007,000	
	Corridor[1]	3,400,000	South of 68°
1983	Seward Peninsula	8,594,000	
	Lime Hills	3,513,000	
	Fortymile	3,885,000	Selected by the State 2/82; tentatively dropped from lease schedule.
1984	Tanana	5,107,000	
	Lower Yukon	7,832,000	
	Noatak	1,350,000	Parts of this unit selected by the State 2/82; tentatively dropped from lease schedule.
1985	Kvichak	595,000	
	Bettles	3,342,000	
	Steese/White Mountain	2,250,000	

[1] Denali and Corridor blocks are now being analyzed for possible opening to mineral leasing. A Public Land Order opening the lands so determined will be issued by September 30, 1982.

The principal activities of the Bureau of Land Management that are related to Alaska's minerals and energy resources are (1) preparation for the scheduling of Federal oil and gas leases in the upland areas with the concurrence of the surface management agency and (2) recordation of mining claims and determinations of the validity of mining claims for mineral patents. The Bureau of Land Management rarely produces reports that pertain to the evaluation of mineral and energy resources; the technical information that goes into patent validity determinations becomes public after the process has been completed.

MINERALS MANAGEMENT SERVICE

The primary functions of the Minerals Management Service are to examine and classify Federal lands as to the mineral resources subject to leasing and waterpower and water-storage values; to determine estimated petroleum values for onshore and offshore competitive lease sales; to supervise exploration and development of such leases on Federal and Indian lands; and to maintain accounts and collect royalties and rents of petroleum, coal, and certain other mineral commodities such as potash. The Minerals Management Service, established in 1982, has taken over all the functions of the former Conservation Division of the Geological Survey and is responsible to the Minerals Management Board.

The Minerals Management Service's regulations and procedures are subject to frequent review and appraisal to avoid or mitigate the consequences of pollution incidents, surface damage, or other hazards that may be associated with operations conducted under leases and prospecting permits.

The Minerals Management Service prepares background material for leases well in advance of the lease sale date and in coordination with the Bureau of Land Management, the Geological Survey, and other Federal and State agencies. (Table 1 and fig. 2 describe onshore areas tentatively scheduled for lease.) The Minerals Management Service also is involved in the preparation of environmental impact statements for proposed lease areas. Further, the Minerals Management Service refines resource estimates for each area to be leased by using geological and geophysical information and identifies hazards to exploration and production in these areas. For each lease tract, it arrives at a value that is used as a basis for accepting or rejecting bids received during lease sales. The Minerals Management Service then becomes responsible for collection of and accounting for the money due the Federal Government from oil or gas produces and for rents and royalties.

NATIONAL PARK SERVICE

In managing the Federal park system, the National Park Service is directed ". . . to conserve the scenery and natural and historic objects and the wildlife . . . and to provide for enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations."[1] Administrative policy is based on the principles of maintenance of the natural resources and on the concept that national interest dictates decisions affecting private or public enterprise in the parks. The National Park Service currently has jurisdiction over an estimated 52 milllion acres of park lands in Alaska (fig. 1).

National Park Service responsibility for mining claims and mining on park lands in Alaska and elsewhere is limited basically to mineral examinations

[1]From the act establishing the National Park Service, approved August 25, 1916 (39 Stat 535).

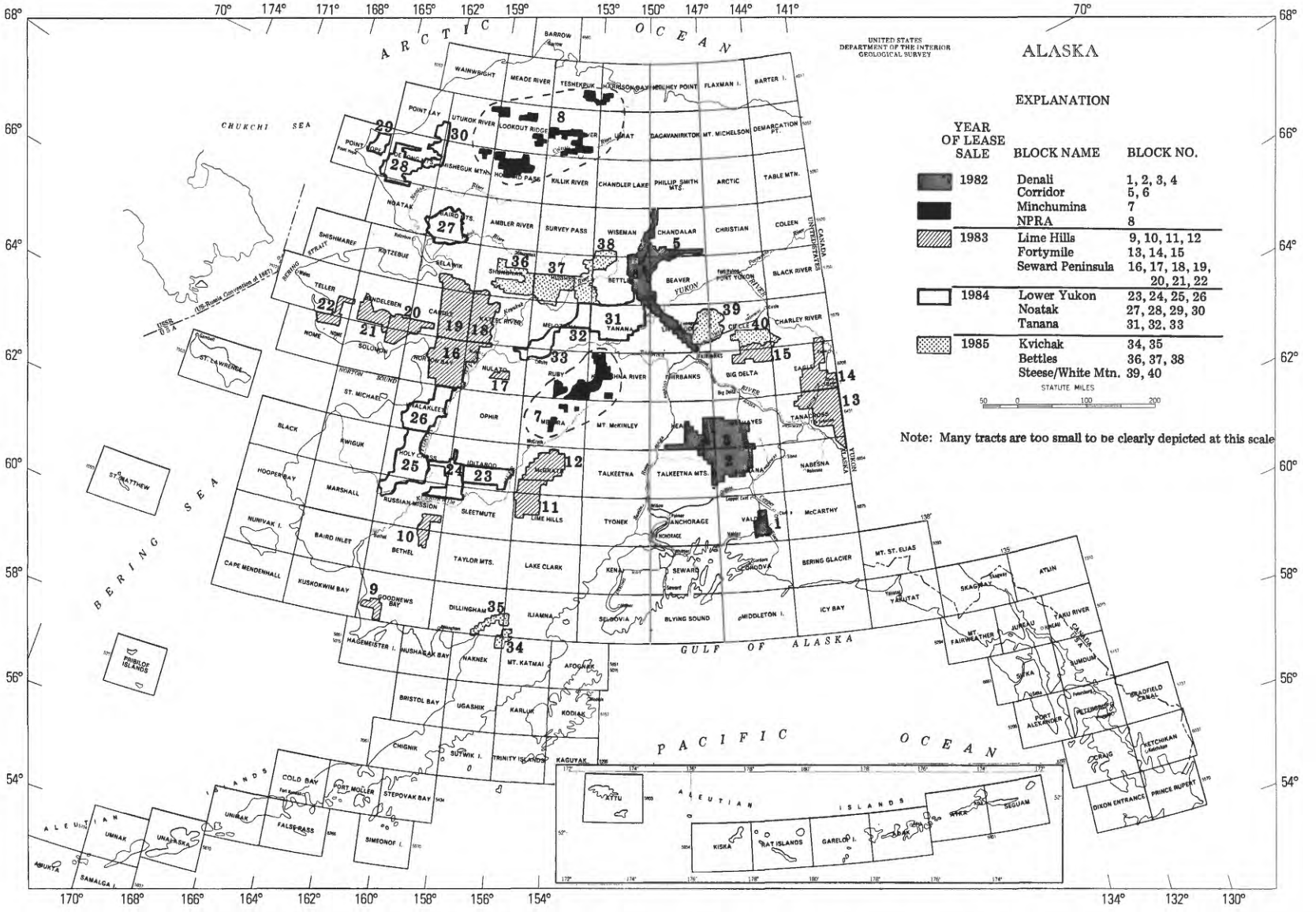


FIGURE 2. — Areas tentatively scheduled for analysis prior to uplands oil and gas leasing by the Bureau of Land Management.

and determinations of valid existing rights, environmental assessments of the natural and cultural resources and potential impacts of mining on Federal or other lands, protection of park resources through mining plans developed under Federal regulations, and approval of mining plans of operation. The assessments and mining plans are available for public review.

Except for validity determinations, the National Park Service rarely collects or publishes basic data about mineral deposits, commonly relying on information gathered by claimants, the Geological Survey, the Bureau of Mines, or State or private sources. Validity determinations also involve the Bureau of Land Management and the Office of Appeals and Hearings. Results of mineral examinations are made public when final decisions are made.

U.S. FISH AND WILDLIFE SERVICE

The national mission of the U.S. Fish and Wildlife Service is to provide the Federal leadership to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of people.

In Alaska, the Fish and Wildlife Service seeks to accomplish this mission through a variety of programs that implement the provisions of the Endangered Species Act, Marine Mammals Protection Act, Fish and Wildlife Coordination Act, River and Harbors Act, the National Wildlife Refuge System Administration Act, various migratory bird laws, and other statutes. Direct activities under these laws include administration of 76 million acres of National Wildlife Refuges, fish and wildlife research, law enforcement, and review and comment on permit requests and environmental impact statements.

Under the provisions of ANILCA, 16 refuges (fig. 1) were created or enlarged to conserve fish and wildlife populations and their habitats, as well as other values. These refuges are closed to entry, location, and patent under mining laws but are open to entry under the mineral leasing laws.

While many traditional functions have been deemed appropriate for these areas, other uses, including oil and gas leasing, will be permitted when such activities are compatible with the purposes for which the refuges were established. The compatible uses will be determined through the Comprehensive Conservation Planning process currently under way for these refuges. Except as required in the Conservation Plans and in the baseline study on the Arctic Coastal Plain, the Fish and Wildlife Service does little mineral assessment work.

DEPARTMENT OF AGRICULTURE

FOREST SERVICE

The mission of the Forest Service, Department of Agriculture, is to provide a continuing flow of natural resource goods and services to help meet national needs and to contribute to meeting such needs worldwide. To do this, it assesses and analyzes present and anticipated needs, supplies, and uses for resources in public and private forests and rangeland; makes these resources fully productive; encourages and assists private landowners through State organizations to improve, protect, and use forest resources; develops and distributes information about technology; and directs programs of resource conservation. The Forest Service encourages management of its lands for multiple use to provide a sustained flow of renewable resources. The Forest Service is developing management plans for both of Alaska's National Forests, Tongass and Chugach, which together encompass about 23 million acres (fig. 1).

The Forest Service also administers nonrenewable resources to help meet the Nation's need for mineral and energy resources by accommodating exploration and development on Federal lands under its jurisdiction, consistent with other values of the lands. It provides research information and technology to help with postmining reclamation and promotes energy-efficient activities on Forest Service lands. Forest Service geologists also check the validity of claims in trespass cases, patent requests, and claims planned for development in withdrawn areas of the national forest system. The Forest Service's validity evaluations of claims to mineral resources on lands proposed for withdrawal normally is done by examining the history of claims and compiling information that has been gathered primarily by the Bureau of Land Management, the Bureau of Mines, and the U.S. Geological Survey and by reviewing the patent actions. The results of the evaluations are published in the Federal Register.

DEPARTMENT OF ENERGY

The functions of the Department of Energy are primarily in the areas of administering the current petroleum acts and Congressional mandates relating to energy, monitoring grants, and overseeing contracts for studies of geothermal and uranium energy resources described in later sections of this report.

The Department is represented in Alaska by a small staff in Anchorage that acts as the Secretary of Energy's representative to the State and the public.

The Department of Energy's National Uranium Resource Evaluation (NURE) program was initiated in 1974 to estimate the domestic uranium resources in the 48 conterminous States and Alaska. Projects of national scope, the Airborne Radiometric and Magnetic Surveys (ARMS) and the Hydrogeochemical and Stream Sediment Reconnaissance Survey (HSSR), and geologic topical studies of regional or provincial scope were conducted to define geologic environments favorable for uranium deposition. These assessments were carried on in areas including those of uranium production, known ore reserves, and estimated potential resources. Components of the NURE program active in Alaska have consisted of ARMS, HSSR, geologic map compilation, quadrangle evaluation, and topical and regional studies related to uranium depositional favorability and provenance characteristics.

CONTACTS FOR FURTHER INFORMATION

For more information about Federal programs or projects concerned with mineral or energy resources of Alaska, please contact the following:

Department of the Interior

Bureau of Land Management	Neal Bassett, Chief Branch of Land and Minerals Federal Building 701 C Street Anchorage, AK 99513
Bureau of Mines	John Mulligan, Chief Alaska Field Operations Center P.O. Box 550 Juneau, AK 99802
Minerals Management Service	Joseph Jones, Regional Manager 800 A Street Anchorage, AK 99501
National Park Service	John Cook, Regional Director Alaska Area Office 540 West 5th Avenue Anchorage, AK 99501
U.S. Fish and Wildlife Service	Keith Schreiner, Regional Director 1011 East Tudor Road Anchorage, AK 99503
U.S. Geological Survey	Thomas Miller, Chief Branch of Alaskan Geology Gould Hall, APU Campus University Drive Anchorage, AK 99504

Department of Agriculture

Forest Service	Fred Harnisch, Forest Staff Officer 2221 East Northern Light Boulevard Anchorage, AK 99508
Department of Energy	Fred Chiei, Regional Representative Federal Building 701 C Street Anchorage, AK 99513

OIL AND GAS

Cook Inlet and the Arctic North Slope (fig. 3) are the only producing oil and gas provinces in the State of Alaska. The "Oil and Gas Journal" (listed with references cited, p. 20) reported that oil production in the State at the end of 1981 had reached approximately 1.68 million (42-gallon) barrels per day or about 19.5 percent of the total production of the United States. Approximately 1.6 million barrels per day of this production are from the Arctic North Slope. Most of the remainder is from offshore Cook Inlet; only about 9,000 barrels per day are from onshore areas adjacent to the Inlet.

The U.S. Geological Survey estimates, in Circular 860 (Dolton and others, 1981, listed in Selected References), that, of the undiscovered recoverable oil and gas resources in onshore Alaska, approximately 87 percent is on the North Slope and 9 percent is in the Cook Inlet area. The distribution of oil and gas exploration and development activities during 1980 and 1981 reflects both the petroleum potential of the areas and the availability of land. Most of the development and exploration efforts were on State of Alaska leases in the Prudhoe Bay-Kuparuk River field area of the Arctic North Slope (fig. 3). In the remainder of the North Slope, the Geological Survey drilled 16 wells in the National Petroleum Reserve of

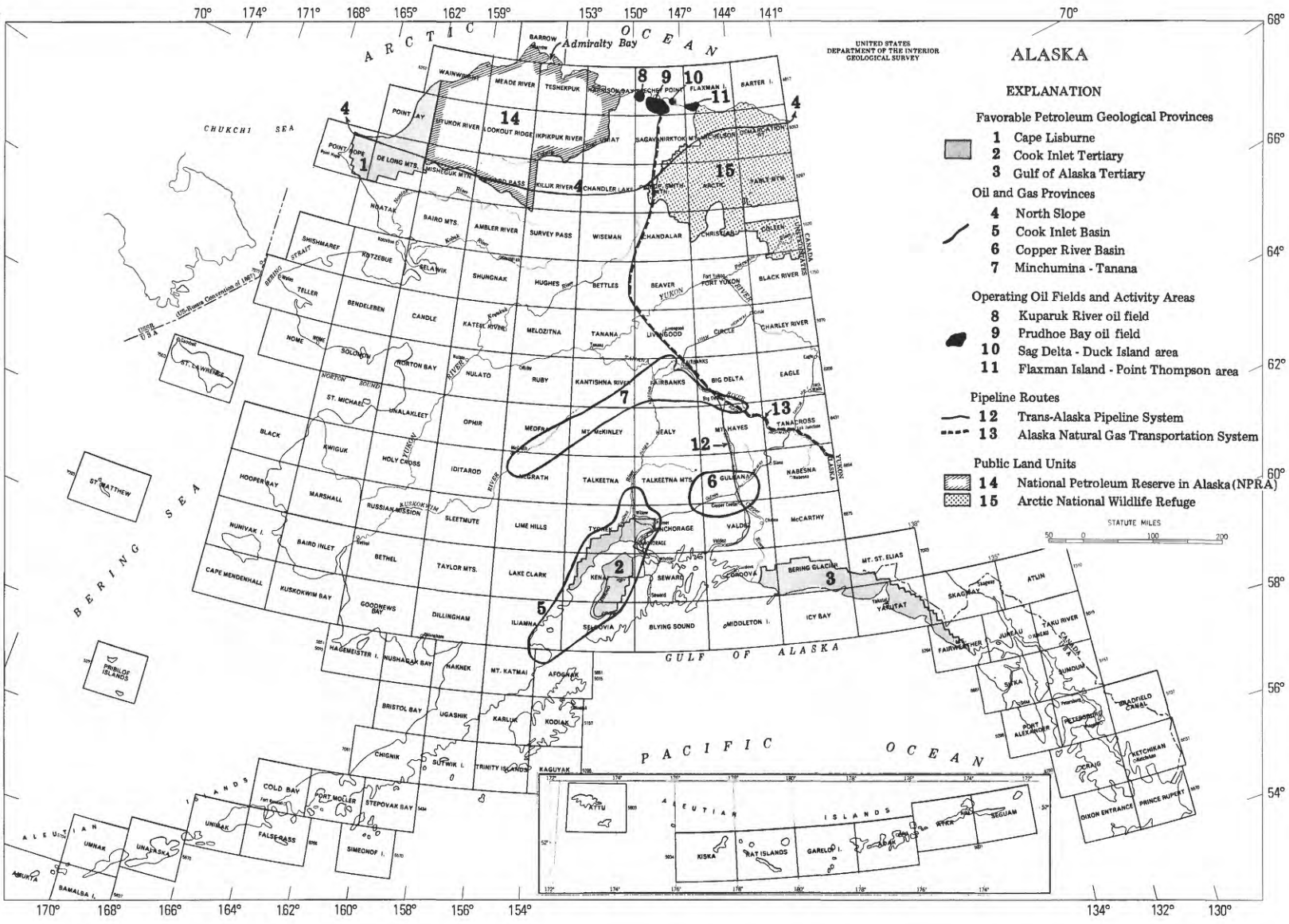


FIGURE 3.—Operating oil fields, areas of industrial activity, favorable petroleum geological provinces, oil and gas provinces, and pipeline routes.

Alaska (NPRA), and private industry drilled two wells on Native lands. In the Cook inlet area, three wells were drilled to delineate two small gas discoveries, and four other exploration wells were unsuccessful. Outside of the Cook Inlet area and the North Slope, only three exploration wells were drilled, all on Native lands.

The passage of the Alaska National Interest Lands Conservation Act (ANILCA) in December 1980 may alter the future exploration picture in Alaska. As a result of this act, plans are under way for leasing of Federal lands in Alaska and for geological and geophysical exploration of the Arctic National Wildlife Refuge (ANWR). Further, the Department of the Interior's 1981 appropriations act required the competitive leasing of oil and gas in NPRA to private industry.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

Bureau of Land Management.—The Interior Department's 1981 appropriations act required that the first lease sale of up to 2 million acres of NPRA be conducted by August 1982. In December 1980, the Bureau of Land Management issued a call for nominations in NPRA. Although all 23 million acres of NPRA were nominated, the Bureau of Land Management, in consultation with the U.S. Geological Survey, selected for further study approximately 5.8 million acres that have the highest potential for oil and gas and that are areas for which industry expressed the greatest interest. Following government study and an environmental assessment, 1.5 million acres were selected from the study area and scheduled for sale in December 1981. The sale, however, was rescheduled and held on January 27, 1982. High bids from the sale totaled $61,155,838.91 on 29 of the 59 tracts offered. A second sale was scheduled for May 26, 1982.

The Bureau of Land Management has started a systematic study of the oil and gas resources, the wilderness characteristics, and the wildlife resources in the Central Arctic Management Area (CAMA), an area between NPRA and ANWR and north of latitude 68°, as required by Section 1001 of ANILCA. This study, to be completed by the Bureau of Land Management no later than December 1988, is to be the basis for recommendations concerning future use and management of the oil and gas resources in the central North Slope.

Section 1008 of ANILCA authorized the Secretary of the Interior to establish an oil and gas leasing program for Federal lands south of 68° north latitude. (See table 1 and fig. 2.) The Bureau of Land Management has started an analysis to determine which lands under its jurisdiction should be opened to mineral, including oil and gas, leasing. The analysis, to be completed by 1985, will include environmental assessments and amendments to land-use plans where needed, all of which will involve the public. At the close of 1981, plans were well along for a process whereby the Bureau of Land Management would accept applications on 276,480 acres for noncompetitive oil and gas leases in the Minchumina area in central Alaska (fig. 3.)

U.S. Geological Survey.—The southern part of the CAMA covers a significant part of the overthrust belt of the central Brooks Range, a geologically complex area. Assessment of the petroleum potential of this area was initiated in 1981 by the Geological Survey as part of the Alaska Mineral Resource Assessment Program (AMRAP, further described in the section on nonfuel minerals). Fieldwork in the Killik River and Chandler Lake (1:250,000-scale) quadrangles began in 1981, and a major part of the program will be completed during the 1982 field season. Objectives of the program include determining (1) the type and abundance of potential hydrocarbon traps, (2) the distribution of potential hydrocarbon reservoir rocks on the thrust sheets of this part of the Brooks Range, and (3) the potential for hydrocarbon source rocks by organic chemical analysis.

Studies by the Geological Survey related to the exploration of NPRA have been expanded and extended eastward to increase the data base for petroleum assessments in the central North Slope and the ANWR. A computer data base containing information about rock types and microfossils in most of the exploratory wells on the North Slope has been developed. Studies of the richness and maturity of potential oil and gas source rocks have been made from well samples and surface outcrops and are also part of the data base. These projects and others are part of the Geological Survey's North Slope Petroleum Program whose goal is to assess the petroleum potential of the North Slope of Alaska.

The Geological Survey and U.S. Fish and Wildlife Service have started preparing an environmental impact statement for geological and geophysical exploration on the northwest coast of the ANWR, east of an area where industry wells have indicated some oil and gas potential.

Research activities on the North Slope include two Geological Survey projects to determine whether petroleum reservoirs can be related to near-surface

chemical or geophysical anomalies. One study is in progress to determine whether microseepage of helium from petroleum reservoirs will result in anomalously high concentrations of helium in near-surface permafrost. Results to date show a pattern of high helium concentrations between Admiralty Bay and the Arctic Ocean that may be related to a stratigraphic trap for oil in sandstones. A second project will attempt to determine whether hydrocarbons seeping from the subsurface reduce iron oxides in near-surface rocks to form the mineral magnetite. Preliminary data suggest that, where quantities of magnetite are large enough to detect with low level aeromagnetic surveys, the magnetic anomalies can be correlated with known oil and gas deposits and surface seeps.

In the Cook Inlet Basin, projects related to resource assessments for the offshore lease sales have provided additional information on the source rocks, reservoirs, and structural framework of the basin. Surface geological mapping, Continental Offshore Stratigraphic Test well studies, and seismic surveys were included in these projects. From these studies, a proposed model for the generation and entrapment of the oil and gas deposits in the basin has been developed. In the proposed model, oil was generated in Middle Jurassic source beds and migrated across a major unconformity into the overlying Tertiary reservoir sands. Therefore, the proximity of the Tertiary reservoirs to the underlying Middle Jurassic source rocks may be a critical factor for oil accumulation in the basin. The major gas reserves are nonassociated gas in the shallow (less than about 6,500 feet) sands of the coal-bearing nonmarine Kenai Group rocks. This shallow gas is believed to be of biologic origin and indigenous to the Kenai Group.

Regional geologic and mapping projects, such as AMRAP, have provided geologic information important to oil and gas assessments in central Alaska (Minchumina Basin), the Copper River basin, and the Alaska Peninsula. In addition, work by Geological Survey parties in the Norton Bay, Nulato, and Unalakleet quadrangles has shown that geologic structures in the onshore areas also are found in seismic records for offshore areas. (See, for example, Fisher and others, 1981, listed with Selected References.)

As part of the assessment of the undiscovered oil and gas resources of the United States, an assessment of the onshore Alaska oil and gas resources was published by the Geological Survey in Circular 860 (Dolton and others, 1981, listed with Selected References). Risked mean estimates of the undiscovered *recoverable* oil and gas resources for onshore Alaska were 6.9 billion barrels of oil and 36.6 trillion cubic feet (TCF) of natural gas; these estimates are approximately 13 percent of the estimated undiscovered *recoverable* oil and 9 percent of the undiscovered *recoverable* gas for the total onshore area of the United States. An update of the detailed assessment in the NPRA completed in May of 1980 estimated the undiscovered *in-place* sources to be 6.0 billion barrels of oil and 11.3 TCF of gas. A similar type of assessment for the ANWR, published in Mast and others (1980, listed with Selected References), estimated *in-place* undiscovered resources of 4.8 billion barrels of oil and 11.9 TCF of gas. The Geological Survey also provided a briefing about North Slope petroleum geology to the National Petroleum Council for their assessment of the Arctic oil and gas resources.

During 1981, the Geological Survey's Office of National Petroleum Reserve in Alaska completed the operational phase of the petroleum exploration program in the NPRA. The Geological Survey had been assigned the responsibility of continuing the petroleum exploration program and the activities initiated by the Department of the Navy when the Reserve was transferred from the Department of the Navy to the Department of the Interior on June 1, 1977. Highlights for 1980 and 1981 include:

- Thirteen exploratory wells were completed, seven in 1980 and six in 1981 (table 2; fig. 4). At the completion of the drilling, all contractor equipment and drilling rigs were demobilized from the NPRA, and all materials, equipment, and supplies were removed from the Reserve, declared surplus, or transferred to Barrow for use in operating and maintaining the Barrow gas field. The base camp at Point Lonely was closed on December 6, 1981.
- A total of 1,700 miles (1,110 miles in 1980 and 590 miles in 1981) of seismic data were collected, processed, and interpreted.
- The Geological Survey continued to operate and maintain the South Barrow gas field, which supplies gas to the village of Barrow and nearby Federal installations. Three development wells were drilled in the newer East Barrow gas field, about 7 miles southeast of the South Barrow gas field. Production facility construction continued at the East Barrow gas field. When completed, the new production will double the amount of natural gas available to the Barrow area.

TABLE 2.—*National Petroleum Reserve in Alaska exploration test wells, 1980–81 (see fig. 4)*

Well no.	Name	Location	Total depth (feet)	Date completed	Deepest horizon	Remarks
1	Tunalik Test Well No. 1.	22 mi SE of Icy Cape	20,335	1-07-80	Argillite basement	Gas test; plugged and abandoned.
2	Ikpikuk Test Well No. 1.	42 mi SW of Lonely	15,481	2-28-80	Argillite basement	Gas shows; plugged and abandoned.
3	Lisburne Test Well No.1.	110 mi SW of Umiat	17,000	6-02-80	Lisburne-Endicott Group.	Gas shows; plugged and abandoned.
4	Seabee Test Well No. 1.	1 mi NW of Umiat	15,611	4-16-80	Basal Cretaceous	Gas test; plugged and abandoned.
5	Walakpa Test Well No. 1.	15 mi S of Barrow	3,666	2-07-80	Argillite basement	Gas shows; plugged and abandoned.
6	East Simpson Test Well No. 2.	50 mi SE of Barrow	7,505	3-15-80	Argillite basement	Poor gas shows; plugged and abandoned.
7	West Dease Test Well No. 1.	28 mi SE of Barrow	4,170	3-26-80	Argillite basement (Devonian or older).	Poor gas shows; plugged and abandoned.
8	Awuna Test Well No. 1.	152 mi SSW of Barrow	11,200	4-20-80	Early Cretaceous Fortress Mountain Formation.	Gas shows; plugged and abandoned.
9	Walakpa Test Well No. 2.	4 mi SSW of Walakpa Test Well No. 1.	4,360	2-15-81	Argillite basement	Recovered gas at a rate of 2.4 million cubic feet per day; temporarily abandoned.
10	North Inigok Test Well No. 1.	60 mi NNE of Umiat	10,170	4-04-81	Triassic Shublik Formation.	Gas shows; plugged and abandoned.
11	Kuyanak Test Well No. 1.	30 mi SSE of Barrow	6,690	3-31-81	Argillite basement	Poor gas shows; plugged and abandoned.
12	Tulageak Test Well No. 1.	24 mi ESE of Barrow	4,015	3-23-81	Argillite basement	Plugged and abandoned.
13	Koluktak Test Well No. 1.	70 mi W of Umiat	5,882	4-19-81	Early Cretaceous Torok Formation.	Plugged and abandoned.
14	South Barrow No. 15.	10 mi ESE of Barrow	2,278	9-18-80	Argillite basement	Completed as a gas well.
15	South Barrow No. 18.	12 mi ESE of Barrow	2,135	10-14-80	Argillite basement	Completed as a gas well.
16	South Barrow No. 20.	11 mi ESE of Barrow	2,356	5-10-80	Argillite basement	Gas shows; suspended as a nonproducer.

- Environmental rehabilitation activities continued in the Reserve with the collection of more than 2,140 tons of debris and waste materials from numerous sites. These materials were consolidated and stockpiled at several collection points. Initial rehabilitation work was done at six well sites, and follow-up reseeding and refertilization work was completed at other sites.
- Well data were released to the public on all wells completed before the end of fiscal year 1980. All geophysical data collected from 1974 through fiscal year 1979 also have been released.

Minerals Management Service.—Resource evaluation activities of the Geological Survey's Conservation Division (set up in January 1982 as the Minerals Management Service and hereafter referred to by the new name) included geological and geophysical studies in the NPRA to support the Bureau of Land Management's leasing program. Initial oil and gas resource assessments were made to select the most promising resource areas for study and environmental assessment. More detailed assessments were made to select the final sale tracts, and evaluations were made on those tracts for use in the process of accepting or rejecting bids. Lands west of the NPRA and south of 68° north latitude, as described in Section 1008 of ANILCA, were reviewed, and "favorable petroleum geological provinces" designated in three areas: the onshore Cook Inlet Tertiary Province, the Cape Lisburne Province, and the onshore Gulf of

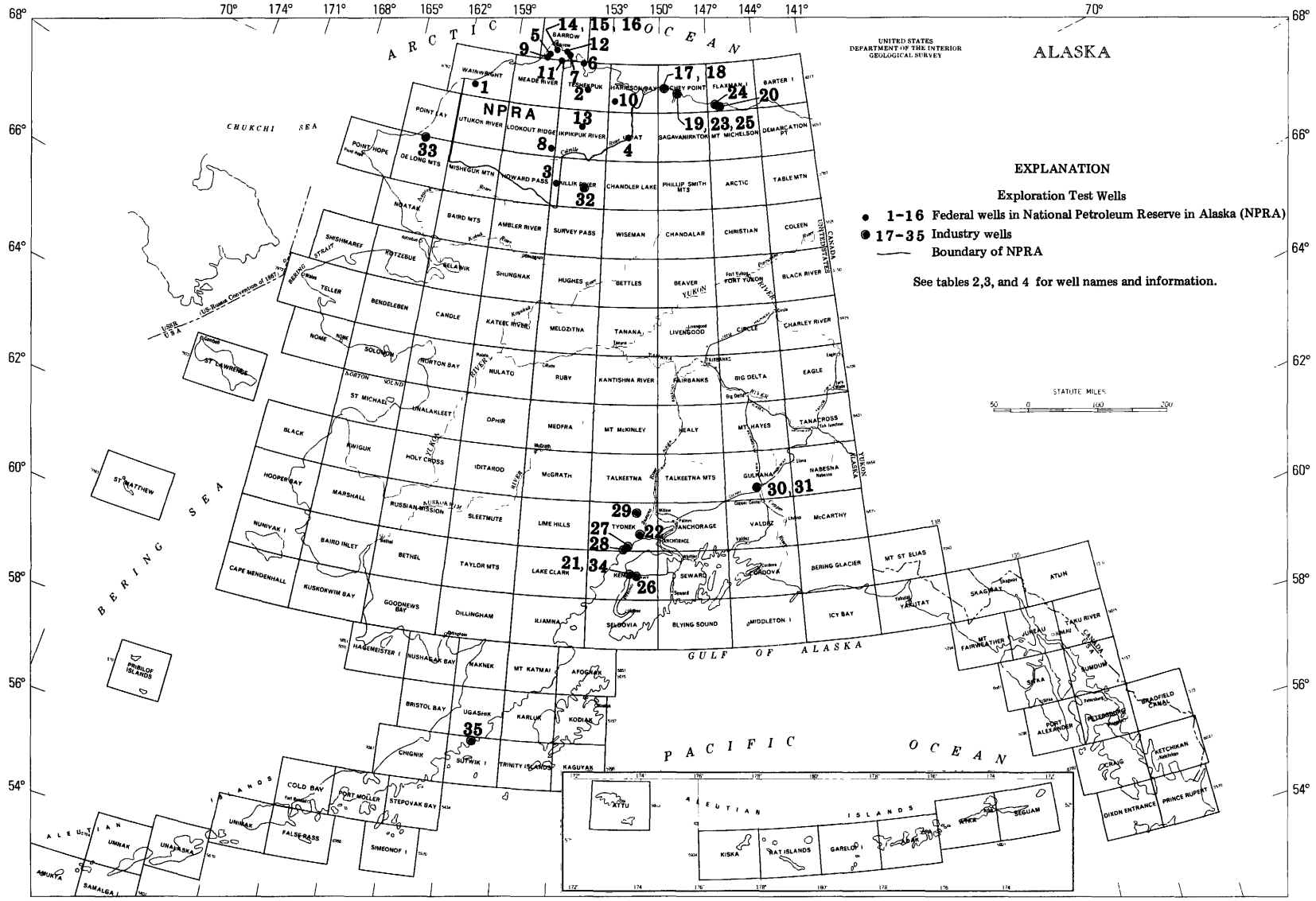


FIGURE 4. – Locations of wells drilled by industry and the Federal Government in 1980 and 1981.

Alaska Tertiary Province (fig. 3). Detailed descriptions and a map of these areas are available from the Regional Manager, Minerals Management Service in Anchorage (800 A Street, Anchorage, AK 99501). Lands within the "favorable petroleum geological provinces" must be competitively leased for oil and gas, but other Federal lands will be available for noncompetitive leasing.

Regulations, field operations, and royalty accounting functions of the Minerals Management Service were related to the drilling and production operations in the producing fields of the Kenai Peninsula. During 1981, the royalty accounting functions were transferred to the central accounting office in Denver.

STATE OF ALASKA LEASE SALES

Three onshore lease sales were held by the State of Alaska in 1980 and 1981.

- Sale 31 took place in the Prudhoe Bay area in September 1980. All 78 tracts (198,801 acres) offered received bids, and high bids totaled $12,771,300. Terms of the sale were 20 percent royalty and 30 percent net profit share with a 10-year lease term, according to "Petroleum Information" (September 17, 1980; the journal is listed on page 20).
- Sale 32 in the Kenai Peninsula area of the Cook Inlet Basin was held in August 1981 and included both onshore and offshore lands. There were 78 tracts (202,000 acres) offered, and 59 tracts (151,591 acres) received bids. Terms were a fixed bonus of $10 per acre with royalty bidding and a minimum royalty of 20 percent. Royalty bids ranged from approximately 20 percent to 59 percent, as reported in "Petroleum Information" (August 26, 1981).
- Sale 33 in the northern part of the Cook Inlet Basin took place in May 1981. There were 202 tracts (821,098 acres) offered, and 103 tracts (429,983 acres) received bids. Terms were a fixed bonus of $10 per acre with royalty bidding and minimum royalty of 20 percent. "Petroleum Information" (May 20, 1981) reported that royalty bids ranged from approximately 21.3 percent to 64.1 percent.

Five State sales are planned for 1982: Prudhoe Bay Uplands, Beaufort Sea, Middle Tanana/Copper River, Kenai Peninsula, and lower Cook Inlet.

INDUSTRY ACTIVITY IN 1980 AND 1981

The following are highlights of industry activities for 1980 and 1981.

- The most significant oil and gas developments during 1980 and 1981 took place in the Prudhoe Bay area (fig. 3). At the Kuparuk River field, on the west side of the Prudhoe Bay field complex, development drilling and related activities continued. Production began in December 1981 at an initial rate of 50,000 barrels per day. Oil is delivered by a 26-mile, 16-inch pipeline to the trans-Alaska pipeline at Prudhoe Bay. Plans call for an increase in Kuparuk's production to 250,000 barrels per day in 1986. At that level, the field would rank second in daily production in the United States to Prudhoe Bay. Total recoverable oil production is estimated to be 1.2 billion to 1.5 billion barrels. Development, when completed in the next 5 to 10 years, will include as many as 800 producing and water injection wells, with total costs estimated to be $6 billion to $8 billion.
- Oil production at Prudhoe Bay was approximately 1.6 million barrels per day at the end of 1981, and in November 1981 a total of 2 billion barrels of oil had passed through the trans-Alaska pipeline to the Valdez terminal. The operators have secured permits for a waterflooding project at Prudhoe, whereby saltwater will be injected into reservoir rocks to help maintain the reservoir pressure. It is estimated that this project will increase oil recovery by 5 to 9 percent. The injection of processed seawater is planned to start in 1984, according to an article in "Petroleum Information" (February 10, 1982).
- Significant discoveries were reported for four areas along the coast of the Beaufort Sea in successful exploration wells. Several confirmation wells have been drilled in these areas, but commercial production has not been established or claimed by the operators. Figure 4 shows the location of these wells; table 3 gives selected information about the wells.
    (1) Point Thomson—In July 1981, Exxon Co., USA, announced a discovery at its Alaska State C-1 well site. The well tested 3.4 million cubic feet (MCF) of gas and 874 barrels of condensate. This is the sixth reported discovery in an area approximately 12 miles long and 3 miles wide along the Beaufort Sea coast. The easternmost well, the Exxon Alaska

TABLE 3.—*Successful onshore industry exploration test wells, 1980–81 (see fig. 4)*

Well no.	Name	Location	Total depth (Feet)	Date completed	Deepest horizon	Remarks
17	Conoco, Milne Point No. 1.	North Slope, 25 mi NW of Prudhoe, Bay.	10,180	4–15–80	?	Combined flow rates of 785–1,300 barrels per day of oil with small amounts of gas.
18	Conoco, Milne Point No. 2.	North Slope, 24 mi NW of Prudhoe Bay.	9,635	5–04–81	?	Tested 1,900 barrels per day of oil.
19	Conoco, Gwydyr Bay No. 2A.	North Slope	11,510	4–12–81	?	Tested two zones; one flowed 3,000 barrels per day of oil and 2.7 million cubic feet per day of gas, the other flowed 740 barrels per day of oil.
20	Exxon, Alaska State C–1.	North Slope, 48 mi E of Prudhoe Bay.	13,761	7–14–81	?	Flowed 3.4 million cubic feet per day of gas with 874 barrels per day of condensate.
21	Union, Cannery Loop No. 3.	Cook Inlet Basin, 1 mi E of Kenai.	11,125	9–12–81	Kenai Group	Suspended following a 5-week testing program.
22	Cities Service, Lewis River D–1.	Cook Inlet Basin, 50 mi NW of Anchorage.	8,025	10–03–81	?	Suspended gas well.

State A–1, was the first discovery in the area and is the only well for which data have been released. These data indicate approximately 115 feet of Tertiary oil-bearing sand, and the well produced 1,586 barrels of oil and 1.39 MCF of gas during 21.5 hours of testing. Although well data have not been released on the five remaining discoveries, the reservoirs are reported to be in rocks of Early Cretaceous or early Tertiary age. Oil reserve estimates by the State of Alaska Division of Energy and Minerals Management range from a low of 400 million barrels to a high of 900 million barrels, with a most likely estimate of 600 million barrels. Gas estimates range from 3.2 to 6.0 TCF, with a most likely estimate of 4.5 TCF, according to Van Dyke (1980, listed on page 20). Three exploratory wells are being drilled on the islands approximately 3 miles north of the coast, which, if successful, could extend the production area northward into the Beaufort Sea.

(2) Milne Point Unit—This area is just northwest of the Prudhoe Bay field along the coast of the Beaufort Sea. Conoco, Inc., reported two discoveries in the area and is considering development of its reserves. The Milne Point No. 1 Well tested at a rate of 785 to 1,300 barrels of oil per day with small amounts of natural gas, and the Milne Point No. 2 Well tested 1,900 barrels of oil per day, according to "Petroleum Information" (February 10, 1982). No data have been released for the wells, but the reservoirs are reported to be in the Triassic Sag River sand, the Lower Cretaceous Kuparuk River sands, and the Upper Cretaceous Prince Creek sand. The State of Alaska Division of Minerals and Energy Management estimated the reserves for the Milne Point area to range from a low of 30 million barrels to a high of 80 million barrels and a most likely estimate of 45 million barrels of oil (Van Dyke, 1980).

(3) Gwydyr Bay Area—Oil was first discovered in the Gwydyr Bay area in the Hamilton Brothers Point Storkersen No. 1 Well in 1969. Since 1969, several wells have recovered significant amounts of oil, and in 1981 the Conoco Gwydyr Bay No. 2A Well tested 3,000 barrels of oil per day and 2.7 MCF of gas from one zone and 740 barrels of oil per day from a second zone. However, Conoco has no known plans at present to develop Gwydyr Bay, according to "Petroleum Information" (February 10, 1982). Production is from the Permo-Triassic Sadlerochit Group, just north of the complex series of down-to-the-north normal faults that define the northern boundary of the Prudhoe Bay field. The State of Alaska Division of Minerals and

Energy Management has estimated oil reserves to range from a low of 50 million barrels to a high of 120 million barrels, with a most likely value of 80 million barrels (Van Dyke, 1980).

(4) Sag Delta Area—Potential in this area just east of Prudhoe Bay appears to be mainly offshore, but some production may extend onshore. Geological information and well data have not been released for this area, but flow rates from five wells in the nearshore area have been reported by "Petroleum Information" (February 10, 1982). In the Sag Delta area, Sohio Alaska Petroleum Company reported flows from three wells of 2,475 barrels of oil per day, 4,400 barrels of oil per day, and 674 barrels of oil per day. Just to the east, Exxon reported 2,600 barrels of oil per day and 1,100 barrels of oil per day from two of its Duck Island Unit wells. These discoveries indicate a possible productive trend of 10 miles, but it is not known whether the reservoir is continuous or whether production is from the same horizon. No reserve estimates, which would include data from these recent discoveries, are available, but most of the reserves are probably offshore.

- In the Cook Inlet Basin, three exploratory wells were drilled to evaluate previous gas discoveries. Union Oil Company of California drilled two tests at its Cannery Loop Unit discovery located just north of the Kenai gas field on the Kenai Peninsula. The first well, drilled about 3 miles northwest of the discovery well, was abandoned, and the second, drilled a mile north of the discovery well, was suspended after extensive testing. No geological or engineering data have been released on these wells, and no reserve estimates have been made. Cities Service Oil Company's Lewis River D-1 Delineation Well in the undefined Lewis River gas field was suspended as a gas well.
- Thirteen unsucccessful industry exploration tests drilled in 1980 and 1981 are listed in table 4, and

TABLE 4.—*Unsuccessful onshore industry exploration test wells, 1980–81 (see fig. 4)*

Well no.	Name	Location	Total depth (Feet)	Date completed	Deepest horizon	Remarks
23	Conoco, Gwydyr, Bay State No. 1.	North Slope, 10 mi NW of Prudhoe Bay.	11,102	4-25-80	Sadlerochit Formation.	Plugged and abandoned.
24	Exxon, Point Thompson No. 4.	North Slope, 40 mi E of Prudhoe Bay.	15,074	12-20-80	?	Plugged and abandoned.
25	Mobil, Gwydyr State Unit No. 1	North Slope, 15 mi NW of Prudhoe Bay.	11,372	4-12-80	Sadlerochit Formation.	Plugged and abandoned.
26	Chugach Electric, Robinson Loop Unit No. 1	Cook Inlet, 12 mi E of Kenai.	9,150	3-15-80	Tyonek Formation.	Plugged and abandoned.
27	Samasko, Kaldachabuna No. 1.	Cook Inlet, 45 mi W of Anchorage.	12,976	12-01-80	Kenai Group (Hemlock?).	Suspended.
28	Texaco, Nicolai Creek Unit No. 6.	Cook Inlet, 50 mi W of Anchorage.	11,776	2-07-80	Kenai Group (Hemlock?).	Plugged and abandoned.
29	Union, Trail Ridge Unit No. 1	Cook Inlet, 55 mi NW of Anchorage.	13,708	12-13-80	?	Suspended.
30	Amoco, Altna Inc. Well No. 1.	Copper River basin, 12 mi N of Glennallen.	7,928	4-16-80	?	Plugged and abandoned.
31	Amoco, Altna Inc. Well "A" No. 1.	Copper River basin, 6 mi N of Glennallen.	5,677	8-06-80	?	Plugged and abandoned.
32	Chevron, Killik No. 1.	North Slope, 85 mi SW of Umiat.	12,491	12-05-81	?	Plugged and abandoned.
32	Chevron, Akulik No. 1.	North Slope, 10 mi E of Cape Beaufort.	17,029	4-29-81	?	Plugged and abandoned.
34	Union, Cannery Loop No. 2.	Cook Inlet Basin, 3 mi E of Kenai.	10,731	5-16-81	Kenai Group	Plugged and abandoned.
35	Chevron, Koniag No. 1.	Alaska Peninsula, 66 mi of Port Heiden.	10,907	7-09-81	?	Plugged and abandoned.

the locations are shown on figure 4. Six of these wells were located on Native lands, six on State leases, and one on fee land. The decrease in drilling activity from nine wells in 1980 to four in 1981 is probably a result of the unavailability of unexplored leases and the large exploration drilling effort directed at the offshore Beaufort Sea leases that were sold in the 1979 joint State-Federal lease sale. Well data from all of these wells are still proprietary, and the geological significance of these tests is speculative. However, in two areas the tests should provide especially valuable data. In the foothills province of the North Slope, Chevron USA, Inc., was unsuccessful at its two deep tests, the Killik No. 1 and Akulik No. 1 wells. These wells and the NPRA Lisburne Test Well No. 1 apparently have failed to find significant hydrocarbons in this poorly known part of the North Slope. The geology of this large area is complex and has numerous low-angle thrust sheets. When available, the information from the Chevron wells will be a major contribution to the geology of the area. In a little-explored northward extention of the Cook Inlet Basin, Union was also unsuccessful at their Trail Ridge No. 1 Test Well. However, the well was drilled to a depth of 13,708 feet and may indicate a thickness of Tertiary rocks adequate for generation of oil or gas.

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Efforts continued during 1980 and 1981 to finance the construction of the Alaska Natural Gas Transportation System, whose proposed route is shown in figure 3. Sponsors of the pipeline asserted that the project could not be financed without changes in the pipeline legislation. On December 15, 1981, President Reagan signed into law a waiver package designed to liberalize ground rules for financing and construction of the massive project, which was estimated to cost approximately $50 billion if completed on schedule by 1987, according to an article in the "Oil and Gas Journal" (December 14, 1981). However, the waiver package has not been successful, and the sponsors have delayed the project for 2 years, citing depressed crude oil prices, the short-term oil and gas supply outlook, high interest rates, and the recession ("Oil and Gas Journal," May 10, 1982). Pipeline backers will continue to work on a financing plan.

REFERENCES CITED

Oil and Gas Journal, published by Pennwell Publishing Company, 1421 South Sheridan Road, Box 1260, Tulsa, OK 74101.

Petroleum Information, published by Petroleum Information Corporation, a subsidiary of A. C. Nielson Company, P.O. Box 2278, Anchorage, Alaska.

Van Dyke, W. D., 1980, Proven and probable reserves on leased State lands, North Slope, Alaska: State of Alaska Department of Natural Resources, 11 p.

URANIUM

Interest in uranium exploration has recently declined worldwide because of falling prices resulting both from a glut in the uranium market and from public concern over existing and planned nuclear generating plants in the United States. Uranium exploration in Alaska has suffered also because of high logistic costs and because no large high-grade uranium deposits have been found. A general decrease in government uranium activity in Alaska parallels that of industry and results in part from the fact that major projects such as the Department of Energy's National Uranium Resource Evaluation (NURE) are nearly complete. Continued budget limitations suggest further decline of new government survey and research projects.

Uranium minerals frequently are found in granitic or volcanic rocks. Ground water passing through these igneous or volcanic rocks leaches the uranium minerals and may transport them to chemically suitable environments, where they are precipitated. Such environments are commonly permeable continental sandstones that contain carbonaceous material. Large areas in Alaska contain sandstone deposits that could have served as host rocks for uranium deposits, and, in addition, many of these areas are near potentially good igneous source rocks. So far, no sedimentary uranium deposits in Alaska have been commercially developed, but the discovery of interesting subcommercial deposits in other areas suggests that commercial deposits eventually may be found. Private exploration and government research continue in an effort to develop the technology to find uranium deposits and to identify sandstone deposits that contain uranium.

The only uranium deposit in Alaska that has produced commercial quantities of ore is an unusual granite located on Bokan Mountain in southeastern Alaska near the southern end of Prince of Wales Island (fig. 5).

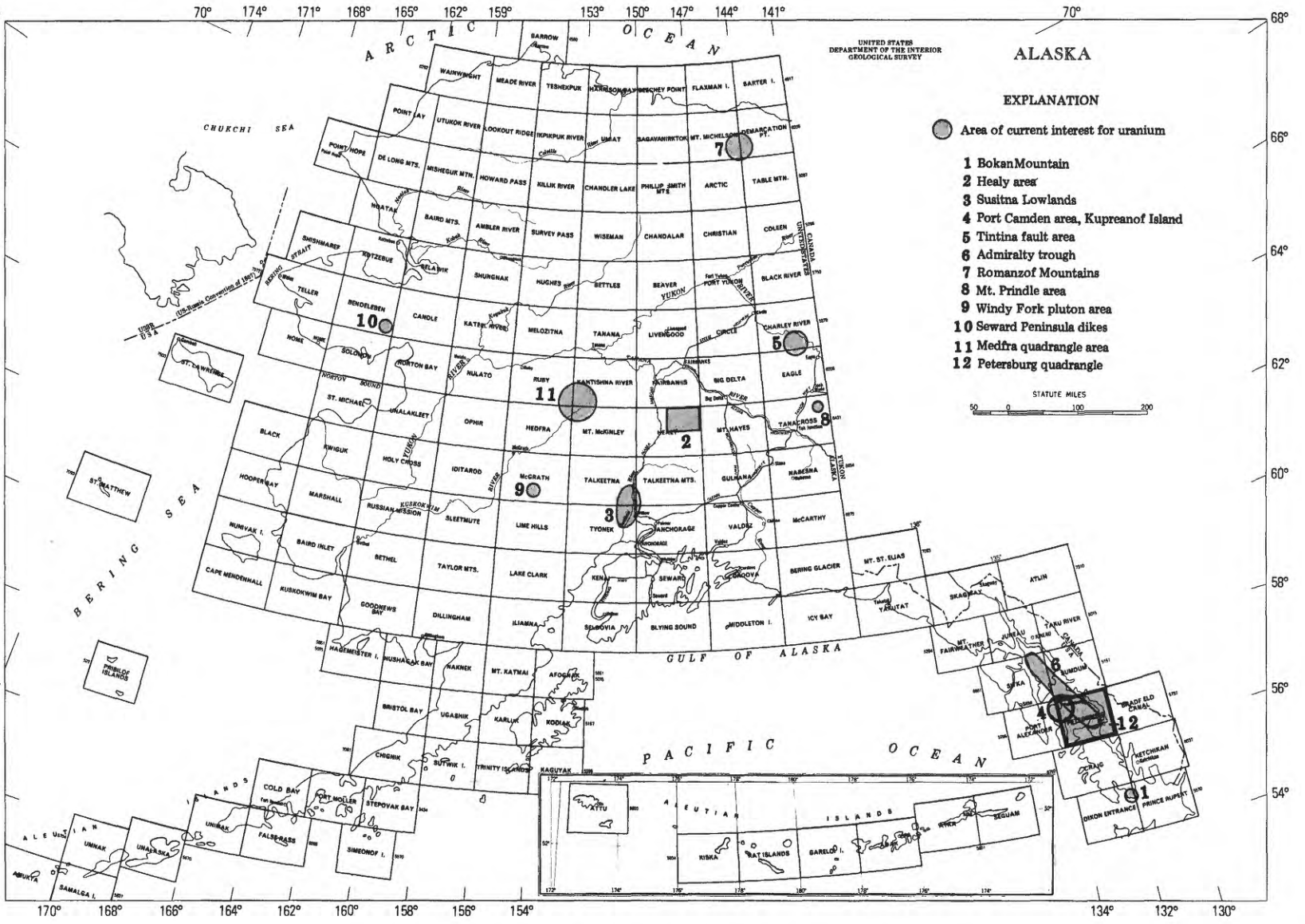


FIGURE 5.—Areas of current interest and industry activity for uranium resources.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

U.S. Geological Survey.—Recent Geological Survey studies have noted uranium enrichment in continental Tertiary sedimentary rocks in central, southeastern, and south-central Alaska (fig. 5). Uranium in these deposits commonly is associated with carbonized wood and siderite, an iron carbonate mineral.

Near Healy, south of Fairbanks, three types of uranium deposits were found—a weak roll front developed in Tertiary sandstones, a mineralized zone at the bottom of the Healy Formation, and a mineralized zone in an oxidized fault zone in Paleozoic rocks. The zone at the base of the Healy Formation contains ore-grade material as uraniferous siderite nodules, but it is too thin and discontinuous to have commercial potential.

Slight uranium enrichment, as much as 72 parts per million, has been found in the Susitna Lowlands north of Anchorage in Tertiary continental sandstone. The uranium content is far below ore grade, but it indicates that weak epigenetic mineralization has occurred.

Uranium contents as high as 0.2 percent have been found in carbonized wood fragments in continental sandstone of the Tertiary Kootznahoo Formation at the north end of Port Camden, southeastern Alaska (at the northwest corner of the Petersburg quadrangle in fig. 5). Rare carbonized wood fragments there do not suggest a commercial deposit. The uranium in southeastern Alaska also is associated with siderite and dolomite, a carbonate rock. More detailed studies are in progress.

In 1980, uranium-related field studies were carried out where Tertiary continental sandstone formations crop out in the area of the Tintina fault zone northwest of Eagle (fig. 5). Similar studies also were carried out in the Tertiary Kootznahoo Formation in the Admiralty trough, which extends from Zarembo Island in southeastern Alaska northward to Admiralty Island (fig. 5). Reports on these activities are in preparation.

During 1981, samples were collected from potential uranium sources and host rocks near Cordova (fig. 5) on the coast of the Gulf of Alaska. Several radioactive anomalies have been detected in airborne radiometric surveys of lower Tertiary sedimentary rock in this area. A report on this study is in progress.

Geological Survey studies in the Romanzof Mountains area of the northeastern North Slope (fig. 5) in 1980 indicate that there is little potential for uranium mineralization there, even though phosphate nodules in the Shublik Formation give total-count scintillometer values 5 to 6 times those of background for the area. Further, uranium concentrations 4 to 5 times those of background have been found in the central part of the Okpilak granite batholith in the Arctic National Wildlife Refuge. The batholith apparently was not exposed to erosion until very recent times and therefore did not contribute uraniferous material to nearby sedimentary rocks, which have characteristics favorable for hosting uranium deposits but do not show evidence of uranium mineralization.

A brief reconnaissance survey of the Mount Prindle area (fig. 5) was made by the Geological Survey in 1981. Uranium is found in the igneous rocks there, but preliminary studies suggest that Mount Prindle is more interesting as a rare earth and thorium prospect than as a uranium source. Petrologic studies are currently under way.

Reconnaissance studies in the Windy Fork area of the northern part of the southern Alaska Range (fig. 5) indicate that some granitic rocks of middle Tertiary age are anomalously rich in uranium. These studies suggest the possibility of disseminated uranium deposits or uranium enrichment in at least two of these granite bodies. The Windy Fork pluton is particularly interesting because of the combination of alkaline-rich granitic rocks, high uranium background values, high fluorine levels, and indications of remobilized uranium, all generally considered favorable criteria for the occurrence of uranium deposits.

The presence of widespread uranium- and thorium-rich dike swarms in the southeastern Seward Peninsula (Bendeleben quadrangle, fig. 5) is discussed in Geological Survey Bulletin 1530 (Miller, in press). These unusual alkaline-rich rocks have average uranium and thorium contents of more than 40 and 120 parts per million, respectively, and therefore represent one of the more uraniferous intrusive rock units in North America.

A preliminary report published in 1980 pointed out the possibility of uranium mobilization associated with silica-rich volcanic rocks in the Medfra quadrangle of interior Alaska (fig. 5). Similar volcanic rocks occur elsewhere in Alaska's interior with associated uranium prospects. They constitute a potential uranium exploration target.

Two projects in the Petersburg quadrangle (fig. 5) in southeastern Alaska have been gathering data on uranium from about 600 stream-sediment samples

and from airborne radiometric surveys. Reports have not been published yet.

Department of Energy.—The recent work of the Department's NURE program has included surveys by airborne magnetic and spectral gamma detection apparatus on a flight line spacing of about 6.2 miles and water and sediment sampling at a spacing of one sample per 9 square miles. Initially, analyses were made only for radioelements, but later analyses included up to 40 elements. Resource assessments also were conducted. A preliminary index map of the Department's open-file report coverage of Alaska was released in January 1982 (Dennis and others, 1982, listed with Selected References).

The Department has released numerous reports from its NURE studies. These include 22 airborne spectrometer and magnetometer surveys, 55 hydrogeochemical and stream-sediment reconnaissance basic-data reports, and 47 hydrogeochemical reconnaissance reports on selected quadrangles. Figure 6 shows the quadrangles covered in these studies. All these reports were released by Bendix Field Engineering Corporation in Grand Junction, Colo. (See Selected References for the Department's reports published in 1980 and 1981.) In addition to these quadrangle reports, the Department of Energy, through the Bendix Field Engineering Corporation, has published reports about a gamma-ray spectrometer and magnetometer survey of the area near Lake Minchumina near the intersection of the Mount McKinley, Ruby, Medfra, and Kantishna River quadrangles; about the genesis of the Bokan Mountain deposit in southeastern Alaska; about mineral investigations in central and eastern Alaska; about uranium and thorium determinations for samples collected from seven quadrangles in eastern Alaska; and about uranium-thorium concentrations in representative rocks from Alaskan crystalline terranes.

The level of the Department's activity has been reduced recently because of funding limitations. The NURE program also is nearing completion.

INDUSTRY ACTIVITY IN 1980 AND 1981

A general decline in industry activity in uranium exploration in Alaska occurred during 1980 and 1981. Most exploration was of a reconnaissance nature. The following are highlights of the years' activities.

- Urangesellschaft, U.S.A., Inc., has held as many as 157 claims on Federal lands and 1,271 claims on State land. The company has drilled about 40 exploratory holes. Their work was especially intense in the Healy Creek area (fig. 5). However, in 1981, the firm ceased exploration activities and abandoned all claims in the Healy basin. (See Dickson, 1982, listed below.)
- The Anaconda Company, under contract to Cook Inlet Region, Inc., a Native corporation, undertook reconnaissance work for a variety of minerals, including uranium.

REFERENCE CITED

Dickson, R. K., 1982, Uranium mineralization in the Nenana coal field, Alaska, *in* Short notes on Alaskan geology: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, Geological Report 73, p. 37–42.

COAL AND PEAT

Coal may prove to be Alaska's most abundant fossil fuel. Historically, however, the primary problem has not been finding Alaskan coal, but rather finding a market for selling or using it. There are approximately 10 medium to large coal fields in the State, as well as many isolated occurrences of undefined extent that may be identified as major coal fields after more geologic investigation (Barnes, 1967, listed on page 27). Recently, four fields (fig. 7) have been of particular interest: (1) Northern Alaska coal field, (2) Nenana coal field, (3) Beluga-Capps Glacier coal field, and (4) Bering River coal field.

The Northern Alaska coal field is located north of the Brooks Range and west of the lower Colville River. The coal-bearing rocks are of Cretaceous age. These rocks have been folded into east-west-trending synclines and anticlines, the limbs of which dip 5° to 20°. Coal-bearing strata are known or inferred to underlie an area of about 58,000 square miles and are present in horizons as deep as 6,000 feet. The many coal beds range in thickness from a few inches to more than 22 feet. The coal is bituminous and subbituminous and has a low sulfur content.

The Nenana coal field consists of a series of discontinuous basins that extend for 80 miles along the northern flank of the Alaska Range. The coal-bearing rocks are found in four formations that range in age from late Oligocene to late Pliocene. They crop out in a discontinous belt 1 to 30 miles wide. Estimates of the size of the area underlain by coal-bearing strata range from 200 to 350 square miles. The subbituminous coal beds have been mildly faulted and folded and range in thickness from a few inches to 60 feet. The Jarvis Creek area of this field

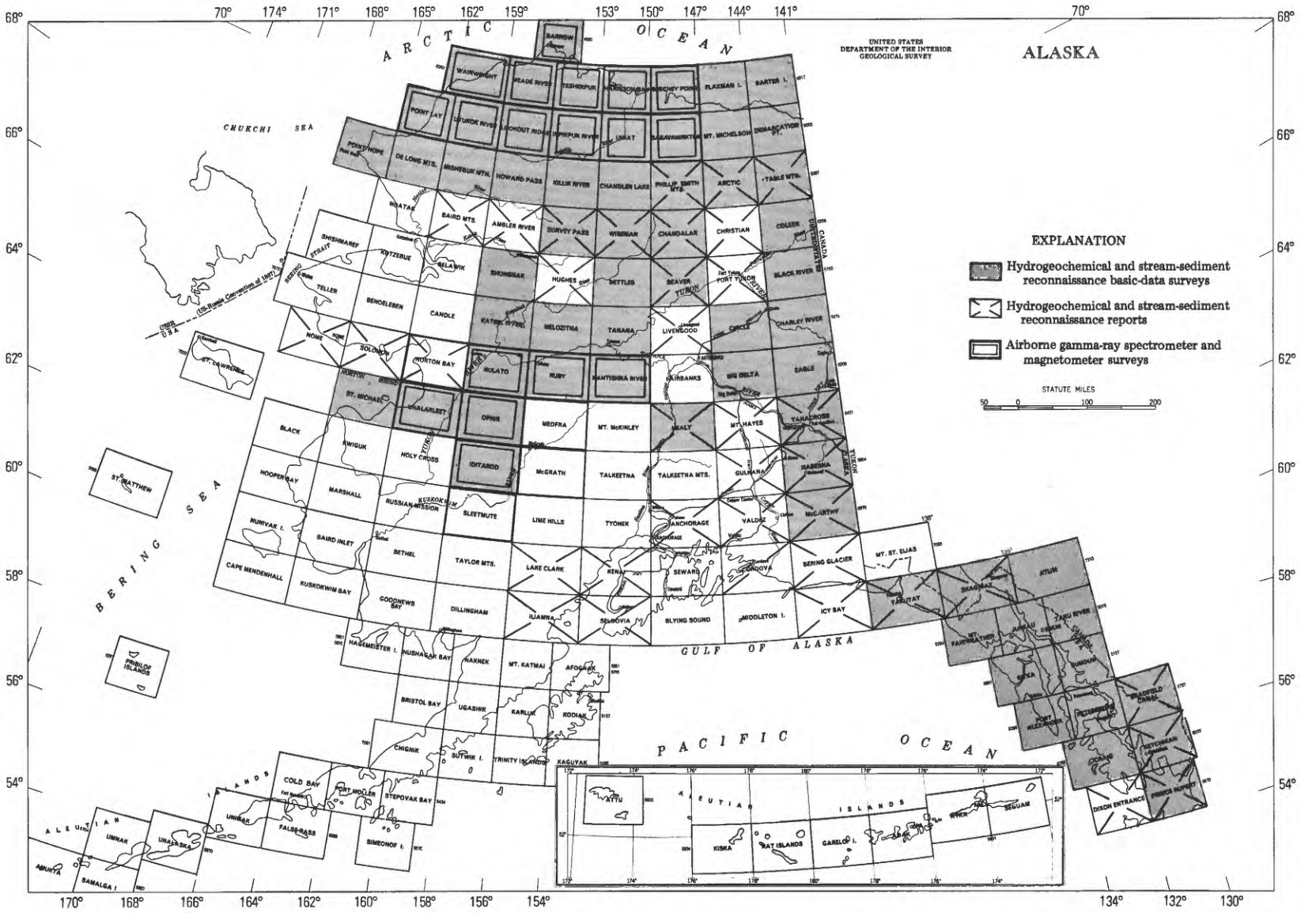


FIGURE 6.—Quadrangles for which National Uranium Resource Evaluation reports were released in 1980 and 1981. (See Department of Energy reference list for report numbers.)

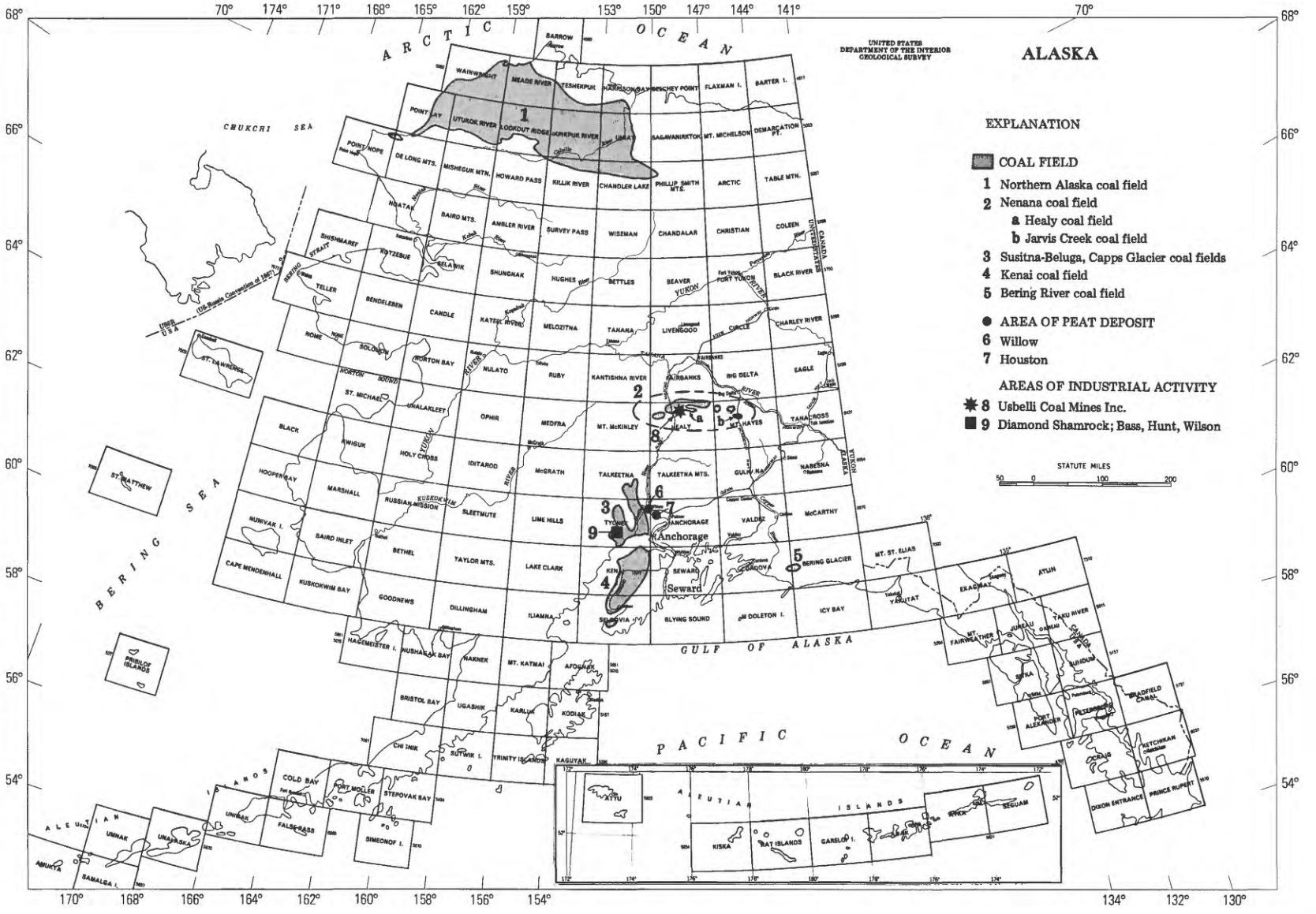


FIGURE 7.—Locations of coal and peat deposits of current interest and areas of industrial activity.

was mined in the past, and the field includes Alaska's only active coal mine, the Usibelli mine in the Healy area.

The Beluga coal field is part of the Susitna field and includes the Capps Glacier and Chuitna fields, which are of current interest. The subbituminous coal beds are in rocks of early Tertiary age and are part of a large, broad, structural basin modified locally by gentle folds with dips generally less than 5°. The coal beds underlie about 3,400 square miles. Many of the coal beds, some of which are as thick as 50 feet, have little overburden and are amenable to surface mining.

The coal of the Bering River field is in a 50-square-mile area between Bering Lake and the ice fields of the Chugach Range. Coal ranges in rank from bituminous to anthracite. The many coal beds range in thickness from a few inches to 60 feet. Strata in this area are tightly folded and cut by many faults. Many beds were thickened abnormally by the intense deformation, and most are generally crushed and sheared. Because of this structural complexity, no estimates of the amount of coal present have been made.

Peat deposits occur in more than 25 million acres in Alaska, particularly in surficial deposits in low-altitude areas of the State. According to geological studies by the State of Alaska, south-central Alaska contains about 2 million acres of fuel-grade peat, and more than 1 million acres of such peat is found on the Alaska Peninsula and Aleutian Islands. The average thickness of unfrozen peat measured in south-central Alaska is about 6 feet.

In the past year, the State has expressed interest in peat as an energy source. Deposits north of Anchorage (fig. 7) have been the focus of recent work by the State and Federal governments and will be studied further.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

Bureau of Mines.—The Bureau of Mines investigated coal exposures in the Bering River coal field as part of the 1980 Roadless Area Resource Evaluation II studies. Reports on that work have not been published yet.

Department of Energy.—The Department, in a joint feasibility study with Placer-Amex and the Cook Inlet Region, Inc., a Native corporation, has investigated methanol production from subbituminous Beluga coals. This study proposed surface mining of 8.5 million tons of Beluga coal per year. The possible lifespan of the project has not been announced; however, a 1977 State of Alaska report (Conwell, 1977, listed on p. 27) estimates that the field contains 2.4 billion tons of coal. The coal would be transported by rail to a plant near Granite Point, on the coast near the southern boundary of the Tyonek quadrangle (fig. 7) for processing and conversion. This synthetic methanol gas produced from the coal would be converted to 54,000 barrels of liquid methanol per day.

Department of Agriculture.—The Soil Conservation Service recently has studied the reclamation potential in the Beluga coal field. However, there is no present activity in the area by the Service.

Minerals Management Service.—In early 1980, the Geological Survey's Conservation Division, which became the Minerals Management Service in January 1982, made electric logs of a series of shallow seismic shot holes in the western part of the Northern Alaska coal field. Samples were collected wherever possible. Preliminary data suggest that the quantity and quality of the coal there are consistent with previous estimates; a report published in 1975 by the University of Alaska estimated that about 1 trillion tons of coal were present in the area. Currently, no coal studies are under way in this area by the Minerals Management Service or by other Federal agencies.

U.S. Geological Survey.—Several units of the U.S. Geological Survey have been involved in coal studies, commonly in cooperative efforts involving two or more branches or divisions. Most projects treat environmental concerns or chemical aspects of coal. No exploratory drilling specifically for coal is under way at this time.

The Geological Survey has been investigating the Cook Inlet coal lands for several years. This study has focused on the nature, location, and extent of general environmental concerns and potential problems that could result from coal mining activities proposed for this area. Studies also address problems associated with facility siting (that is, a methanol plant), transportation routes, and growth of communities. An important part of this investigation is a drilling operation to determine the physical properties of the coal-bearing rocks, and, whenever possible, coal cores have been collected and submitted for chemical analysis. Preliminary data indicate that the Beluga-Capps Glacier area coals are subbituminous, have low sulfur and moderate ash contents, and contain a large amount of water. Further analyses of coal samples currently are under way by the Geological Survey.

Affolter and others (1981, listed with Selected References) made public the moisture and ash con-

tents, forms of sulfur, heat of combustion, and the major, minor, and trace element concentrations of 118 coal samples from the following 1:250,000-scale quadrangles: (1) Utukok River (Northern Alaska coal field), (2) Healy (Nenana coal field), (3) Kenai (Kenai coal field), and (4) Seldovia (Kenai coal field) (fig. 7). Their open-file report includes a comparison of the above coal chemical data to that for coals from the Powder River area in Wyoming. Table 5 summarizes the findings. The study indicates that Alaska's coals are similar to the Powder River coals, which are extensively mined.

As part of the Alaska Mineral Resource Assessment Program of the Geological Survey, geologists have been investigating the Nenana coal field, which probably contains more than 2 billion tons of coal. Analyses of about 20 samples indicate that the coals are lignite A to subbituminous B, with 17 to 27 percent moisture, 3 to 13 percent ash, 0.1 to 0.3 percent sulfur, and a Btu range of 7,500 to 9,400. Elements of environmental concern, such as arsenic, beryllium, mercury, molybdenum, antimony, and selenium, are present in smaller amounts in these coals than in most other U.S. coals.

TABLE 5.—*Comparison of selected characteristics of coal samples from Alaska and the Powder River region of Wyoming (from Affolter and others, 1981)*

Sample location (quadrangle)	Number of samples	Moisture (arithmetic mean, percent)	Ash (arithmetic mean, percent)	Sulfur (arithmetic mean, percent)	Btu (per pound)
Healy (Alaska)___	12	24.1	10.2	0.2	8,030
Kenai (Alaska)___	10	21.7	15.3	.4	7,320
Seldovia (Alaska)_	6	16.4	13.6	.4	8,140
Utukok River (Alaska).	24	10.4	9.3	.3	10,770
Powder River (Wyoming).	86	10.5	7.7	.5	11,110

Geological Survey hydrologists recently have completed reconnaissance studies of hydrologic conditions in the Beluga, Healy, and Peters Creek (northern part of the Susitna field) coal areas (fig. 7). A study of trace metals in surface water and stream sediments in the Healy area also is under way. This information will provide baseline data if production begins.

COOPERATIVE STATE-FEDERAL STUDIES OF PEAT RESOURCES

The Department of Energy funded studies of two areas in the Susitna Valley that contain peat deposits. The work, by State and Geological Survey geologists, was completed in 1981. The investigations centered on deposits in the Houston and Willow areas, about 30 miles north of Anchorage. Seventy-nine cores were taken in the Rogers Creek area near Willow. Peat thickness averaged 7 feet over 2,595 acres. Based on a figure of 200 tons of air-dried peat for each acre-foot, there are nearly 4 million tons of peat in that area. Near Houston, 49 cores were taken, and the peat averaged 5 feet in thickness. Based on the same amount of air-dried peat per acre-foot, almost 2 million tons of peat are present. The deposits meet the criteria for fuel-grade peat and have an energy value of at least 8,000 Btu per pound. The State is planning to request bids in 1982 to make feasibility studies of possible pilot plants for producing fuels.

INDUSTRY ACTIVITY OF 1980 AND 1981

The following are highlights of the years' industry activities

- The Sun Eel Shipping Company of South Korea agreed to buy more than 7 million tons of coal over the next decade from Alaska's sole operating mine, Usibelli Coal Mines, Inc., at Healy (Nenana coal field). The coal will be moved by rail from Healy to Seward, an ice-free port on Prince William Sound, for shipment to South Korea.
- The Bass, Hunt, Wilson group and Diamond Shamrock Coal Company jointly funded a $25-million, 3-year predevelopment study to examine the potential for large-scale mining of the Beluga area coals. The leases cover 21,000 acres of State land and will be studied for mining and marketing potential. A multimillion ton surface operation is envisioned, but the company has not indicated a potential lifespan for the operation. The coal would be moved to tidewater for shipment by freighters.

REFERENCES CITED

Barnes, F. F., 1967, Coal resources of Alaska: U.S. Geological Survey Bulletin 1242-B, 36 p.

Conwell, C. N., compiler, 1977 Energy resources map of Alaska: State of Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys Information Circular 11, 1 sheet.

GEOTHERMAL RESOURCES

Geothermal resources in Alaska are being used only for local recreational purposes, space heating, and agriculture. The widespread recent volcanic activity in the Aleutian Islands, the Alaskan Peninsula, the Wrangell Mountains, and elsewhere throughout

the State, however, points to numerous areas of anomalous subsurface heat flux that suggests Alaska has a large potential for geothermal energy resources. Quantitative estimates of the potential geothermal energy and the selection of individual sites for further exploration are being conducted now in several localities (see fig. 8).

The Aleutian volcanic arc and the western end of the Wrangell Mountains appear to have the highest potential for development of large-scale energy sources. The western end of the Wrangell Mountains lies adjacent to major transportation routes and could provide electrical energy for use in Alaska. The potentially large geothermal areas in the remote Aleutians and the Alaska Peninsula are expected to be of most economic use to industries that have high energy requirements for processing raw material (for example, aluminum) rather than to the limited indigenous population or for power transmission outside those areas.

The thermal springs in interior and southeastern Alaska appear to represent deeply circulating water of atmospheric origin, termed meteoric water. Despite lower estimates of subsurface temperatures than from the Aleutian Islands and Alaska Peninsula thermal springs, the demand for cheaper energy in the remote regions of interior Alaska may cause these small thermal springs sites to be the first geothermal area to be exploited in the State. Hot water could be used for space heating, as is done in Iceland, or, as the use of heat exchangers becomes technologically practicable for the generation of electrical power, these springs could provide limited electrical power for local use by remote villages.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

U.S. Geological Survey.—The Geological Survey continued studies of volcanic centers that have potential near-surface heat reservoirs on the Alaska Peninsula in 1980 and 1981, concentrating on Peulik, Ugashik, Kialagvik, Chiginigak, and the newly discovered Yantarni volcanoes, all in the Ugashik quadrangle (highlighted in fig. 8). Preliminary work suggests that these volcanic centers have produced silica-rich ash or lavas in geologically recent times, indicative of possible shallow magma chambers and correspondingly shallow heat reservoirs. Present studies are concentrating on understanding the age and characteristics of the volcanic centers so as to estimate the magnitude of their heat content and resulting geothermal potential.

Detailed studies of Mount Drum volcano in the western Wrangell Mountains (fig. 8) have been completed by the Geological Survey. They suggest that the volcano began to form 800,000 years ago and was intermittently active until less than 240,000 years ago. Calculations based on the volume of the underlying magma chamber, its age, and its composition suggest a stored heat content of 265×10^{18} calories.

STATE STUDIES, 1980 AND 1981

The State of Alaska has appropriated $700,000 for a follow-up program of test drilling in 1982 at Pilgrim Springs on the Seward Peninsula 40 miles north of Nome (fig. 8). Two 150-foot test holes drilled earlier produced 195°F water and artesian flow at a rate of more than 150 gallons per minute (Turner and Forbes, 1980, listed on p. 30).

The Alaska Division of Geologic and Geophysical Surveys reported (Motyka and others, 1980, listed on p. 30) an assessment of 7 thermal springs in southern southeastern Alaska in 1980 and on 20 thermal spring sites between Atka Island in the Aleutians and Becharof Lake (Motyka and others, 1981, listed on p. 30) on the Alaska Peninsula in 1981 (fig. 8). The springs, all previously known, are thought to represent deeply circulating meteoric waters discharging along fracture systems adjacent to granitic rock masses. Chemical characteristics of the water, used to determine subsurface temperature, indicate that those temperatures in the springs are below 300°F. This relatively low subsurface temperature suggested by water chemistry, together with the low discharges and the geologic setting, yields a rather low geothermal energy potential for other than local use.

A summary report on geothermal energy resources of Alaska was published in 1980 by the Geophysical Institute of the University of Alaska under contract to the Department of Energy (Turner and others, 1980, listed on p. 30). The location, geologic setting, temperature, flow rate, and energy characteristics of known thermal springs in Alaska are discussed, as are igneous-related geothermal systems.

The Geophysical Institute, also under contract to the Department of Energy, completed in early 1982 a preliminary investigation of the geothermal energy resources of the Lower Susitna Basin near Willow in south-central Alaska (Turner and Westcott, 1982, listed on p. 30) (fig. 8). Evidence from dry wildcat well temperatures and helium soil gas surveys suggests that discontinuous subsurface hot-water reservoirs may be present in the Willow area and possibly

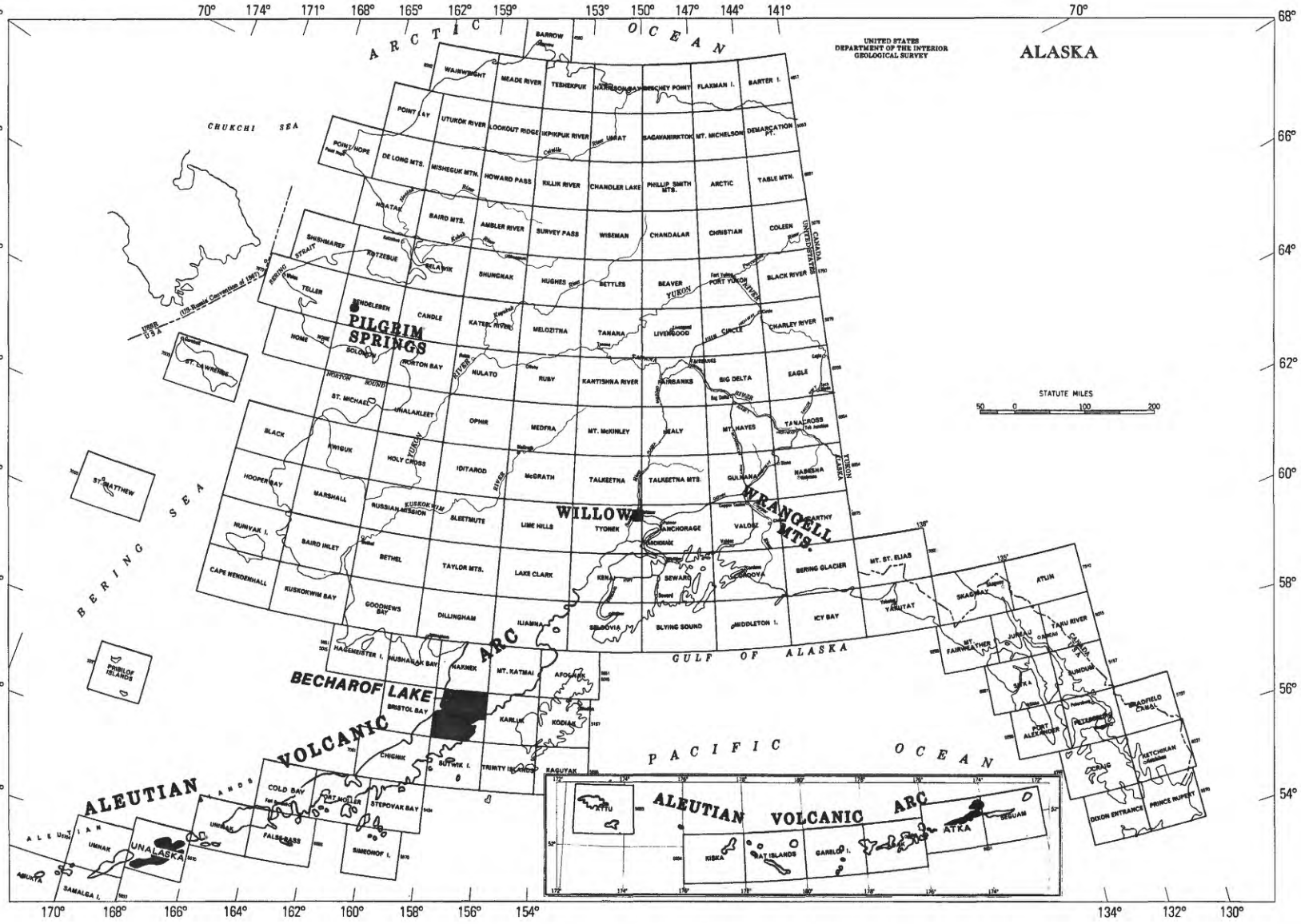


FIGURE 8. – Areas of geothermal resources and development activity.

farther to the east. The hot water, whose presence is not yet confirmed, could be used for space heating and agricultural purposes. This resource, if present, would be related to a sedimentary basin with an abnormally high thermal gradient.

MAJOR EVENTS OF 1980 AND 1981

In early 1982, the Alaska Power Authority awarded a $4.7 million contract for preliminary geothermal development on the flanks of Makushin Volcano on Unalaska Island in the eastern Aleutian Islands (fig. 8). Makushin Volcano is a large, historically active stratavolcano with a summit caldera. Recent work there by the Alaska Division of Geological and Geophysical Surveys has located eight fumarole fields; hydrothermal reservoirs may exist near the fumarole fields on the southeast flank of the volcano. A detailed exploratory drilling plan is being prepared that will include three shallow (about 1,500 feet) test holes and a deep test hole (estimated at 4,000 to 6,000 feet). The village of Unalaska and its harbor, Dutch Harbor, constitute a major fishing center of national significance and a potential user of energy that might be generated from Makushin Volcano, which is only 7 miles away.

REFERENCES CITED

Motyka, R. J., Moorman, M. A., and Liss, S. A., 1981, Assessment of thermal spring sites, Aleutian Arc, Atka Island to Becharof Lake—Preliminary results and evaluation: Alaska Division of Geological and Geophysical Surveys Open-File Report 144, 173.

Motyka, R. J., Moorman, M. A., and Reeder, J. W., 1980, Assessment of thermal spring sites in southeastern Alaska—Preliminary results and assessment: Alaska Division of Geological and Geophysical Surveys Open-File Report 127, 72 p.

Turner, D. L., and Forbes, R. B., 1980, A geological and geophysical study of the geothermal potential of Pilgrim Springs, Alaska: Report to Division of Geothermal Energy, U.S. Department of Energy, Cooperative Agreement DE-FD07-79-ET-27034, 165 p.

Turner, D. L., Forbes, R. B., Albanese, Mary, Macbeth, Joyce, Lockhart, A. B., and Seed, S. M., 1980, Geothermal energy resources of Alaska: Report to Division of Geothermal Energy, U.S. Department of Energy, Contract DE-AS07-781-DO1720,19 p.

Turner, D. L., and Wescott, E. M., 1982, A preliminary investigation of the geothermal energy resources of the Lower Susitna Basin: Report to Division of Geothermal Energy, U.S. Department of Energy, Cooperative Agreement DE-FC07-79-ET-27034, 50 p.

NONFUEL MINERALS

Mining activities and exploration for nonfuel minerals have increased greatly in Alaska in the past several years (Carnes, 1980, and Pittman, 1981, listed with Selected References; Eakins, 1981, and Conwell and Eakins, 1982, listed on p. 43). At least three factors contributed to this increase: (1) the resolution of many land status questions, (2) discoveries of large deposits of copper, molybdenum, zinc, and lead in parts of the State previously poorly explored, and (3) a dramatic increase in the price of gold. The revival of gold mining in Alaska, spurred by the price change, has been especially notable. The number of people employed in gold mining has increased more than tenfold, chiefly in small operations, but includes a few operations with a large capital investment in heavy equipment and milling facilities. The acceleration in company exploration for other mineral commodities has been nearly as rapid. Total expenditures for exploration have increased from approximately $40 million in 1976 to more than $100 million in 1981. Five companies estimate 1982 expenditures of more than $10 million each. Similarly, the number of active mining claims in Alaska has increased rapidly in the last 5 years. More than 43,000 new claims were filed in Alaska in 1981.

Many mineral deposits that have been known previously are being intensively reevaluated. The heavy investment in exploration also has been spurred by recent public announcements of large mineral deposits in widely separated areas of Alaska. In northern Alaska, major deposits of zinc, lead, silver, and barite (barium sulfate) occur in a belt at least 120 miles long in the De Long Mountains of the western Brooks Range and are localized in dark shale and chert host rocks of mid-Paleozoic age. A belt containing at least three major copper deposits extends for more than 100 miles along the southern flank of the Brooks Range, where mineralization is associated with felsic (light-colored) volcanic rocks. In central Alaska, 55 million tons of high-grade asbestos has been blocked out on Doyon Corporation Native lands near Eagle, and numerous placer- and lode-gold properties are in development or production. In southeastern Alaska, the project most frequently in the news in 1980 and 1981 was the giant Quartz Hill deposit east of Ketchikan, which contains at least two billion pounds of molybdenum in quartz monzonite porphyry. Similar host rocks occur elsewhere in the Coast Range of southeastern Alaska; for example, at Burroughs Bay northeast of Ketchikan and at Groundhog Basin east of Wrangell,

where they are the focus of considerable exploration activity. The Greens Creek deposits of silver, lead, and zinc on Admiralty Island west of Juneau are the largest deposits yet discovered in a poorly known regional province of late Paleozoic or early Mesozoic metamorphosed volcanic rocks on Kupreanof, Admiralty, and Kuiu Islands (Berg and Grybeck, 1980; Berg and others, 1981, listed with Selected References). The locations of these and other mineral deposits are shown on figure 9.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

U.S. Geological Survey.—Three Geological Survey programs have been designed specifically to provide information about the mineral and energy potential of Alaska for Congress, the Administration, and the public and private sectors to consider in land-use, exploration, or development decisions. These are the Alaska Mineral Resources Assessment Program (AMRAP), work funded by the Office of National Petroleum Reserve in Alaska (ONPRA), and the Roadless Area Resource Evaluation (RARE II) program.

The major purpose of AMRAP is to produce a comprehensive assessment of the State's mineral and energy endowment by the year 2000. To achieve this broad objective, AMRAP functions on four levels. The goal of Level I is to publish statewide summaries of mineral potential. These summaries have been completed for some time (Berg and Cobb, 1967; Cobb, 1973; Clark and others, 1974; Cobb and others, 1977, listed on p. 42–43) and will be updated soon. The summaries necessarily depend upon studies at progressively greater detail. Level II projects describe the potential of large regions of Alaska at 1:1,000,000 scale. During 1977 and 1978, reports were completed for all regions except southeastern Alaska (Eberlein and Menzie, 1978; Grybeck and DeYoung, 1978; Hudson and DeYoung, 1978; MacKevett and others, 1978, listed on p. 43); a preliminary report for that area was issued in 1981 (Berg and others, 1981, listed with Selected References), and final reports will be completed in the 1983 fiscal year. Level III studies, currently the main focus of the program, are multidisciplinary. They apply geology, geochemistry, geophysics, geochronology, and remote sensing to produce mineral resource assessments of 1:250,000-scale quadrangles. Seventeen quadrangles have been completed since the program began in 1975, and an additional five are nearing completion. Active field studies are under way in 12 quadrangles. Figure 10 shows the current status of AMRAP studies. Level III studies are being carried on in areas of high mineral or energy resource potential in the Killik River, Chandler Lake, and Wiseman quadrangles of the central Brooks Range (including Gates of the Arctic National Park); the Solomon and Bendeleben quadrangles of the Seward Peninsula; the Circle quadrangle of east-central Alaska; the Healy and Mount Hayes quadrangles in the eastern Alaska Range; the Ugashik, Karluk, Port Moller, and Stepovak Bay quadrangles on the Alaska Peninsula; and the Petersburg and Juneau quadrangles of southeastern Alaska.

Detailed studies of individual mining districts, specific mineral deposits, or topics related to the formation of deposits constitute Level IV of AMRAP and provide much needed control for the areal studies. Twenty-seven projects are continuing at this level, including two studies of copper deposits in the southern Brooks Range, and a study of placer gold deposits in interior Alaska, the Alaska Range, and the Seward Peninsula. Two Level IV projects are studying the relations between processes that form mineral deposits (metallogenesis) and those that disrupt the enclosing host rocks into distinct geologic entities (tectonostratigraphic terranes). One such project is in the eastern Alaska Range and the other in southeastern Alaska. These new concepts for studying mineral deposits may yield ways to characterize and explore for them. Many of the Level IV projects involve cooperation with scientists from other Federal agencies, State agencies, or Canadian government agencies and from educational institutions.

Figure 11 shows the coverage, by quadrangle, of Alaska by mineral occurrence reports that have resulted from or were instrumental in AMRAP work.

Recent studies funded by ONPRA, with Geological Survey and Bureau of Mines participation, have provided much new resource information about the western part of the Brooks Range, particularly the De Long Mountains and the North Slope (for example, Curtis and others, 1980; Ellersieck and others, 1980; Lange and others, 1980; Jansons and Baggs, 1980; Jansons and Parke, 1981, listed with Selected References.) Prospective areas for zinc, lead, silver, and barite mineralization have been delineated on both Federal lands in the NPRA and adjacent lands that are open for exploration. Figures 12*A* and 12*B* show the locations of these cooperative project study areas; table 6 lists the projects included.

A joint project of the Geological Survey and the Bureau of Mines in the Prince William Sound-Kenai

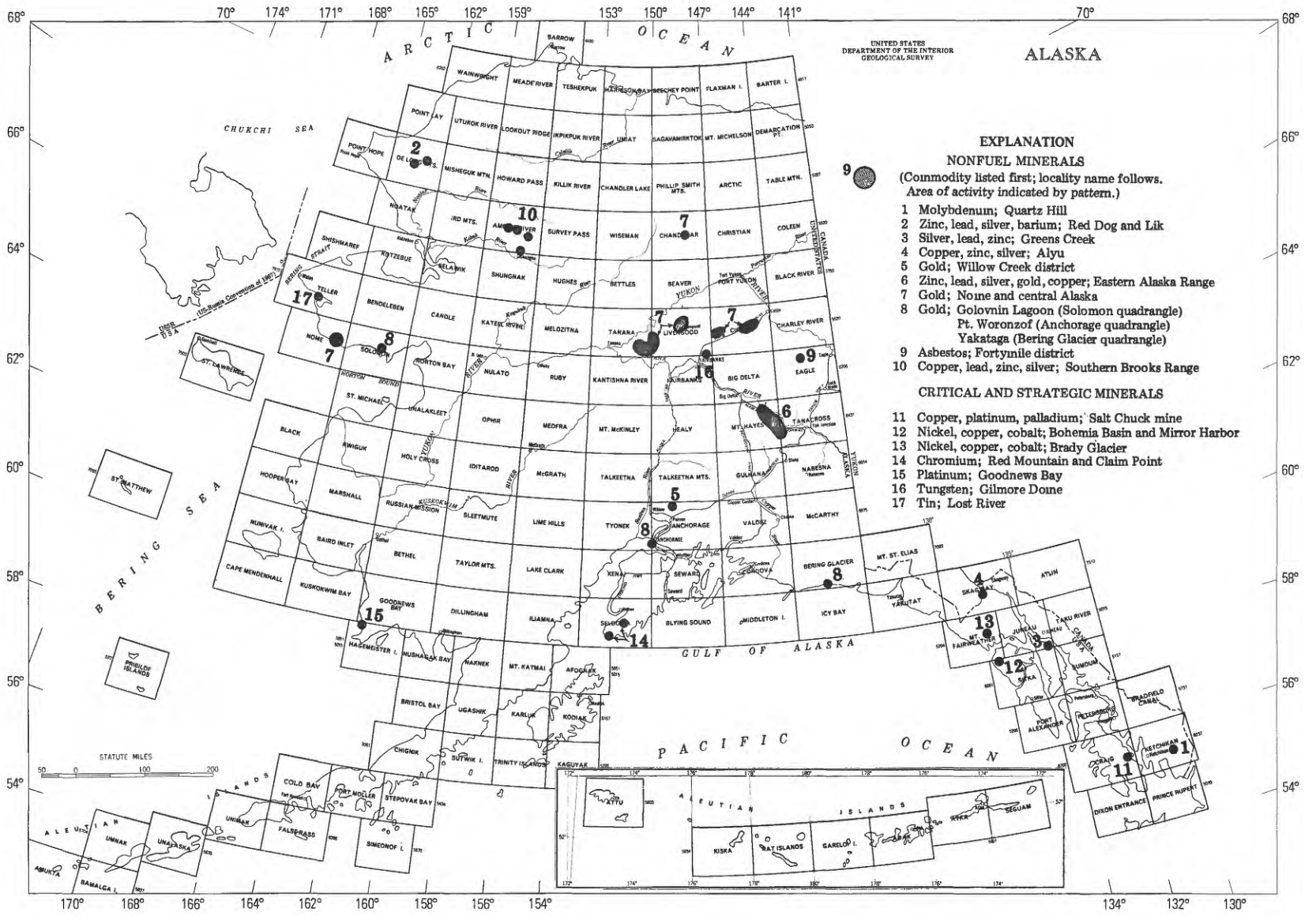


FIGURE 9.—Sites of important industrial activity for nonfuel, critical, and strategic minerals in 1980 and 1981.

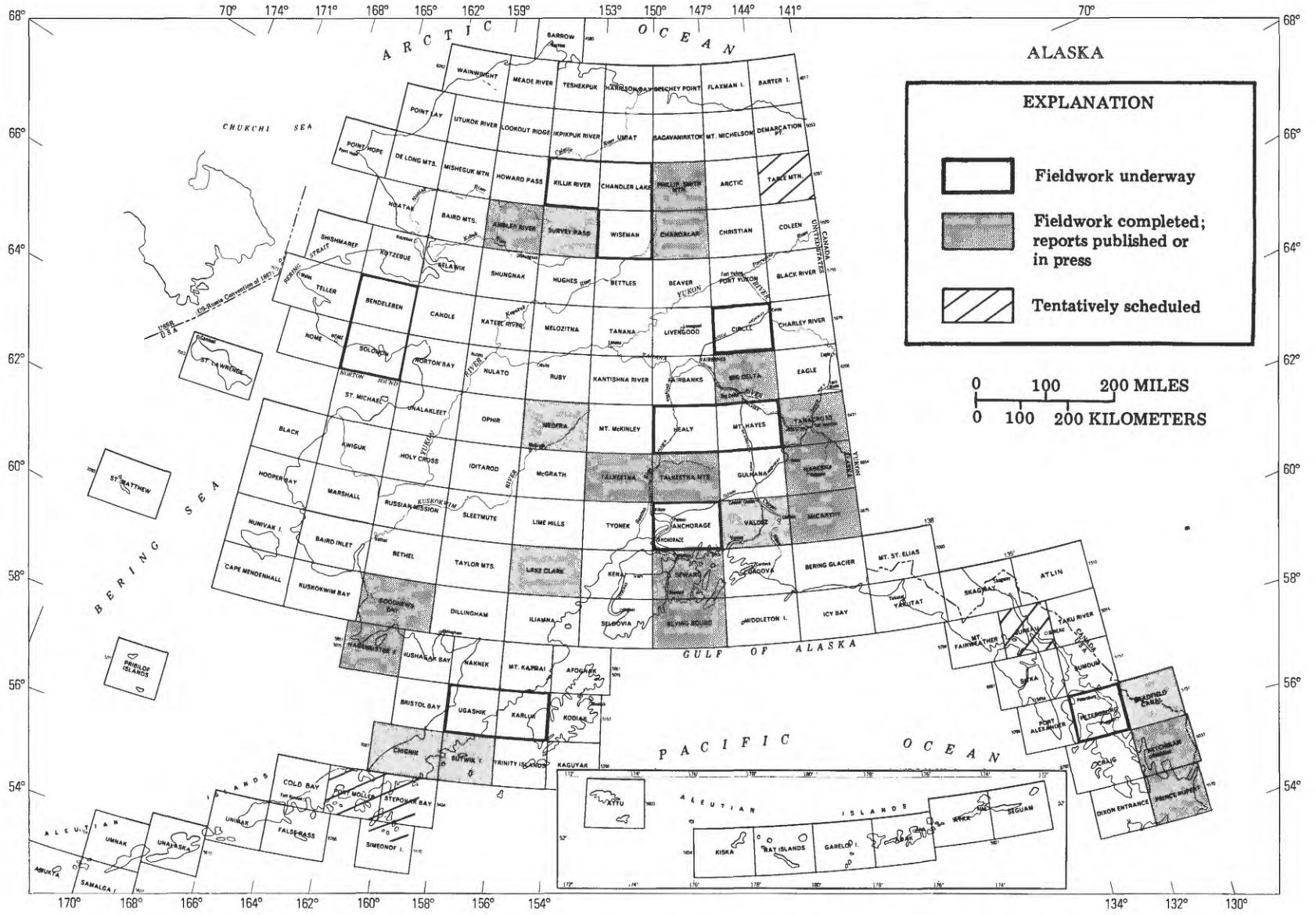


FIGURE 10. – Status of Level III Alaska Mineral Resource Assessment Program (AMRAP) studies, January 1, 1982.

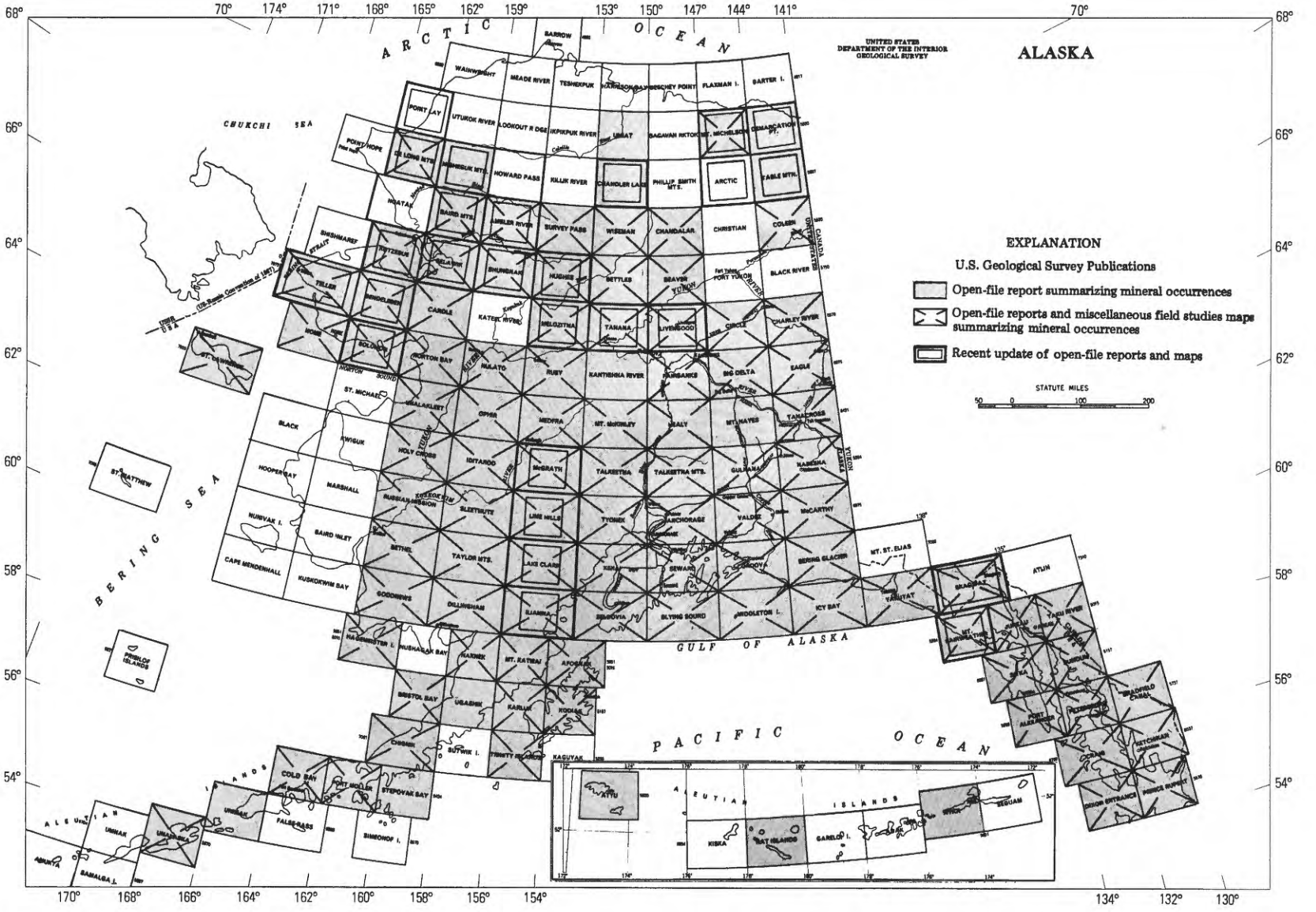


FIGURE 11.—Quadrangles for which the U.S. Geological Survey has published compilations of mineral occurrence information. (See the U.S. Geological Survey reference list for 1980 and 1981 reports in the series shown.)

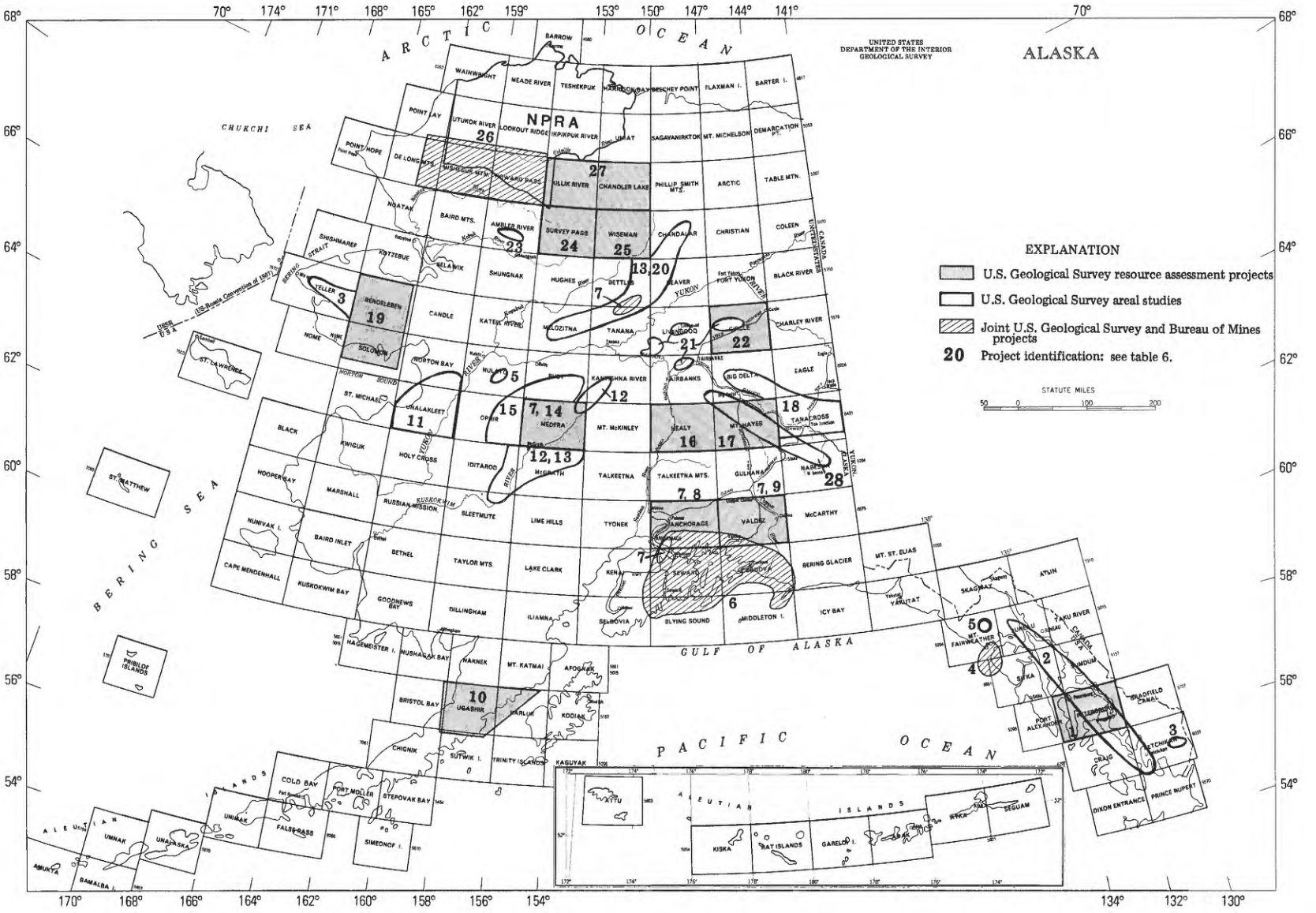


FIGURE 12*A*.—Locations of areas studied in 1980 and 1981 by the U.S. Geological Survey and Bureau of Mines for nonfuel, critical, and strategic mineral resources.

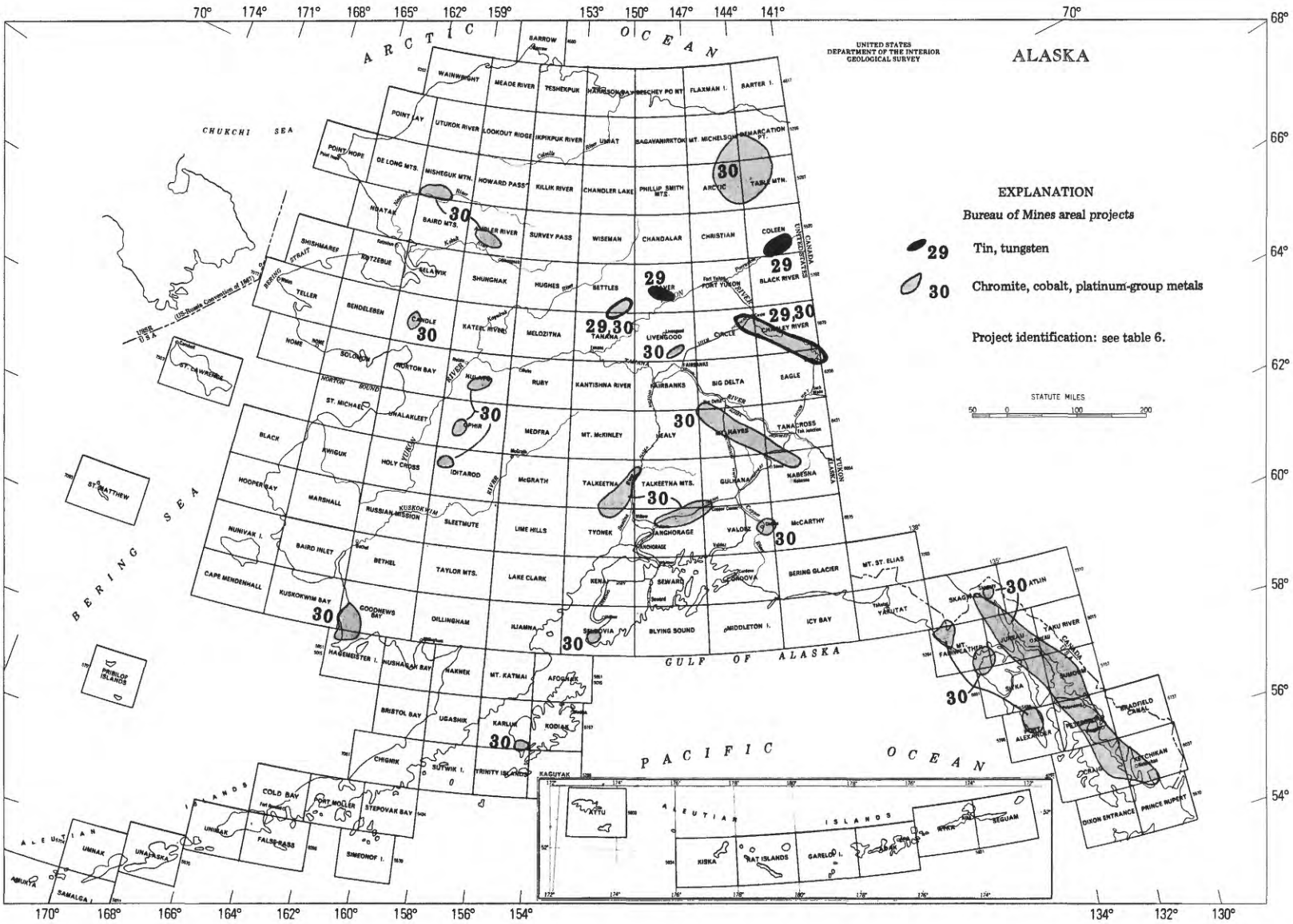


FIGURE 12*B*.—Locations of areas studied in 1980 and 1981 by the Bureau of Mines for nonfuel, critical, and strategic mineral resources.

TABLE 6.—*Abbreviated titles or brief descriptions of projects whose study areas are shown in figures 12A and 12B. The patterns on the figures distinguish resource assessment studies (such as AMRAP), areal studies, and projects undertaken jointly by the U.S. Geological Survey and the Bureau of Mines*

U.S. Geological Survey
1 Petersburg quadrangle.
2 Southeastern Alaska geotectonics and metallogenesis.
3 Alaska tin-molybdenum studies.
4 West Chichagof-Yakobi Wilderness study.
5 Alaska mafic and ultramafic rocks.
6 Chugach RARE II study.
7 Geochronology of Alaskan ore deposits.
8 Anchorage quadrangle.
9 Valdez quadrangle.
10 Ugashik and Karluk quadrangles.
11 Unalakleet and Norton Bay quadrangles.
12 Tin commodity study.
13 Alaska accreted terranes.
14 Medfra quadrangle.
15 Ruby and Ophir quadrangles.
16 Healy quadrangle.
17 Mt. Hayes quadrangle.
18 Yukon and Tanana area.
19 Solomon and Bendeleben quadrangles.
20 Yukon-Koyukuk transect.
21 Alaska gold placers.
22 Circle quadrangle.
23 Ambler district ore genesis.
24 Survey Pass quadrangle.
25 Wiseman quadrangle.
26 Mineral studies in the National Petroleum Reserve in Alaska.
27 Killik River and Chandler Lake quadrangles.
28 Eastern Alaska Range metallogenesis.
Bureau of Mines[1]
29 Tin and tungsten occurrences:
Beaver; Hodzana River area.
Bettles; Kanuti River area.
Charley River; VABM Bend area.
Coleen; Rapid River, Old Crow Hills, Porcupine prospects.
30 Chromite, cobalt, and platinum-group metals occurrences:
Misheguk Mountain; Western Brooks Range (mafic and ultramafic trend).
Ambler River; Bornite, Ruby Creek copper deposits.
Bettles; Kanuti River area.
Candle; Koyuk area.
Nulato; Ruby-Poorman area.
Ophir; Tolstoi area.
Goodnews Bay; Snow Gulch and Goodnews Bay areas.
Talkeetna; Kahiltna River area.
Seldovia; Seldovia-Red Mountain area.
Anchorage; Eklutna-Chugach trend (mafic-ultramafic complex).
Valdez; Spirit Mountain deposit.
Mt. Fairweather; Lituya Bay, Orange Point, Brady Glacier, Crillon-La Perouse deposits (mafic-ultramafic complex).
Mt. Fairweather (SW corner); Mirror Harbor, Bohemia Basin deposits.
Skagway; Klukwan iron deposit (mafic-ultramafic complex).
Juneau southeast to Prince Rupert; Funter Bay, Jingle-Jangle and Sumdum, Blashke Island, Union Bay, Mt. Burnett, Salt Chuck mine area, Sultana, Jumbo and Green Monster mines, Duke and Percy Islands, Yellow Hill deposits.
Port Alexander; Red Bluff Bay, Snipe Bay deposits.
Charley River; Eagle area deposits.
Arctic; Eastern Brooks Range occurrences.
Mt. Hayes and southeast; Chistochina River area.
Karluk; Halibut Cove, Grant Lagoon, Long Beach, Seven Mile Beach prospects.
Iditarod; Golden Horn, Mt. Hurst and Innoko area.

[1] Quadrangle names indicate location of mineral occurrences; a generalized deposit name follows.

Peninsula region of southern Alaska is to produce by fiscal year 1983 a multidisciplinary mineral and energy resources assessment at 1:250,000 scale of 2.8 million acres in the Chugach National Forest. This area was selected for further planning by the Forest Service under RARE II (fig. 12*A*). Also in this area, detailed studies of gold, copper, and molybdenum occurrences are being conducted—for example, in the Girdwood, Hope-Sunrise, Moose Pass, Passage Canal-Port Wells, Knight Island-Latouche, Port Valdez, and Ellamar areas—to determine size, nature, and origin of specific mineral deposits. (See, for example, Mitchell and others, 1981, listed with Selected References). Between 1898 and 1930, lode and placer gold production in the region was in excess of 250,000 troy ounces; minor placer mining has continued until the present time, with an estimated production of between 4,000 and 5,000 ounces in 1980 and 1981. Copper mines in the Prince William Sound area produced more than 214 million pounds of copper between 1900 and 1930, but there has been no subsequent production.

Geological Survey and Bureau of Mines publications resulting from these projects in 1980 and 1981 are listed with the selected references at the end of this report.

Bureau of Mines.—The Bureau of Mines land assessment and minerals availability programs provide new information about the nonfuel minerals potential of Alaska. The mineral land assessment program provides evaluations of minerals and the mineral potential of Federal lands. Two studies recently completed by the Bureau of Mines and the Geological Survey under the latter program were in the NPRA (Jansons and Baggs, 1980; Jansons and Parke, 1981, listed with Selected References) and the West Chichagof-Yakobi Wilderness study area (Still and Weir, 1981, listed with Selected References). A third joint study, of the Chugach National Forest RARE II area, will be completed in fiscal year 1983. (See Jansons, 1981, listed with Selected References.) Figure 12*A* shows the locations of the project study areas.

The Bureau's minerals availability program collects, summarizes, stores, and updates information on occurrences of mineral resources statewide. Mineral properties are identified, located, and selected for evaluation through the Bureau of Mines' Minerals Industry Location System (MILS). Mineral property identification is initiated by evaluator determination on either a commodity or areal basis. The basic information about the property is coded by the evaluator for inclusion in the MILS computer data

bank. Figure 13 is a printout of current MILS data for an Alaskan property and shows some kinds of information that can be found in the data bank. If it is determined that sufficient reserves are contained on the property, the deposit record is forwarded for a Minerals Availability System (MAS) evaluation that addresses the quantity and quality of the mineral supply, the definition of engineering and beneficiation technologies for extraction and recovery of the mineral commodity, the calculation of capital and operating costs, and institutional restraints on minerals availability. All resulting information is stored in the Bureau of Mines' mainframe computer.

To meet its program goals, MAS uses a complex computer and communications system that allows mineral information to be rapidly stored, manipulated, and retrieved. Figure 14 is a computer-plotted map (here reduced to page size) showing the locations of mineral deposits in Alaska. Information about the availability and contents of computer-plotted maps or printouts of MAS and MILS data can be obtained from the Chief, Alaska Field Operations Center, Juneau, Alaska.

The Bureau of Mines has recently completed minerals evaluations for the NPRA; the Ramparts, Yukon Flats, and Porcupine River areas; the Chugach Mountains, Prince William Sound, and Kenai Peninsula; and the western Chichagof and Yakobi Islands areas. Reports resulting from the evaluations and investigations in these areas during 1980 and 1981 are included in the section listing selected Bureau of Mines references at the end of this report.

The Bureau of Mines currently is working with the University of Alaska and the State to update a map series titled "Mineral terranes of Alaska" (University of Alaska, 1979, listed on p. 43).

In addition, a Bureau of Mines minerals specialist serves as a liaison between members of industry, State agencies, and other Federal organizations for mineral developments on Federal and non-Federal land. He is responsible for providing Alaskan data for the annual Bureau of Mines yearbook and other national publications, and he is the Bureau's principal public contact for information about minerals in the State.

INDUSTRY ACTIVITY IN 1980 AND 1981

Several important activities by industry were initiated or continued in 1980 and 1981. These are briefly described below, and their locations are shown in figure 9.

- U.S. Borax and Chemical Corporation continued drilling and development work at the Quartz Hill molybdenum deposit 40 miles east of Ketchikan. An agreement by U.S. Forest Service and the State of Alaska was reached on the preferred road corridor from the deposits to tidewater. The deposit is reported to contain 2 billion pounds of molybdenum with a gross value in excess of $18 billion (1981 prices). The Geological Survey recently has completed studies of the geochemistry, age, and composition of the intrusive rocks that are associated with the deposit (for example, Hudson and others, 1981). Pertinent reports are included in the list of selected references at the back of this report.
- Cominco American carried on exploration and development work at the Red Dog and Lik zinc, lead, silver, and barite deposits in the De Long Mountains of the western Brooks Range 90 miles north of Kotzebue. According to a company press release, preliminary drilling has outlined deposits estimated to contain a minimum of 85 million tons of material averaging 17.1 percent zinc, 5.0 percent lead, and 2.4 ounces per ton of silver. The original report of mineralization in the Red Dog area was made by the Geological Survey in 1970 (Tailleur, 1970, listed on p. 43); follow-up work by the Geological Survey and Bureau of Mines projects in the area have outlined additional prospective areas. Pertinent recent releases are included in the list of selected references. (See the reports listed with discussion of work funded by ONPRA.) The deposits occur on lands owned by NANA Inc., a Native corporation, and are adjacent to park lands of the Noatak National Preserve. An agreement for a mining feasibility study has been completed jointly by Cominco American and NANA.
- Continued underground development work by Greens Creek Joint Venture at the Greens Creek silver, lead, and zinc deposit on Admiralty Island 20 miles southwest of Juneau has delineated 3 million to 4 million tons of high-grade material with minor values of gold, copper, and cadmium. Current in-place value (1981 prices) exceeds $800 million. Active Geological Survey studies in the area and in areas of similar host rocks elsewhere in southeastern Alaska have generated preliminary reports (such as Berg's article *in* Albert and Hudson, eds., 1981),

MINERALS AVAILABILITY SYSTEM
DEPOSIT LISTING

DATE PRINTED: JAN 08, 1981 PAGE 7833

DEPOSIT NAME: GRUBSTAKE GULCH SEQUENCE NUMBER: 0020850120

>>>> MILS - DATA SET <<<<
(MINERAL INDUSTRY LOCATION)

STATE: ALASKA
COUNTY: ANCHORAGE
TYPE OF OPERATION: PLACER
CURRENT STATUS: PRODUCER
LATITUDE: N 61DEG 45MIN 30SEC
LONGITUDE: W 149DEG 25MIN 43SEC
UTM - ZONE: 06
HEMISPHERE: NORTHERN
NORTHING: 6849450
EASTING: 371805
POINT OF REFERENCE: CLAIM
PRECISION: 5 KILOMETERS
ELEVATION: 716 METERS
PRECISION: 10 METERS
EVALUATOR: MIRL-DWB

MINE MAP REPOSITORY:
QUADRANGLE: ANCHORAGE
RIVER BASIN NAME:
RIVER BASIN CODE:
HYDROLOGIC UNIT CODE: 19050002
DATUM OF ELEVATION: SEA LEVEL
MAP NAME: D-7
SCALE: 15 MIN
DOMAIN: STATE
TYPE OF MINERAL HOLDINGS:
LOCATED CLAIM
TYPE OF EVALUATION: L

TYPE OF PLANT:
PLANT IDENTIFIER:
YEAR FIELD CHECKED:
YEAR OF INFORMATION ENTRY: 1978
MAINTAINING FIELD CENTER:
ALASKA
MINERAL PROPERTY FILE:
CORE LIBRARY:
MINES IDENTIFICATION: 5000297
GEOLOGICAL SURVEY CRIB:
LAST MILS MODIFICATION:
NOV 06, 1980
LAST DEPOSIT MODIFICATION:
NOV 06, 1980

--PUBLIC LAND SURVEY--
PRINCIPAL MERIDIAN:
SEWARD
TOWNSHIP: 019 N
RANGE: 001 W
SECTION: 10
SECTION SUBDIVISION:
SURVEY STATUS: GRID

>>>> COMMODITY - DATA SET <<<<

RECORD NO.	COMMODITY	MODIFIER	MARKETABILITY	STANDARD INDUSTRIAL CODE	DATE OF LAST MODIFICATION
01	GOLD	PLACER	PRIMARY		NOV 20, 1978
02	SILVER		COPRODUCT		NOV 20, 1978

>>>> NAMES(ALTERNATE) - DATA SET <<<<

WILLOW CREEK
WILLOW GRUBSTAKE GULCH

>>>> OWNERSHIP - DATA SET <<<<

RECORD NO.	NAME OF OWNER	STATUS	PERCENT OF OWNERSHIP	LOCATION OF HOME OFFICE	YEAR OF INFORM.	DATE OF LAST MODIFICATION
01	MRAK PLACER MINE	OPERATOR	%	USA ALASKA	1980	NOV 06, 1980
02	BILL MRAK	OWNER	%	USA ALASKA	1980	NOV 06, 1980

*

FIGURE 13.—Sample listing from the Minerals Availability System of the Bureau of Mines.

DATE PRINTED: JAN 08, 1981

MINERALS AVAILABILITY SYSTEM
DEPOSIT LISTING

PAGE 7834

DEPOSIT NAME: GRUBSTAKE GULCH

SEQUENCE NUMBER: 0020850120

>>>> DEVELOPMENT - DATA SET <<<<

** DEVELOPMENT SCHEDULE NOT ENTERED **

>>>> COMMENTS - DATA SET <<<<

SET REFERENCE	LINE NO.	
	001	NO RECORD OF PRODUCTION. PROBABLY COMBINED WITH WILLOW CR.
e	001	NUMBER OF MEN EMPLOYED 790616=4
e	002	NUMBER OF MEN EMPLOYED 801007=4
o	001	OWNER-OPERATOR ADDRESS:
o	002	MRAK PLACER MINE, BILL MRAK
o	003	BOX 1963
o	004	PALMER, ALASKA 99645
o	005	TELE: (907) 745-3635

>>>> BIBLIOGRAPHY - DATA SET <<<<

SET REFERENCE	LINE NO.	
	001	PAIGE AND KNOPF, 1907, P. 116-118 (B314)
	002	PAIGE AND KNOPF, 1907, P. 65-66 (B327)
	003	BROOKS, 1910, P. 42 (B442)
	004	BROOKS, 1911, P. 165 (P70)
	005	KATZ, 1911, P. 139, 150-151 (B480)
	006	CAPPS, 1914, P. 250-253 (B592)
	007	*CAPPS, 1915, P. 52-54 (B607)
	008	BROOKS, 1915, P. 48 (B622)
	009	CAPPS, 1916, P. 200 (B642)
	010	SMITH, P. S., 1932, P. 31 (BB24)
	011	SMITH, P. S., 1933, P. 31 (B836)
	012	RAY, J. C., 1933, P. 188, 228 (B849-C)
	013	SMITH, P. S., 1939, P. 44 (B910-A)
	014	SMITH, P.S., 1939, P. 41 (B917-A)
	015	MOXHAM AND NELSON, 1952, P. 5 (C184)
	016	RAY, R. G., 1954, P. 83 (B1004)
	017	JASPER, 1902, P. 81
	018	JASPER, 1906, P. 3 (GC 7)
	019	COBB, 1972, P. 12-13 (OF508)
	020	COBB, 1972 (MF409)
	021	COBB, 1973, P. 19 (B1374)
o	001	ALASKA KARDEX 085-032
o	002	ALASKA KARDEX 085-077
o	003	ALASKA KARDEX 085-288
o	004	ALASKA KARDEX 085-307
o	005	ALASKA KARDEX 085-332
o	006	ALASKA KARDEX 085-082
o	007	ALASKA KARDEX 085-281
o	008	ALASKA KARDEX 085-330
o	009	ALASKA KARDEX 085-505
o	010	ALASKA KARDEX 085-506
o	011	ALASKA KARDEX 085-507

*

FIGURE 13.—Sample listing from the Minerals Availability System of the Bureau of Mines—Continued.

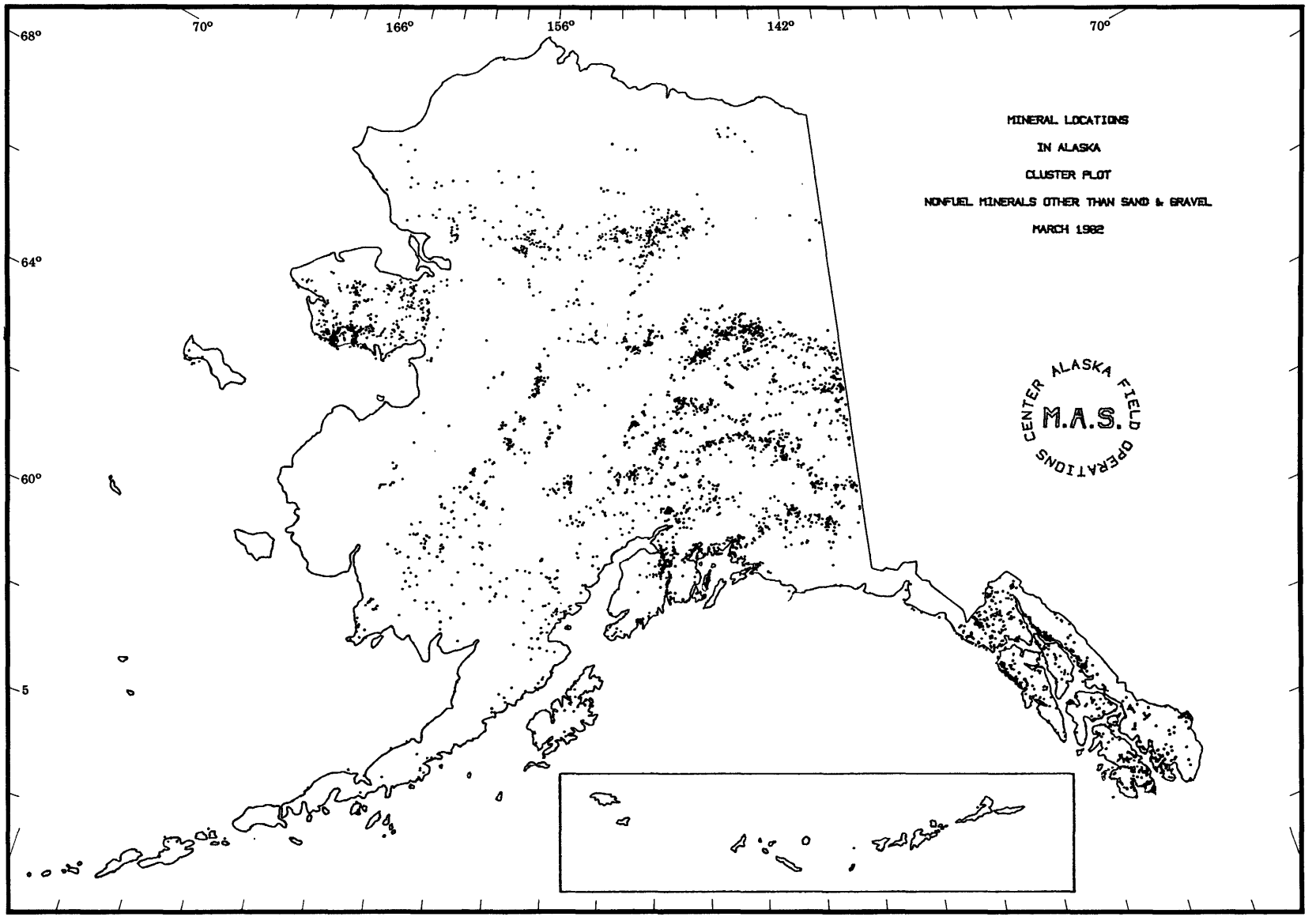


FIGURE 14. — Bureau of Mines computer-plotted map showing mineral locations (except sand and gravel) in Alaska from information in the Minerals Availability System data bank. The computer does not print latitude and longitude or scale.

which are included in the list of selected Federal publications at the end of this report.

- Anaconda Copper Company has continued work at the Alyu copper, zinc, silver, and barite deposits 38 miles northwest of Haines. The original report of mineralization in the Glacier Creek area (MacKevett, 1971, listed on p. 43) was published by the Geological Survey.
- Development has been renewed at the Independence lode gold mine in the Willow Creek district of the Talkeetna Mountains 45 miles northeast of Anchorage, including construction of a mill, by Coronado Mining Company. The Willow Creek district ranks second to the Juneau district in total lode gold production in Alaska, but little mining has been done there since World War II. The results of recent Geological Survey and Bureau of Mines studies in the area were published in 1978, and additional studies are being conducted.
- Exploration and drilling of more than 30 promising zinc, lead, silver, and gold occurrences in a 400-square-mile area in the eastern Alaska Range are being continued by the Anaconda Copper Company and Resource Associates of Alaska. Active Geological Survey and State of Alaska projects in the area have resulted in preliminary reports (for example, Lange and others, 1981; Nockleberg and others, 1981, listed with reports by Geological Survey authors in non-Survey publications in Selected References). Sixteen papers summarizing geology, geochemistry, geophysics, and metallogenesis studies were presented at a Survey-sponsored public meeting in Anchorage in March 1982.
- There have been a revival of lode gold mining and an "explosion" of placer gold activity on the Seward Peninsula and in central Alaska, especially Circle, Fairbanks, Livengood, Chandalar, and Manley Hot Springs districts. Recent total production is estimated at more than 128,000 ounces (or a value of more than $55 million at $430 per ounce). Gold refineries were established in Fairbanks and Anchorage to handle local placer gold. Studies of lode and placer deposits in the Fairbanks district by the State of Alaska are continuing, and statewide studies of placer deposits by the Geological Survey have been reported in professional meetings or brief preliminary reports.
- Three widely separated beach and offshore placer gold deposits are at various stages of development. About 20,000 acres in Golovnin Lagoon approximately 65 miles east of Nome are being tested by Goodwin Resources, Ltd. A $500,000 pilot recovery plant capable of handling 900 tons of sand per day is being built on the beach near Yakataga by Cusac Industries, Ltd., and Alaska Gold Mines, Inc., of Vancouver, British Columbia. Plans to use a large suction dredge to mine 550 acres of tidal and offshore tracts near Point Woronzof in Cook Inlet adjacent to the Anchorage International Airport have been announced by Cook Inlet Exploration and Development. Geological Survey studies are continuing in all three areas.
- A joint announcement was made by WGM, Inc., and Doyon, Ltd., concerning asbestos reserves in the Fortymile district near Eagle. Drilling on Doyon Native entitlement lands has substantiated at least 55 million tons averaging 6.35 percent asbestos fiber. Current Geological Survey studies in the region have identified favorable targets for other commodities as well.
- Mining company and Geological Survey geologists did further exploration on the southern flank of the western Brooks Range, extending the areas of known copper, lead, zinc, and silver mineralization at least an additional 50 miles eastward. Several billion dollars (1981 prices) worth of metals have been proven by drilling at the four largest deposits (Bornite, Arctic Camp, Sun, and Smucker). The strategic element cobalt is present in significant quantities in at least one of the deposits (Bornite), according to reports presented at the Alaska Miners Association meeting in Anchorage in October 1981 and at the Northwest Mining Association meeting in Spokane in November 1981.
- Most of the twelve Native regional corporations in the State increased their mineral-related activities. Some corporations have retained consultants to evaluate their mineral resources and have entered into leasing agreements, joint ventures, or stock acquisition with various exploration and development companies.

REFERENCES CITED

Berg, H. C., and Cobb, E. H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 1246, 254 p.

Berg, H. C., Decker, J. E., and Abramson, B. S., 1981, Metallic mineral deposits of southeastern Alaska: U.S. Geological Survey Open-File Report 80-122, 145 p.

Clark, A. L., Berg, H. C., Cobb, E. H., Eberlein, G. D., MacKevett, E. M., Jr., and Miller, T. P., 1974, Metal provinces of Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-834, scale 1:5,000,000.

Conwell, C. N., and Eakins, G. R., 1982, Mining sees steady increase: Alaska Construction and Oil, January 1982, p. 28-32.

Cobb, E. H., 1973, Placer deposits of Alaska: U.S. Geological Survey Bulletin 1374, 213 p.

Cobb, E. H., Dusel-Bacon, Cynthia, MacKevett, E. M., Jr., and Berg, H. C., 1977, Map showing distribution of mineral deposits (other than organic fuels and construction materials) in Alaska: U.S. Geological Survey Open-File Report 77-496, 1 sheet, scale 1:2,500,000.

Eakins, G. R., 1981, Exploration in Alaska in 1980 below record level but hopes for 1981: Western Miner, February 1981, p. 73-77.

Eberlein, G. D., and Menzie, W. D., 1978, Maps and tables describing areas of metalliferous mineral resource potential of central Alaska: U.S. Geological Survey Open-File Report 78-1-D, 43 p., 2 sheets, scale 1:1,000,000.

Grybeck, Donald, and DeYoung, J. H., Jr., 1978, Map and tables describing mineral resources potential of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 78-1-B, 18 p., 1 sheet, scale 1:1,000,000.

Hudson, Travis, and DeYoung, J. H., Jr., 1978, Map and tables describing areas of mineral resources potential, Seward Peninsula, Alaska: U.S. Geological Survey Open-File Report 78-1-C, 62 p., 1 sheet, scale 1:1,000,000.

MacKevett, E. M., Jr., 1971, Analyses of samples and preliminary geological summary of barite, silver, and base metal deposits near Glacier Creek, Skagway B-4 quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 71-195 (500), 8 p.

MacKevett, E. M., Jr., Singer, D. A., and Holloway, C. D., 1978, Maps and tables describing metalliferous mineral resource potential of southern Alaska: U.S. Geological Survey Open-File Report 78-1-E, 45 p., 2 sheets, scale 1:1,000,000.

Tailleur, I. L., 1970, Lead-, zinc-, and barite-bearing samples from the western Brooks Range, Alaska, *with a section on* Petrography and mineralogy, by G. D. Eberlein and Ray Wehr: U.S. Geological Survey Open-File Report 70-319 (445), 16 p.

University of Alaska, Arctic Environmental Information and Data Center, 1979, Mineral terranes of Alaska: 6 sheets at 1:1,000,000 scale and a sheet of explanation. [Prepared under contract to the Bureau of Mines.]

CRITICAL AND STRATEGIC MINERALS

Alaska has significant potential for large deposits of chromium, cobalt, nickel, platinum-group metals, tin, tungsten, and other critical and strategic minerals. These commodities have received increasing study and exploration in the past 5 years, both from the Federal Government and from private industry.

Economic concentrations of chromium, cobalt, nickel, and platinum-group metals generally are restricted to layered igneous mafic and ultramafic rocks. These host rocks are widespread in Alaska in diverse geologic settings. Placer deposits of platinum also occur, for example, near Goodnews Bay and in the Ophir district, in streams that drain areas where mafic and ultramafic rocks crop out. Lode tin and tungsten deposits generally are located near the borders of certain types of granitic intrusions and in their contact rocks. Numerous placer occurrences of tin occur in streams that drain lode deposits. Tin occurrences are widespread in central Alaska from the Seward Peninsula to the Canadian border and also may be present in the southern Alaska Range.

ACTIVITY BY FEDERAL AGENCIES IN 1980 AND 1981

U.S. Geological Survey.—The Geological Survey's AMRAP, described more fully in the section on nonfuel minerals, has three current projects that pertain to critical and strategic minerals. The first is a Level IV study of mafic and ultramafic rocks, with their associated deposits of chromium, cobalt, nickel, and platinum-group metals. Studies of mafic and ultramafic rocks in the Glacier Bay National Park have been completed recently (Himmelberg and Loney, 1981, listed with Selected References beginning on p. 45). Studies of discontinuous occurrences in interior Alaska that spread more than 250 miles from near Bettles to west of Ophir are continuing. The second project is a tin commodity project that gathers information on the numerous lode and placer occurrences of tin in Alaska and refines the information, when warranted, with additional field studies. These two projects have resulted in recent reports, which are listed in the Selected References section. The third project, a continuing Level IV geological, geochemical, and geophysical study of the Yukon-Koyukuk region, has included detailed mapping and sampling of tin-bearing granite intrusions in the Hodzana Highlands of interior Alaska. In addition, Level III resource assessments are being prepared for the Goodnews Bay and West Chichagof-Yakobi Islands regions, which contain known resources of platinum and nickel-cobalt, respectively. Areas of activity for these minerals are shown in figures 9, 12*A* and 12*B* (in the nonfuel minerals section), and reports about these projects' findings are in the Selected References list at the end of this report.

Bureau of Mines.—The critical and strategic minerals program of the Bureau of Mines currently emphasizes cobalt, chromite, and the platinum-group metals. In addition, preliminary studies of tungsten and manganese occurrences in the Fortymile district and tin occurrences near the trans-Alaska pipeline recently have been completed. A preliminary

information circular on cobalt, chromite, and the platinum-group metals was published by the Bureau of Mines (Barker and others, 1981, listed with Bureau of Mine reports in Selected References). The circular gives summary descriptions of known and potential deposits in southeastern Alaska, the Kenai Peninsula, central Alaska, and the western Brooks Range. Bureau of Mines evaluations of most of these occurrences are continuing (Dahlin and others, 1981, listed in the Selected References). Detailed investigations, including metallurgical studies, of chromite and platinum-group metals in layered ultramafic rocks of the Kanuti River region of central Alaska are being carried out by the Bureau of Mines. Figures 9 and 12*B* show the areas of interest, and the pertinent reports are listed under the Bureau of Mines heading in Selected References.

INDUSTRY ACTIVITY IN 1980 AND 1981

Following are highlights of industry activity.

- Fox Geologic Consultants, of Vancouver, British Columbia, drilled at the Salt Chuck Mine near Kasaan, about 45 miles northwest of Ketchikan on Prince of Wales Island. This mine produced copper, platinum, and palladium ore from sulfide lenses in ultramafic rocks from about 1907 to 1941.
- Inspiration Development Company announced at the annual convention of the Northwest Miners Association in Spokane in November 1981 that it had done additional exploration of the nickel-copper-cobalt deposits at Bohemia Basin on Yakobi Island and at Mirror Harbor on Chichagof Island, 75 and 60 miles, respectively, northwest of Sitka. Industry interest in the Bohemia Basin deposits has been renewed because the claim sites have not been included in the designated wilderness area. The Mirror Harbor deposits are in the West Chichagof-Yakobi Wilderness area created by ANILCA. Preliminary reports of joint Geological Survey and Bureau of Mines mineral-resources studies in the area are scheduled for release in 1982.
- The Brady Glacier nickel-copper-cobalt deposit was surrounded by wilderness areas of the Glacier Bay National Park of ANILCA, further complicating development. Final Geological Survey reports on petrology and geochemistry of the host rocks for the deposit have been issued (Himmelberg and Loney, 1981, listed with Geological Survey reports in Selected References). The Bureau of Mines is investigating other reported occurrences in the area.
- The chromite deposits in ultramafic rocks at Red Mountain and Claim Point on the Kenai Peninsula south of Homer were drilled by the Anaconda Copper Company, as reported at the meeting of the Alaska Miners Association in Anchorage in October 1981. The deposits are owned by the Chugach Native Association, a regional Native corporation. A publication about the structure and petrology of the Red Mountain ultramafic body has been published by the Geological Survey (Toth, 1981, listed with Selected References.)
- R. A. Hanson Mining Company has resumed platinum placer mining at Goodnews Bay after a 5-year lapse. Previous mining operations produced more than 640,000 ounces of platinum, and the remaining reserves are estimated at 500,000 ounces. The placers occur in ancient and present channels in the valley of the Salmon River and its tributaries that drain ultramafic rocks exposed in Red Mountain. These deposits are at present the only commercial source of nonbyproduct platinum metals in the country. Several Geological Survey studies have resulted in preliminary reports on the area's geology (Mertie, 1976; Hoare and Coonrad, 1979, listed on p. 45). The Bureau of Mines is investigating other reported occurrences in the area.
- Tungsten concentrates were produced at the Yellow Pup mine on Gilmore Dome, 15 miles northwest of Fairbanks. Active exploration for tungsten also has occurred in the Circle area, which currently is being subjected to an AMRAP Level III resource assessment by the Geological Survey.
- The Bering Straits Native Corporation acquired the Lost River tin-fluorite deposits on the Seward Peninsula. Industry interest in the deposits and numerous analogs elsewhere in west-central Alaska persists. Tin placer production on the Seward Peninsula and in the Tofty district, 100 miles west of Fairbanks, continues year after year at about 100,000 pounds. Placer tin occurs in many streams in central Alaska. Regional resource appraisal by the Geological Survey of potential mineral commodities continues in the Bendeleben and Solomon quadrangles on the Seward Peninsula.

REFERENCES CITED

Hoare, J. M., and Coonrad, W. L., 1979, Geologic map of the Goodnews and Hagemeister Island quadrangles region, southwestern Alaska: U.S. Geological Survey Open-File Report 78-9-B, 1 sheet, scale 1:250,000.

Mertie, J. B., 1976, Platinum deposits of the Goodnews Bay district, Alaska: U.S. Geological Survey Professional Paper 938, 42 p.

SELECTED REFERENCES, FEDERAL PUBLICATIONS

The following lists of references published in 1980 and 1981 have to do with various aspects of mineral-related activity by Federal agencies in Alaska. It is not a complete list of publications of any agency. For example, reports about the determination of earthquake epicenters, basic hydrologic data or research, or bathymetry and geology of offshore areas are not included, though that information may be important to some phases of mineral investigations.

The U.S. Geological Survey regularly publishes its findings in several types of reports. A monthly listing titled "New Publications of the Geological Survey" is available free from the Geological Survey, 329 National Center, Reston, VA 22092; the contents of the list are compiled annually into a free book titled "Publications of the Geological Survey, [year]." Prices and addresses of the offices from which reports can be obtained are given in the monthly listings or are available at the Geological Survey's Public Inquiries Offices. The Geological Survey's Circulars 832-A and 843 list programs and projects active in fiscal years 1980 and 1981, respectively. Accomplishments for those years are described in Circulars 844 and 868; the latter is in preparation at this time.

The Bureau of Mines also publishes a variety of reports describing the results of its investigations. The Bureau of Mines' central distribution office is the Branch of Production and Distribution, Division of Publications, 4800 Forbes Avenue, Pittsburgh, PA 15213. Many Bureau of Mines reports are available through the U.S. Government Printing Office in Washington, D.C.; some are available through the National Technical Information Service in Springfield, Va. The reports listed herein and an index of the publications about mineral investigations in Alaska from 1911 to 1981 are in the Bureau of Mines' Juneau library. For information about the availability of these reports, contact the Chief, Alaska Field Operations Center, Box 550, Juneau, AK 99802.

Reports prepared by other Federal agencies on their mineral-related studies are generally available through the agencies' Alaskan offices or at the Department of the Interior's Alaska Resources Library, 701 C Street, Anchorage, AK 99513.

[Occasionally an imprint date is not the same as the year of release. A very small number of the reports listed here as having been released in 1980 or 1981 were actually published in the following year. It will be possible to obtain these reports by calling for the author, title, and report number, even if the year of publication is not as shown here.]

U.S. GEOLOGICAL SURVEY, 1980

Professional Papers

Bunker, C. M., Hedge, C. E., and Sainsbury, C. L., 1979 [1980], Radioelement concentrations and preliminary radiometric ages of rocks of the Kigluaik Mountains, Seward Peninsula, Alaska: U.S. Geological Survey Professional Paper 1129-C, p. C1-C12.

Foose, M. P., Menzie, W. D., Singer, D. A., and Hanley, J. T., 1980, The distributions and relationships of grade and tonnage among some nickel deposits: U.S. Geological Survey Professional Paper 1160, 14 p.

Hoffman, J. D., Brew, D. A., Forn, C. L., and Johnson, B. R., 1979 [1980], Chemical variability of a metavolcanic rock unit in the Tracy Arm-Fords Terror Wilderness study area, Alaska: U.S. Geological Survey Professional Paper 1129-D, p. D1-D8.

Johnson, B. R., Forn, C. L., Hoffman, J. D., Brew, D. A., and Nutt, C. J., 1980, Efficient stream-sediment sampling design: An experiment at Tracy Arm, Alaska: U.S. Geological Survey Professional Paper 1129-E, p. E1-E9.

Jones, D. L., Silberling, N. J., Csejtey, Béla, Jr., Nelson, W. H., and Blome, C. D., 1980, Age and structural significance of ophiolite and adjoining rocks in the Upper Chulitna district, south-central Alaska: U.S. Geological Survey Professional Paper 1121-A, p. A1-A21.

Pan, Kuo-Liang, Overstreet, W. C., Robinson, Keith, Hubert, A. E., and Crenshaw, G. L., 1980, Equivalent uranium and selected minor elements in magnetic concentrate from the Candle quadrangle, Solomon quadrangle, and elsewhere in Alaska: U.S. Geological Survey Professional Paper 1135, 115 p.

U.S. Geological Survey, 1980, Geological Survey research 1980: U.S. Geological Survey Professional Paper 1175, 459 p.

Bulletins

Detterman, R. L., and Reed, B. L., 1980, Stratigraphy, structure, and economic geology of the Iliamna quadrangle, Alaska: U.S. Geological Survey Bulletin 1368-B, p. B1-B86.

National Technical Information Service (NTIS)

Koch, R. D., O'Leary, R. M., and Risoli, D. A., 1980, Analytical data from rock, stream-sediment, and stream-sediment heavy mineral concentrate samples from Bradfield Canal

quadrangle, southeastern Alaska: NTIS PB-81 631, available on magnetic tape.

———1980, Analytical data from rock, stream-sediment, and stream-sediment heavy mineral concentrate samples from Bradfield Canal quadrangle, southeastern Alaska: NTIS PB-81 649, 28 p.

Open-File Reports

Bartsch-Winkler, Susan, 1980, List of geologic maps in Alaska published by the U.S. Geological Survey, post-1930; scales 1:20,000 to 1:63,360 (through June 1980): U.S. Geological Survey Open-File Report 80-1251, 15 p., 1 oversize sheet.

———1980, List of geologic maps in Alaska published by the U.S. Geological Survey, post-1930; scales 1:96,000 to 1:250,000 (through June 1980): U.S. Geological Survey Open-File Report 80-1252, 15 p., 1 oversize sheet.

Berg, H. C., 1980, The Alaska Mineral Resources Assessment Program—Guide to information about the geology and mineral resources of the Ketchikan and Prince Rupert quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 80-794, 43 p.

Berg, H. C., and Grybeck, Donald, 1980, Upper Triassic volcanogenic Zn-Pb-Ag (-Cu-Au) mineral deposits near Petersburg, Alaska: U.S. Geological Survey Open-File Report 80-527, 9 p., 1 oversize sheet.

Brew, D. A., and Morrell, R. P., 1980, Intrusive rocks and plutonic belts of southeastern Alaska: U.S. Geological Survey Open-File Report 80-78, 34 p.

Chleborad, A. F., Yehle, L. A., Schmoll, H. R., and Gardner, C. A., 1980, Preliminary field geotechnical data and geophysical logs from a drill hole in the Capps coal field, Cook Inlet region, Alaska: U.S. Geological Survey Open-File Report 80-393, 17 p., 2 oversize sheets.

Cobb, E. H., 1979 [1980], Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Seldovia quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-87, 47 p.

———1980, Summary of references to mineral occurences (other than mineral fuels and construction materials) in the Kenai and Tyonek quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-86, 37 p.

———1980, Selected Geological Survey, U.S. Bureau of Mines, and Alaska Division of Geological and Geophysical Surveys reports and maps released during 1979, indexed by quadrangle: U.S. Geological Survey Open-File Report 80-291, 103 p.

———1980, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Mount McKinley quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-363, 150 p.

———1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in fifteen quadrangles in southwestern and west-central Alaska (Atka, Attu, Bristol Bay, Chignik, Cold Bay, Hagemeister Island, Mount Katmai, Naknek, Port Moller, Rat Islands, Saint Lawrence, Stepovak Bay, Ugashik, Unalaska, Unimak): U.S. Geological Survey Open-File Report 80-909, 103 p.

Cobb, E. H., and Csejtey, Béla, Jr., 1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Talkeetna Mountains quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-716, 63 p.

Cobb, E. H., and Eberlein, G. D., 1980, Summaries of data and lists of references to metallic and selected nonmetallic mineral deposits in the Big Delta and Tanacross quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-1086, 76 p.

Cobb, E. H., and Elliott, R. L., 1980 Summaries of data and lists of references to metallic and selected nonmetallic mineral deposits in the Ketchikan and Prince Rupert quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-1053, 156 p.

Cobb, E. H., and MacKevett, E. M., Jr., 1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the McCarthy quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-885, 156 p.

Cobb, E. H., and Reed, B. L., 1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Talkeetna quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-884, 106 p.

Cobb, E. H., and Richter, D. H., 1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Nabesna quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-927, 116 p.

Cobb, E. H., and Tysdal, R. G., 1980, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Blying Sound and Seward quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-621, 284 p.

Curtin, G. C., Day, G. W., and Tripp, R. B., 1980, Histograms and correlation table for selected elements in samples of the ash of black spruce needles from the Tanacross quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-655, 22 p.

———1980, Histograms and correlation table for selected samples of the ash ground birch leaves in the Tanacross quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-656, 22 p.

Curtis, S. M., Ellersieck, I. F., Mayfield, C. F., and Tailleur, I. L., 1980, Silver, copper, lead, and zinc stream-sediment geochemical anomalies in Misheguk Mountain quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-315, 1 oversize sheet.

Decker, John, 1980, Preliminary aeromagnetic map of southeastern Alaska: U.S. Geological Survey Open-File Report 79-1694, 1 oversize sheet.

———1980, Geologic map of western Chichagof Island, southeastern Alaska: U.S. Geological Survey Open-File Report 80-150, 2 oversize sheets.

Detterman, R. L., Allaway, W. H., Jr., O'Leary, R. M., Gruzenski, A. L., Hurrell, J. T., and Risoli, D. A., 1980, Sample location map and analytical data for rock samples collected in 1979, Ugashik and Karluk quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-142, 1 sheet.

Ellersieck, I. F., Curtis, S. M., Gruzenski, A. L., Mayfield, C. F., and Tailleur, I. L., 1980, Copper, lead, and zinc in stream-sediment samples from the De Long Mountains quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-795, 3 oversize sheets.

Gibson, H. A., and Tailleur, I. L., 1980, Map showing relation between aeromagnetic data and geology, southern National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 80-516, 3 oversize sheets.

Griscom, Andrew, 1980, Aeromagnetic interpretation of the Big Delta quadrangle, Alaska: U.S. Geological Survey Open-File Report 78-529-B, 10 p., 2 oversize sheets.

Hackett, S. W., 1980, Aeromagnetic interpretation maps of the Ambler River quadrangle, Alaska: U.S. Geological Survey Open-File Report 78-120-K, 19 p., 3 oversize sheets.

Karl, S. M., Berg, H. C., Grybeck, Donald, and Abramson, B. S., 1980, Preliminary map and tables describing metalliferous and selected nonmetalliferous mineral deposits in the Petersburg and eastern Port Alexander quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-793, 16 p., 4 oversize sheets.

King, H. D., Risoli, D. A., Cooley, E. F., O'Leary, R. M., Speckman, W. A., Spiesman, D. L., Jr., and Galland, D. W., 1980, Final results and statistical summary of analysis of geochemical samples from the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811-F, 134 p.

Koch, R. D., Elliott, R. L., O'Leary, R. M., and Risoli, D. A., 1980, Trace-element data for stream-sediment samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-910-B, 172 p.

———1980, Trace-element data for stream-sediment heavy mineral concentration samples from Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-910-C, 68 p.

Mast, R. F., McMullin, R. H., Bird, K. J., and Brosgé, W. P., 1980, Resource appraisal of undiscovered oil and gas resources in the William O. Douglas Arctic Wildlife Range: U.S. Geological Survey Open-File Report 80-916, 62 p.

Miller, T. P., 1980, Uranium- and thorium-rich volcanic rocks of the Sischu Creek area, Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-803, 8 p.

Molnia, B. F., 1980, Impact of coastal processes on resource development with an example from Icy Bay, Alaska: U.S. Geological Survey Open-File Report 79-1693, 13 p.

Patton, W. W., Jr., Moll, E. J., Dutro, J. T., Jr., Silberman, M. L., and Chapman, R. M., 1980, Preliminary geologic map of Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811-A, 1 oversize sheet.

Reed, B. L., and Miller, T. P., 1980, Uranium and thorium content of some Tertiary granitic rocks in the southern Alaska Range: U.S. Geological Survey Open-File Report 80-1052, 15 p.

Schmoll, H. R., Dobrovolny, Ernest, and Gardner, C. A., 1980, Preliminary geologic map of the middle part of the Eagle River valley, Municipality of Anchorage, Alaska: U.S. Geological Survey Open-File Report 80-890, 11 p. 1 oversize sheet.

Silberman, M. L., MacKevett, E. M., Jr., Connor, C. L., and Matthews, Alan, 1980, Metallogenic and tectonic significance of oxygen isotope data and whole-rock potassium-argon ages of the Nikolai Greenstone, McCarthy quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-2019, 29 p.

Singer, D. A., Csejtey, Béla, and Miller, R. J., 1980, Map and discussion of the metalliferous and selected nonmetalliferous mineral resources of the Talkeetna Mountains quadrangle, Alaska, U.S. Geological Survey Open-File Report 78-588-Q, 33 p., 1 oversize sheet.

Singer, D. A., Menzie, W. D., DeYoung, J. H., Jr., Sander, M., and Lott, A., 1980, Grade and tonnage data used to construct models for the Regional Alaskan Mineral Resources Assessment Program: U.S. Geological Survey Open-File Report 80-799, 58 p.

U.S. Geological Survey, 1980, Aeromagnetic map of Afognak Island and vicinity, Alaska: U.S. Geological Survey Open-File Report 80-57, 1 oversize sheet.

———1980, Aeromagnetic map of the Chugach area, Alaska: U.S. Geological Survey Open-File Report 80-58, 1 oversize sheet.

Wilson, F. H., 1980, Late Mesozoic and Cenozoic tectonics and the age of porphyry copper prospects, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Open-File Report 80-543, 102 p., 5 oversize sheets.

Witmer, R. J., 1980, Availability of palynomorph and foraminifera microscope slides from test wells of National Petroleum Reserve in Alaska—Group I: U.S. Geological Survey Open-File Report 80-193, 21 p.

Zehner, R. E., Cobb, E. H., Nokleberg, W. J., and Albert, N. R. D., 1980, Geologic bibliography of the Mount Hayes quadrangle, Alaka: U.S. Geological Survey Open-File Report 80-513, 28 p.

Zuffa, G. G., Nilsen, T. H., and Winkler, G. R., 1980, Rock-fragment petrography of the Upper Cretaceous Chugach terrace, southern Alaska: U.S. Geological Survey Open-File Report 80-713, 28 p.

Miscellaneous Field Studies Maps

Brew, D. A., and Morrell, R. P., 1980, Preliminary map of intrusive rocks in southeastern Alaska: U.S. Geological Survey Miscellaneous Investigations Map MF-1048, 1 sheet.

Detra, D. M., and Cooley, E. F., 1980, Distribution and abundance of copper in minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-C, 2 sheets.

———1980, Distribution and abundance of silver and arsenic in minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-G, 2 sheets.

———1980, Distribution and abundance of bismuth, tin, and tungsten in nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-H, 2 sheets.

Detra, D. M., and Day, G. W., 1980, Distribution and abundance of molybdenum in minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-F, 2 sheets.

Detra, D. M., and Hopkins, R. T., 1980, Distribution and abundance of lead in minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-D, 2 sheets.

Detra, D. M., and O'Leary, R. M., 1980, Distribution and abundance of zinc in minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-E, 2 sheets.

Patton, W. W., Jr., and Miller, T. P., 1980, Bedrock geologic map of Bettles and southern part of Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-492, 1 sheet.

Tripp, R. B., and Detra, D. E., 1980, Maps showing mineralogic data for selected minerals in nonmagnetic heavy mineral concentrates of stream sediments in the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map MF-1053-I, 2 sheets.

Miscellaneous Investigations Series

Reed, B. L., and Nelson, S. W., 1980, Geologic map of the Talkeetna quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1174, scale 1:250,000, 15 p., 1 sheet.

Oil and Gas Investigations Charts

Magoon, L. B., and Claypool, G. E., 1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for South Simpson No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-92, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for South Harrison Bay No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-93, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for W.T. Foran No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-94, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for West Fish Creek No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-95, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for North Kalikpik No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-96, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for Cape Halkett No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-97, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for Atigaru Point No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-98, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for South Barrow Nos. 14, 16, 17, and 19 wells, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-99, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for Drew Point No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-100, 1 sheet.

———1980, Vitrinite reflectance and C_1-C_7 hydrocarbon data for Kugrua No. 1 well, North Slope, Alaska: U.S. Geological Survey Oil and Gas Investigations Chart OC-101, 1 sheet.

Circulars

Johnson, K.M., and Williams, J.R., eds., 1979 [1980], The United States Geological Survey in Alaska—Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B1-B163. Following is a partial listing of contents:

Berg, H. C., Significance of geotectonics in the metallogenesis and resource appraisal of southeastern Alaska: A progress report

Brew, D. A., Berg, H. C., and others, The Tertiary Kuiu-Etolin volcanic-plutonic belt, southeastern Alaska

Brew, D. A., Grybeck, Donald, and Johnson, B.R., Summary of mineral resources, Glacier Bay National Monument Wilderness study area, southeastern Alaska

Brew, D. A., and Morrell, R. P., Intrusive rock belts of southeastern Alaska

Carter, R. D., and Lantz, R. J., Development and operation of gas fields in the Barrow area

Carter, R. D., and Madrid, R. J., Availability of NPRA data

Churkin, Michael, Jr., Nokleberg, W. J., and Huie, Carl, Tectonic model for the western Brooks Range, Alaska

Csejtey, Béla, Jr., Regional significance of tectonics of the Talkeetna Mountains, south-central Alaska

Csejtey, Béla, Jr., and Evarts, R. C., Serpentinite bodies in the Willow Creek district, southwestern Talkeetna Mountains, Alaska

Csejtey, Béla, Jr., and Nelson, W. H., Trondhjemite in the Talkeetna Mountains, Alaska

Curtin, G. C., Crim, W. D., and others, Reconnaissance geochemical studies in Alaska

Curtis, S. M., Rossiter, Richard, and others, Gamma-ray values in the Misheguk Mountain region and in parts of Barrow, Teshekpuk, and Harrison Bay quadrangles, Alaska

Dickinson, K. A., Uraninite in sideritic nodules from Tertiary continental sedimentary rocks in the Healy Creek basin area, Alaska

Ellersieck, I. F., Mayfield, C. F., Tailleur, I. L., and Curtis, S. M., Thrust sequences in the Misheguk Mountain quadrangle, Brooks Range, Alaska

Grybeck, Donald, and Nokleberg, W. J., Metallogeny of the Brooks Range, Alaska

Grybeck, Donald, and Brew, D. A., Mineral resource evaluation method used in Glacier Bay National Monument Wilderness study area, southeastern Alaska

Hudson, Travis, Plutonism and regional geology in southern Alaska

Huffman, A. C., and Ahlbrandt, T. S., The Cretaceous Nanushuk Group of the western and central North Slope, Alaska

Johnson, B. R., Miller, T. P., and Karl, Susan, Uranium-thorium investigations of the Darby pluton, Seward Peninsula, Alaska

Jones, D. L., Silberling, N. J., and others, Age and structural significance of ophiolite and adjoining rocks in the Upper Chulitna district, south-central Alaska

Keith, T. E. C., and Foster, H. L., Big Windy Creek hot spring, Circle A-1 quadrangle, Alaska

Mayfield, C. F., Curtis, S. M., Ellerseick, I. F., and Tailleur, I. L., The Ginny Creek zinc-lead-silver and Nimiuktuk barite deposits, northwestern Brooks Range, Alaska

Nelson, S. W., Nokleberg, W. J., Miller-Hoare, Martha, and Mullen, M. W., Siniktanneyak Mountain ophiolite

Nokleberg, W. J., Albert, N. R. D., and Zehner, R. E., The ophiolite of Tangle Lakes in southern Mount Hayes quadrangle, eastern Alaska Range

Palmer, I. F., Bolm, J. G., and others, Hydrocarbon reservoir and source rock characteristics from selected areas of western Alaska

Steele, W. C., Le Compte, J. R., and Albert, N. R. D., Landsat data interpretation for various AMRAP quadrangles, Alaska

Throckmorton, M. L., and Hummel, C. L., Quartzofeldspathic, mafic, and ultramafic granulites identified in the Kigluaik Mountains, Seward Peninsula, Alaska

Zimmerman, Jay, and Soustek, P. G., The Avan Hills ultramafic complex, De Long Mountains, Alaska

Reed, K. M., ed., 1980, The U.S. Geological Survey in Alaska—1980 programs: U.S. Geological Survey Circular 823-A, p. A1-A112.

Publications by Geological Survey authors in non-Survey journals and books

Beck, Myrl, Cox, Allen, and Jones, D. L., 1980, Mesozoic and Cenozoic microplate tectonics of western North America; Penrose Conference Report: Geology, v. 8, no. 9, p. 454-456.

Case, J. E., 1980, Magnetic expression and mineralization of some Tertiary plutons of Prince William Sound and the Alaska Peninsula, southern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 101.

Churkin, Michael, Jr., Carter, Claire, and Trexler, J. H., Jr., 1980, Collision-deformed Paleozoic continental margin of Alaska—Foundation for microplate accretion: Geological Society of America Bulletin, pt. 1, v. 91, no. 11, p. 648-654.

Churkin, Michael, Jr., Nokleberg, W. J., and Huie, Carl, 1980, Collision-deformed continental margin, western Brooks Range, Alaska: Geology, v. 7, no. 8, p. 379-383. [See also comments on this article and replies *in* Geology, v. 8, no. 8.]

Coney, P. J., Silberling, N. J., and Jones, D. L., 1980, Accretionary tectonic styles in the Alaska Range [abs.]: Eos (American Geophysical Union Transactions), v. 61, no. 46, p. 1114.

Csejtey, Béla, Jr., Foster, H. L., and Nokleberg, W. J., 1980, Cretaceous accretion of the Talkeetna superterrane and subsequent development of the Denali fault in south-central and eastern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 7, p. 409.

Decker, John, Wilson, F. H., and Turner, D. L., 1980, Mid-Cretaceous subduction in southeastern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 103.

Dickinson, K. A., 1980, Uranium in Tertiary sediments in Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 698.

Gryc, George, and Bowsher, A. L., 1980, Petroleum exploration of the National Petroleum Reserve in Alaska (NPRA) [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 715-716.

Hein, J. R., and McLean, Hugh, 1980, Reconnaissance geology of Atka Island, central Aleutian Islands, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 110.

Himmelberg, G. R., and Loney, R. A., 1980, Petrology of ultramafic and gabbroic rocks of the Brady Glacier nickel-copper deposit, southeastern Alaska [abs]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 111-112.

Himmelberg, G. R., and Miller, T. P., 1980, Uranium- and thorium-rich vesuvianite from the Seward Peninsula, Alaska: American Mineralogist, v. 65, no. 9-10, p. 1020-1025.

Lange, I. M., Nokleberg, W. J., Plahuta, J. T., Krouse, H. R., Doe, B. R., and Jansons, Uldis, 1980, Geochemistry of volcanogenic zinc-lead-barium deposits, northwestern Brooks Range, Alaska [abs]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 116.

Lantz, R. J., 1980, Barrow gas fields, North Slope, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 737.

MacKevett, E. M., Jr., Armstrong, A. K., Potter, R. W., II, and Silberman, M. L., 1980, Kennecott-type copper deposits, Wrangell Mountains, Alaska—an update and summary [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 117.

Magoon, L. B., and Claypool, G. E., 1980, Two oil types on North Slope of Alaska—Implications for future exploration: Institut Français du Pétrole Revue, v. 35, no. 2, p. 245-256.

Menzie, W. D., and Singer, D. A., 1980, Some quantitative properties of mineral deposits, *in* Meyer, R. F., and Carman, J. S., eds., The future of small-scale mining: New York, United Nations Institute for Training and Research (UNITAR), p. 27-34.

Mitchell, P. A., Silberman, M. L., and O'Neill, J. R., 1980, Gold vein mineralization, north-central Kenai Peninsula, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 142.

Molenaar, C. M., 1980, Cretaceous stratigraphy, Chignik area, Alaska Peninsula, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 752.

Molenaar, C. M., and Bird, K. J., 1980, Stratigraphic relations of Nanushuk Group (Middle Cretaceous) and associated strata, North Slope of Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 752-753.

Mull, C. G., 1980, Evolution of Brooks Range thrust belt and Arctic Slope, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 754-755.

Nilsen, T. H., Brosgé, W. P., Dutro, J. T., Jr., and Moore, T. E., 1980, The Kanayut Conglomerate, a major Upper Devonian delta complex, Brooks Range, northern Alaska [abs]: Geological Society of America Abstracts with Programs, v. 12, no. 7, p. 492.

Nilsen, T. H., Moore, T. E., Dutro, J. T., Jr., and Brosgé, W. P., 1980, Sedimentology of fluvial Upper Devonian Kanayut Conglomerate, Brooks Range, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 758.

Nokleberg, W. J., Albert, N. R. D., Herzon, P. L., and Zehner, R. E., 1980, Accreted Andean-type arc and island-arc terranes in southern Mount Hayes quadrangle, eastern Alaska Range, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 145.

Plafker, George, and Hudson, Travis, 1980, Regional implications of Upper Triassic metavolcanic and metasedimentary rocks on the Chilkat Peninsula, southeastern Alaska: Canadian Journal of Earth Sciences, v. 17, no. 6, p. 681-689.

Till, A. B., 1980, Crystalline rocks of the Kigluaik Mountains, Seward Peninsula, Alaska: Seattle, University of Washington, M. Sc. thesis, 97 p.

U.S. Geological Survey, 1980, [Numerous reports about seismic, paleontological, velocity, and well-log data and summary reports on the National Petroleum Reserve in Alaska]: National Geophysical and Solar-Terrestrial Data Center fliers.

Wilson, F. H., 1980, Late Mesozoic and Cenozoic tectonics and the age of porphyry copper prospects, Chignik and Sutwik Island quadrangles, Alaska Peninsula: Hanover, N.H., Dartmouth College, Ph. D. thesis, 177 p.

Winkler, G. R., Miller, R. J., and Case, J. E., 1980, Blocks and belts of blueschist and greenschist in the Valdez quadrangle, Chugach Mountains, southern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 160.

Yeend, Warren, 1980, Placer gold deposits, Mount Hayes quadrangle, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, no. 3, p. 161.

Yearbook

U.S. Geological Survey, 1980, United States Geological Survey yearbook, fiscal year 1979, 169 p.

U.S. GEOLOGICAL SURVEY, 1981

Professional Papers

Himmelberg, G. R., and Loney, R. A., 1981, Petrology of the ultramafic and gabbroic rocks of the Brady Glacier nickel-copper deposit, Fairweather Range, southeastern Alaska: U.S. Geological Survey Professional Paper 1195, 26 p.

Keith, T. E., Foster, H. L., Foster, R. L., Post, E. V., and Lehmbeck, W. L., 1981, Geology of an alpine-type peridotite in the Mount Sorenson area, east-central Alaska: U.S. Geological Survey Professional Paper 1170-A, p. A1-A9.

Bulletins

Miller, T. P., [1983?], Geology of uraniferous alkaline dikes and associated uranium occurrences in the southeastern Seward Peninsula, Alaska: U.S. Geological Survey Bulletin 1530 (in press; approved in 1981).

Open-File Reports

Affolter, R. H., Simon, F. O., and Stricker, G. D., 1981, Chemical analyses of coal from the Healy, Kenai, Seldovia, and Utukok River 1:250,000 quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-654, 89 p.

Bartsch-Winkler, Susan, and Huffman, A. C., 1981, Petrography of the Nanushuk Group and Torok Formation: U.S. Geological Survey Open-File Report 81-1222, 62 p.

Berg, H. C., Decker, J. E., and Abramson, B. S., 1981, Metallic mineral deposits of southeastern Alaska: U.S. Geological Survey Open-File Report 81-122, 136 p., 1 oversize sheet.

Bird, K. J., 1981, Petroleum exploration of the North Slope in Alaska, U.S.A.: U.S. Geological Survey Open-File Report 81-227, 43 p.

———1981, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska—10 wells from the western part of the National Petroleum Reserve in Alaska (NPRA): U.S. Geological Survey Open-File Report 81-1032, 6 p., 10 oversize sheets.

———1981, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska—26 wells from the northern part of the National Petroleum Reserve in Alaska (NPRA): U.S. Geological Survey Open-File Report 81-1033, 6 p., 26 oversize sheets.

———1981, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska—11 wells from the southeastern part of the National Petroleum Reserve in Alaska (NPRA): U.S. Geological Survey Open-File Report 81-1034, 6 p., 11 oversize sheets.

———1981, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska—15 wells from the southeastern part of the National Petroleum Reserve in Alaska (NPRA): U.S. Geological Survey Open-File Report 81-1035, 6 p., 15 oversize sheets.

———1981, Machine-generated displays of well logs and lithology from selected wells on the North Slope of Alaska—7 wells from the east-central North Slope: U.S. Geological Survey Open-File Report 81-1036, 7 p., 6 oversize sheets.

Bolm, J. G., 1981, Preliminary unevaluated map (1976) showing amounts of uplift in lower Cook Inlet, Alaska: U.S. Geological Survey Open-File Report 81-324, 1 oversize sheet.

Bowsher, A. L., ed., 1981, Proceedings of a workshop on clathrates (gas hydrates) in the National Petroleum Reserve in Alaska, July 16-17, Menlo Park, California: U.S. Geological Survey Open-File Report 81-1298, 165 p.

Bowsher, A. L., and Tailleur, I. L., 1981, Availability of petrographic thin-section slides from the Fortress Mountain Formation, central North Slope, Alaska: U.S. Geological Survey Open-File Report 81-1094, 7 p.

———1981, Availability of cores, cuttings, and petrographic thin-section slides from the Ellesmerian strata of 16 test wells, National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1171, 5 p.

Bowsher, A. L., Tailleur, I. L., and Gibson, H. A., 1981, Availability of petrographic thin sections from thirty-five wells from National Petroleum Reserve in Alaska, North Slope, Alaska: U.S. Geological Survey Open-File Report 81-1307, 8 p.

Brosgé, W. P., Reiser, H. N., Dutro, J. T., Jr., and Detterman, R. L., 1981, Organic geochemical data for Mesozoic and Paleozoic shales, central and eastern Brooks Range, Alaska: U.S. Geological Survey Open-File Report 81-551, 17 pl., 2 oversize sheets.

Cameron, C. C., Malterer, T. J., Rawlinson, S. E., and Hardy, S. B., 1981, Surficial geology and peat resources of the Houston area, Susitna valley, Alaska: U.S. Geological Survey Open-File Report 81-1301, 2 oversize sheets.

———1981, Surficial geology and peat resources of the Rogers Creek area, Susitna valley, Alaska: U.S. Geological Survey Open-File Report 81-1302, 3 oversize sheets.

Camp Dresser & McKee, Inc., 1981, Permit requirements for energy and other natural resources for the State of Alaska: U.S. Geological Survey Open-File Report 81-1249, 91 p.

Cobb, E. H., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Skagway quadrangle, Alaska—Supplement to Open-File Report 78-316, Part A, Summaries of data to January 1, 1980: U.S. Geological Survey Open-File Report 81-82-A, p. A1-A10.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the

Skagway quadrangle, Alaska—Supplement to Open-File Report 78-316, Part B, Lists of references to January 1, 1980: U.S. Geological Survey Open-File Report 81-82-B, p. B1-B9

———1981, Summaries of data and lists of references to metallic and selected nonmetallic mineral occurrences in the Mount Fairweather quadrangle, Alaska—Supplement to Open-File Report 78-316, Part A, Summaries of data to January 1, 1980: U.S. Geological Survey Open-File Report 81-249-A, p. A1-A20.

———1981, Summaries of data and lists of references to metallic and selected nonmetallic mineral occurrences in the Mount Fairweather quadrangle, Alaska—Supplement to Open-File Report 78-316, Part B, Lists of references to January 1, 1980: U.S. Geological Survey Open-File Report 81-249-B, p. B1-B15.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Bendeleben quadrangle, Alaska—Supplement to Open-File Report 75-429, Part A, Summaries of data to January 1, 1980: U.S. Geological Survey Open-File Report 81-363-A, p. A1-A25.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Bendeleben quadrangle, Alaska—Supplement to Open-File Report 75-429, Part B, Lists of references to January 1, 1980: U.S. Geological Survey Open-File Report 81-363-B, p. B1-B26.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic occurrences in the Teller quadrangle, Alaska—Supplement to Open-File Report 75-587, Part A, Summaries of data to January 1, 1980: U.S. Geological Survey Open-File Report 81-364-A, p. A1-A25.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Teller quadrangle, Alaska—Supplement to Open-File Report 75-587, Part B, Lists of references to January 1, 1980: U.S. Geological Survey Open-File Report 81-364-B, p. B1-B25.

———1981, Selected Geological Survey, U.S. Bureau of Mines, and Alaska Division of Geologic and Geophysical Survey reports and maps on Alaska released during 1980, indexed by quadrangle: U.S. Geological Survey Open-File Report 81-442, 164 p.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Solomon quadrangle, Alaska—Supplement to Open-File Report 78-181, Part A, Summaries of data to January 1, 1981: U.S. Geological Survey Open-File Report 81-504-A, p. A1-A30.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Solomon quadrangle, Alaska—Supplement to Open-File Report 78-181, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-504-B, p. B1-B36.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Wiseman quadrangle, Alaska—Supplement to Open-File Report 76-340, Part A, Summaries of data to January 1, 1981: U.S. Geological Survey Open-File Report 81-732-A, p. A1-A21.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Wiseman quadrangle, Alaska—Supplement to Open-File Report 76-340, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-732-B, p. B1-B21.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Tanana quadrangle, Alaska—Supplement to Open-File Report 77-432, Part A, Summaries of data to June 1, 1981: U.S. Geological Survey Open-File Report 81-1313-A, p. A1-A23.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Tanana quadrangle, Alaska—Supplement to Open-File Report 77-432, Part B, Lists of references to June 1, 1981: U.S. Geological Survey Open-File Report 81-1313-B, p. B1-B26.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic occurrences in the Livengood quadrangle, Alaska—Supplement to Open-File Report 76-819, Part A, Summaries to August 1, 1981: U.S. Geological Survey Open-File Report 81-1342-A, p. A1-A48.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic occurrences in the Livengood quadrangle, Alaska—Supplement to Open-File Report 76-819, Part B, Lists of references to August 1, 1981: U.S. Geological Survey Open-File Report 81-1342-B, p. B1-B54.

Cobb, E. H., and Chapman, R. M., 1981, Mineral occurrences (other than mineral fuels and construction materials) in the Kantishna River and Ruby quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-170, 94 p.

Cobb, E. H., and Mayfield, C. F., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Ambler River quadrangle, Alaska—Supplement to Open-File Report 75-628, Part A, Summaries of data to January 1, 1981: U.S. Geological Survey Open-File Report 81-570-A, p. A1-A13.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurences in the Ambler River quadrangle, Alaska—Supplement to Open-File Report 75-638, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-570-B, p. B1-B11.

Cobb, E. H., Mayfield, C. F., and Brosgé, W. P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in Arctic, Baird Mts., Chandler Lake, De Long Mts., Demarcation Pt., Howard Pass, Misheguk Mtn., Mt. Michelson, Noatak, Point Lay, and Table Mtn. quadrangles, Alaska—Supplement to Open-File Report 75-628, Part A, Summaries of data to January 1, 1981: U.S. Geological Survey Open-File Report 81-767-A, p. A1-A24.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in Arctic, Baird Mts., Chandler Lake, De Long Mts., Demarcation Pt., Howard Pass, Misheguk Mtn., Mt. Michelson, Noatak, Point Lay, and Table Mtn. quadrangles, Alaska—Supplement to Open-File Report 75-628, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-767-B, p. B1-B14.

Cobb, E. H., and Miller, T. P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska—Supple-

ment to Open-File Report 75-627, Part A, Summaries of data to January 1, 1981: U.S. Geological Survey Open-File Report 81-847-A, p. A1-A13.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrence in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska—Supplement to Open-File Report 75-627, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-847-B, p. B1-B13.

Cobb, E. H., and Reed, B. L., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Iliamna, Lake Clark, Lime Hills, and McGrath quadrangles, Alaska—Supplement to Open-File Report 76-485, Part A, Summaries to January 1, 1981: U.S. Geological Survey Open-File Report 81-1343-A, p. A1-A25.

———1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Iliamna, Lake Clark, Lime Hills, and McGrath quadrangles, Alaska—Supplement to Open-File Report 76-485, Part B, Lists of references to January 1, 1981: U.S. Geological Survey Open-File Report 81-1343-B, p. B1-B20.

Decker, John, Mullen, M. W., and Schwab, C. E., 1981, Aeromagnetic profile of southeastern Alaska: U.S. Geological Survey Open-File Report 81-505, 1 oversize sheet.

Detra, D. E., Risoli, D. A., O'Leary, R. M., Hurrlee, J. A., and Everman, W. E., 1981, Analytical data and statistical summary from the analyses of stream-sediment and heavy-mineral-concentrate samples collected in Bristol Bay, Ugashik, and Karluk quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-963, 88 p., 3 oversize sheets.

Detterman, R. L., Allaway, W. H., Jr., O'Leary, R. M., Houston, David, and Risoli, D. A., 1981, Sample location map and analytical data for rock samples collected in 1980, Ugashik and Karluk quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-173, 1 oversize sheet.

Detterman, R. L., Allaway, W. H., Jr., and Rossiter, R. H., 1981, Locality map and scintillometer data for Ugashik and Karluk quadrangles: U.S. Geological Survey Open-File Report 81-253, 1 oversize sheet.

Dickinson, K. A., and Roberts, M. E., 1981, Summary of radiometric anomalies in Alaska—Collected under contract with U.S. Department of Energy: U.S. Geological Survey Open-File Report 81-428, 1 oversize sheet.

Dolton, G. L., and others, 1981, Estimates of undiscovered recoverable resources of conventionally producible oil and gas in the United States—A summary: U.S. Geological Survey Open-File Report 81-192, 17 p.

Duffield, W. A., and Guffanti, Marianne, 1981, The Geothermal Research Program of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 81-564, 105 p.

Fisher, M. A., Patton, W. W., Jr., and Holmes, M. L., 1981, Geology and petroleum potential of the Norton Basin area, Alaska: U.S. Geological Survey Open-File Report 81-1316, 51 p.

Gibson, H. A., and Bowsher, A. L., 1981, Availability of foraminifera and palynomorph reports from shothole samples of National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1340, 3 p.

Gough, L. P., and Severson, R. C., 1981, Element concentrations in rehabilitation species from thirteen coal strip mines in five western States and Alaska: U.S. Geological Survey Open-File Report 81-182, 110 p.

Hein, J. R., McLean, Hugh, and Vallier, T. L., 1981, Reconnaissance geologic map of Atka and Amlia Islands, Alaska: U.S. Geological Survey Open-File Report 81-159, 1 oversize sheet.

Hessin, T. D., and Crenshaw, G. L., 1981 [1982], Geochemical map showing the distribution and abundance of sulfate and fluoride in unfiltered water samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-P, 1 sheet.

Hessin, T. D., and Day, G. W., 1981 [1982], Geochemical map showing the distribution and abundance of cobalt, chromium, and nickel in the nonmagnetic heavy-mineral concentrate samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-T, 1 sheet.

Hessin, T. D., and Hoffman, J. D., 1981 [1982], Geochemical map showing the distribution and abundance of cobalt, chromium, and nickel in stream-sediment samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-R, 1 sheet.

Hessin, T. D., Everman, W. K., and Crenshaw, G. L., 1981 [1982], Map showing stream-sediment samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-M, 1 sheet.

———1981 [1982], Geochemical map showing the distribution and abundance of copper, zinc, molybdenum, arsenic, and uranium in filtered water in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-N, 1 sheet.

———1981 [1982], Geochemical map showing anomalous patterns for the element copper in stream sediments, filtered waters, and nonmagnetic heavy-mineral concentrates in the West Chichago-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-O, 1 sheet.

Hessin, T. D., Maslowski, M. G., and Cooley, E. F., 1981 [1982], Geochemical map showing the distribution and abundance of copper, lead, zinc, and barium in the nonmagnetic heavy-mineral concentrate samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-S, 1 sheet.

Hessin, T. D., Maslowski, M. G., and Day, G. W., 1981 [1982], Geochemical map showing the distribution and abundance of silver, arsenic, gold, tin, and tungsten in the nonmagnetic heavy-mineral concentrate in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-U, 1 sheet.

———1981 [1982], Geochemical map showing the distribution and abundance of copper, lead, and barium in stream sediment samples in the West Chichagof-Yakobi Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-27-Q, 1 sheet.

Hessin, T. D., Speckman, W. S., Crenshaw, J. D., Hoffman, J. D., and Cooley, E. F., 1981, Analytical results of various types of samples taken in the West Chichagof-Yakobi

Wilderness study area, Sitka quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-905, 72 p.

Jones, D. L., Silberling, N. J., Berg, H. C., and Plafker, George, 1981, Map showing tectonostratigraphic terranes of Alaska, columnar sections, and summary descriptions of terranes: U.S. Geological Survey Open-File Report 81-792, 20 p., 2 oversize sheets.

Koch, R. D., and Elliott, R. L., 1981, Maps showing distribution of gold and silver in geochemical samples from Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-C, 2 oversize sheets.

———1981, Maps showing distribution and abundance of copper in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-D, 4 oversize sheets.

———1981, Maps showing distribution and abundance of lead in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-E, 4 oversize sheets.

———1981, Maps showing distribution and abundance of zinc in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-F, 4 oversize sheets.

———1981, Maps showing distribution and abundance of molybdenum in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-G, 2 oversize sheets.

———1981, Maps showing distribution and abundance of tin in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-H, 2 oversize sheets.

———1981, Maps showing distribution and abundance of beryllium in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-I, 2 oversize sheets.

———1981, Maps showing distribution and abundance of niobium in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-J, 2 oversize sheets.

———1981, Maps showing distribution and abundance of yttrium in geochemical samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-K, 2 oversize sheets.

Koch, R. D., Elliot, R. L., O'Leary, R. M., and Risoli, D. A., 1981, Trace-element data for rock samples from the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 80-910-A, 1 oversize sheet.

Koch, R. D., Elliot, R. L., and Rossiter, Richard, 1981, Total gamma ray intensities at ground stations in the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-840, 2 sheets.

Le Compte, J. R., 1981, Maps showing interpretation of Landsat imagery of the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811-D, 2 oversize sheets.

———1981, Map showing interpretation of Landsat imagery of the Valdez 1° by 3° quadrangle, southern Alaska: U.S. Geological Survey Open-File Report 80-892-F, 1 oversize sheet.

———1981, Map showing interpretation of Landsat imagery of the Bradfield Canal quadrangle, southeastern Alaska: U.S. Geological Survey Open-File Report 81-728-L, 2 oversize sheets.

———1981, Preliminary maps showing interpretation of Landsat imagery of the Ugashik and Karluk quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-776, 2 oversize sheets.

———1981, Landsat features maps of the Circle quadrangle, Alaska: U.S. Geological Survey Open-File Report 81-782, 2 oversize sheets.

———1981, Landsat features maps of the Petersburg quadrangle and vicinity, southeastern Alaska: U.S. Geological Survey Open-File Report 81-799, 2 sheets.

———1981, Landsat features maps of the Ketchikan and Prince Rupert quadrangles, Alaska: U.S. Geological Survey Open-File Report 81-1139, 2 oversize sheets.

Luepke, Gretchen, and Leong, K. W., 1981, Areal and textural distribution of particulate gold in sediments from Bluff Beach, Alaska: U.S. Geological Survey Open-File Report 81-1085, 39 p.

Luthy, S. T., Foster, H. L., and Cushing, G. W., 1981, Petrographic and chemical data on Cretaceous granitic rocks of the Big Delta quadrangle, Alaska: U.S. Geological Survey Open-File Report 81-398, 12 p., 3 oversize sheets.

Madison, R. J., 1981, Effects of placer mining on hydrologic systems in Alaska: U.S. Geological Survey Open-File Report 81-217, 28 p.

Mitchell, P. A., Silberman, M. L., and O'Neil, J. R., 1981, Genesis of gold vein mineralization in an Upper Cretaceous turbidite sequence, Hope-Sunrise district, southern Alaska: U.S. Geological Survey Open-File Report 81-103, 18 p.

Molenaar, C. M., 1981, Depositional history and seismic stratigraphy of Lower Cretaceous rocks, National Petroleum Reserve in Alaska and adjacent areas: U.S. Geological Survey Open-File Report 81-1084, 43 p.

Molenaar, C. M., Egbert, R. M. and Krystinik, L. F., 1981, Depositional facies, petrography, and reservoir potential of the Fortress Mountain Formation (Lower Cretaceous), central North Slope, Alaska: U.S. Geological Survey Open-File Report 81-967, 32 p.

Moll, E. J., Silberman, M. L., and Patton, W. W., 1981, Chemistry, mineralogy, and K-Ar ages of igneous and metamorphic rocks of the Medfra quadrangle, Alaska· U.S. Geological Survey Open-File Report 81-811-C, 19 p., 2 oversize sheets.

Nilsen, T. H., Moore, T. E., Brosgé, W. P., and Dutro, J. T., Jr., 1981, Sedimentology and stratigraphy of the Kanayut Conglomerate and associated units, Brooks Range, Alaska—Report of 1979 field season: U.S. Geological Survey Open-File Report 81-506, 39 p.

O'Leary, R. M., Risoli, D. A., Curtin, G. C., and McDanal, S. K., 1981, Spectrographic and chemical analyses of stream-sediment and glacial-debris samples from Mount Hayes quadrangle, Alaska: U.S. Geological Survey Open-File Report 81-226, 55 p., 1 oversize sheet.

Petering, G. W., and Smith, T. N., 1981, Stratigraphic sections, Hallo Bay to Katmai Bay, Shelikof Strait, Alaska, 1979: U.S. Geological Survey Open-File Report 81-21, 1 oversize sheet.

Sable, E. G., Dutro, J. T., Jr., Mangus, M. D., and Morris, R. H., 1981, Geology of the Kukpowruk-Nuka Rivers region, northwestern Alaska: U.S. Geological Survey Open-File Report 81-1078, 240 p., 1 oversize sheet.

Schmoll, H. R., Yehle, L. A., and Gardner, C. A., 1981, Preliminary geologic map of the Congahbuna area, Cook Inlet, Alaska: U.S. Geological Survey Open-File Report 81-429, 8 p., 1 oversize sheet.

Schwab, C. E., Patton, W. W., Jr., and Moll, E. J., 1981, Mineral occurrence map of the Medfra quadrangle, Alaska; U.S. Geological Survey Open-File Report 81-811-B, 2 oversize sheets.

Silberling, N. J., Richter, D. H., Jones, D. L., and Coney, P. C., 1981, Geologic map of the bedrock part of the Healy A-1 quadrangle south of the Talkeetna-Broxon Gulch fault system, Clearwater Mountains, Alaska: U.S. Geological Survey Open-File Report 81-1288, 1 oversize sheet.

Silberman, M. L., Field, C. W., and Berry, A. L., eds., 1981, Proceedings of the symposium of mineral deposits of the Pacific Northwest: U.S. Geological Survey Open-File Report 81-355, 345 p. [The following articles were used in preparing parts of this document: Hitzman, M. W., Geology of the BT claim group, southwestern Brooks Range, Alaska (p. 17-28); Lange, I. M., and others, Isotope geochemistry of stratiform zinc-lead-barium deposits, Red Dog Creek and Drenchwater Creek areas, northwestern Brooks Range, Alaska (p. 1-14); Yeend, Warren, Placer gold deposits, Mount Hayes quadrangle, Alaska (p. 74-83).]

Smith, J. G., and Diggles, M. F., 1981, Potassium-argon determinations in the Ketchikan and Prince Rupert quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 78-73-N, 16 p., 1 oversize sheet.

Taylor, M. E., ed., 1981, Short papers for the Second International Symposium on the Cambrian system, 1981: U.S. Geological Survey Open-File Report 81-743, 3 microfiche sheets.

Timmcke, T. A., 1981, Palynology of the Lower Cretaceous Pebble Shale Unit, Point Barrow, Alaska: U.S. Geological Survey Open-File Report 81-1304, 127 p.

Toth, M. I., 1981, Petrology, geochemistry, and origin of the Red Mountain ultramafic body near Seldovia, Alaska: U.S. Geological Survey Open-File Report 81-514, 86 p., 2 oversize sheets.

Varnes, K. L., Dolton, G. L., and McMullin, R. H., 1981, Oil and gas resource assessment areas, U.S. Geological Survey, Geologic Division, 1980—Alaska, regions 1 and 1A: U.S. Geological Survey Open-File Report 81-84-A, 1 oversize sheet.

Williams, J.R., and Johnson, K. M., compilers, 1981, Map and description of late Tertiary and Quaternary deposits, Valdez quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-892-C, 2 oversize sheets.

Wilson, C. W., comp., 1981, Bibliographic references to Alaskan fossils, 1839-May 1979: U.S. Geological Survey Open-File Report 81-628, 74 p.

Wilson, F. H., 1981, Map and table showing radiometric ages of rocks in the Aleutian Islands and the Alaska Peninsula: U.S. Geological Survey Open-File Report 81-471, 23 p., 1 oversize sheet.

Wilson, F. H., and Shew, Nora, 1981, Map and tables showing preliminary results of potassium-argon age studies in the Circle quadrangle, Alaska: U.S. Geological Survey Open-File Report 81-889, 1 oversize sheet.

Winkler, G. R., and Plafker, George, 1981, Geologic map and cross sections of the Cordova and Middleton Island quadrangles, southern Alaska: U.S. Geological Survey Open-File Report 81-1164, 25 p., 1 sheet.

Winkler, G. R., Miller, R. J., MacKevett, E. M., Jr., and Holloway, C. D., 1981, Map and summary table describing mineral deposits in the Valdez quadrangle, southern Alaska: U.S. Geological Survey Open-File Report 80-892-B, 2 oversize sheets.

Winkler, G. R., Silberman, M. L., Grantz, Arthur, Miller, R. J., and MacKevett, E. M., Jr., 1981, Geologic map and summary geochronology of the Valdez quadrangle, southern Alaska: U.S. Geological Survey Open-File Report 80-892-A, 2 oversize sheets.

Witmer, R. J., 1981, Availability of palynomorph and foraminifera microscope slides from test wells of National Petroleum Reserve in Alaska; Group II: U.S. Geological Survey Open-File Report 81-13, 18 p.

———1981, Availability of palynomorph and foraminifera microscope slides from test wells of National Petroleum Reserve in Alaska; Group III—Final release: U.S. Geological Survey Open-File Report 81-1081, 14 p.

Witmer, R. J., Haga, Hideyo, and Mickey, M. B., 1981, Biostratigraphic correlations of selected wells of National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1165, 89 p., 6 oversize sheets.

———1981, Stratigraphic report of 33 wells drilled from 1975 to 1981 in National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 81-1166, 47 p.

Miscellaneous Field Studies Maps

Case, J. E., Barnes, D. F., Detterman, R. L., Morin, R. L., and Sikora, R. F., 1981, Gravity anomaly and interpretation map of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053-J, 5 p., 1 sheet.

Case, J. E., Cox, D. P., Detra, D. E., Detterman, R. L., and Wilson, F. H., 1981, Maps showing aeromagnetic survey and geologic interpretation of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053-B, 2 sheets and 5-page text.

Detterman, R. L., Yount, M. E., and Case, J. E., 1981, Megafossil sample locality map, checklists, and stratigraphic sections of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053-N, 2 sheets.

Grybeck, D. J., and Nelson, S. W., 1981, Map and interpretation of the structural geology of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-B, 1 sheet.

———1981, Mineral deposit map of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-F, 1 sheet.

Grybeck, D. J., McDanal, S. K., Cooley, E. F., and O'Leary, R. M., 1981, Map of anomalous rock samples and histograms of trace metals in rocks of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-E, 1 sheet.

Hamilton, T. D., 1980 [1981], Surficial geologic map of the Killik River quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1234, 1 sheet.

———1981, Surficial geologic map of the Survey Pass quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1320, 1 sheet.

Le Compte, J. R., 1981, Maps showing interpretation of Landsat imagery of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-H, 2 sheets.

Le Compte, J. R., and Steele, W. C., 1981, Maps showing interpretation of Landsat imagery of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053-O, 2 sheets.

Nelson, S. W., and Grybeck, Donald, 1981, Geologic map of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-A, 2 sheets.

Miscellaneous Investigations Series

Detterman, R. L., Miller, T. P., Yount, M. E., and Wilson, F. H., 1981, Geological map of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1229, 1 sheet.

Fabiano, E. B., and Peddie, N. W., 1981, Magnetic total intensity in the United States—Epoch 1980: U.S. Geological Survey Miscellaneous Investigations Series Map I-1370, 1 sheet. (Supersedes Map I-0915.)

Patton, W. W., Jr., and Csejtey, Béla, Jr., 1980 [1981], Geologic map of St. Lawrence Island, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1203, 1 sheet.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1980 [1981], Geologic map of the Demarcation Point quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1133, 1 sheet.

Geologic Quadrangle Maps

Winkler, G. R., and MacKevett, E. M., Jr., 1981, Geologic map of the McCarthy C-7 quadrangle, Alaska: U.S. Geological Survey Geologic Quadrangle Map GQ-1533, 1 sheet.

Circulars

Albert, N. R. D., and Hudson, Travis, eds., 1981, The United States Geological Survey in Alaska: Accomplishments during 1979: U.S. Geological Survey Circular 823-B, p. B1-B151. The following is a partial list of articles:

- Barnes, D. F., Gravity measurements useful in exploration and evaluation of Nimiuktuk barite deposits
- Berg, H. C., Upper Triassic volcanogenic massive-sulfide metallogenic province identified in southeastern Alaska
- Brew, D. A., and others, Newly recognized alkali granite stock, southwestern Kupreanof Island, Alaska
- Carter, R. D., National Petroleum Reserve in Alaska—Data release
- Coney, P. J., Silberling, N. J., Jones, D. L., and Richter, D. H., Structural relations along the leading edge of the Wrangellia terrane in the Clearwater Mountains, Alaska
- Csejtey, Béla, Jr., and St. Aubin, Dennis, Evidence for northwestward thrusting in the Talkeetna superterrane and its regional significance
- Dutro, J. T., Jr., and Patton, W. W., Jr., Lower Paleozoic platform carbonate sequence in the Medfra quadrangle, Alaska
- Le Compte, J. R., and Steele, W. C., Landsat data interpretation in the south-central Brooks Range and in southeastern Alaska
- Menzie, W. D., Foster, H. L., and Mosier, D. L., Metalliferous mineral resource potential of the Big Delta quadrangle
- Molenaar, C. M., Depositional history of the Nanushuk Group and related strata
- Silberman, M. L., Mitchell, P. A., and O'Neil, J. R., Isotopic data bearing on the origin and age of the epithermal lode gold deposits in the Hope-Sunrise mining district, northern Kenai Peninsula, Alaska
- Sonnevil, R. A., New data concerning the geology of the North Bradfield River iron prospect, southeastern Alaska
- Winkler, G. R., Miller, R. J., Silberman, M. L., Grantz, Arthur, Case, J. E., and Pickthorn, W. J., Layered gabbroic belt of regional extent in the Valdez quadrangle
- Yeend, Warren, Placer gold deposits, Mount Hayes quadrangle, Alaska
- Zimmerman, Jay, Frank, C. O., and Bryn, Sean, Mafic rocks in the Avan Hills ultramafic complex, De Long Mountains

Clarke, P. F., Hodgson, H. E., and North, G. W., 1981, A guide to obtaining information from the USGS, 1981: U.S. Geological Survey Circular 777, 42 p.

Coonrad, W. L., ed., 1982, The United States Geological Survey in Alaska: Accomplishments during 1980: U.S. Geological Survey Circular 844, 178 p. Only the following articles, based on work done in 1980, have been used in this document:

- Ellersieck, Inyo, Jansons, Uldis, Mayfield, C. F., and Tailleur, I. L., The Story Creek and Whoopee Creek lead-zinc-silver occurrences, western Brooks Range, Alaska
- Huffman, A. C., Kirk, A. R., and Molenaar, C. M., Uranium investigations—Northeastern Alaska
- Yeend, Warren, Placers and placer mining, Circle district, Alaska

Detterman, R. L., and others, 1981, The Alaska Mineral Resource Assessment Program—Background information to accompany folio of geologic and resources maps of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Circular 802. 16 p.

Dolton, G. L., and others, 1981, Estimates of undiscovered recoverable conventional resources of oil and gas in the United States: U.S. Geological Survey Circular 860, 87 p.

Guild, P. W., 1981, Preliminary metallogenic map of North America: A numerical listing of deposits: U.S. Geological Circular 858-A, p. A1-A93.

———1981, Preliminary metallogenic map of North America: An alphabetical listing of deposits: U.S. Geological Survey Circular 858-B, p. B1-B72.

Reed, K. M., ed., 1981, The U.S. Geological Survey in Alaska—1981 programs: U.S. Geological Survey Circular 843, 111 p.

Shawe, Daniel, comp., 1981, U.S. Geological Survey workshop on nonfuel mineral-resource appraisal of Wilderness and CUSMAP areas: U.S. Geological Survey Circular 845, 18 p.

Whitmore, F. C., Jr., 1981, Resources for the 21st century—Summary and conclusions of the International Centennial Symposium of the U.S. Geological Survey: U.S. Geological Survey Circular 857, 41 p.

Water-Resources Investigations

Scully, D. R., Krumhardt, A. P., and Kernodle, D. R., 1981 [1982], Hydrologic reconnaissance of the Beluga, Peters

Creek, and Healy coal areas: U.S. Geological Survey Water-Resources Investigation 81-56, 71 p. [Also available from NTIS. See also the basic-data release for these areas: Open-File Report 80-1206.]

Publications by Geological Survey authors in non-Survey journals and books

Ben-Avram, Z., Nur, A., Jones, D., and Cox, A., 1981, Continental accretion: From oceanic plateaus to allochthonous terranes: Science, v. 213, no. 4503, p. 47-54.

Brew, D. A., 1981, The Coast plutonic complex in southeastern Alaska and northwestern British Columbia [abs.]: Geological Association of Canada, Annual Meeting, Vancouver, British Columbia, 1981, Programme and Abstracts, p. 9-10.

Bruns, T. R., Carlson, P. R., and Plafker, George, 1981, Structural deformation in northern Gulf of Alaska: Transition from transform to convergent plate motion (abs.): American Association of Petroleum Geologists Bulletin, v. 65, no. 5, p. 907.

Callahan, J. E., 1981, Geology and quality of coal beds in the Cretaceous Corwin Formation in the northern foothills of western arctic Alaska [abs.]: International Symposium on Arctic Geology, 3rd, Calgary, Alberta, Canada, 1981 [Programme with Abstracts], p. 33.

Fox, J. E., Lambert, P. W., and Pitman, J. K., 1981, Depositional environments and reservoir properties of sandstones of Lower Cretaceous Nanushuk and Upper Cretaceous Colville Groups, Umiat Test Well 11, National Petroleum Reserve, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v., 65, no. 5, p. 926.

Gryc, George, and Tailleur, I. L., 1981, Recent exploration results in the National Petroleum Reserve in Alaska [abs.]: International Symposium on Arctic Geology, 3rd, Calgary, Alberta, Canada, 1981 [Programme with Abstracts], p. 55.

Hill, Malcolm, Morris, Julie and Whelan, Joseph, 1981, Hybrid granodiorites intruding the accretionary prism, Kodiak, Shumagin, and Sanak Islands, southwest Alaska: Journal of Geophysical Research, v. 86, no. 11, p. 10569-10590.

Hudson, Travis, Arth, J. G., and Muth, K. G., 1981, Geochemistry of intrusive rocks associated with molybdenite deposits, Ketchikan quadrangle, southeastern Alaska: Economic Geology, v. 76, no. 5, p. 1225-1232.

Lange, I. M., Nokleberg, W. J., and Zehner, R. E., 1981, Mineralization of Late Paleozoic island arc rocks of Wrangellia terrane, Mount Hayes quadrangle, eastern Alaska Range, Alaska [abs.]: Geological Association of Canada Abstacts, v. 6, p. A33.

Lantz, R. J., 1981, Barrow gas-fields—N. Slope, Alaska: Oil and Gas Journal, v. 79, no. 13, p. 197-200.

Magoon, L. B., and Kirschner, C. E., 1981, Evolution of sedimentary systems during Mesozoic and Cenozoic in southern Alaska—An overview [abs.]: American Association of Petroleum Geologists Bulletin, v. 65, no. 5, p. 953.

Marsh, S. P., and Cathrall, J. B., 1981, Geochemical evidence for a Brooks Range mineral belt, Alaska: Journal of Geochemical Exploration, v. 15, no. 1/3, p. 367-380. [See also their article in the Proceedings of the 1980 Symposium of the Association of Exploration Geochemistry held in Hanover, West Germany. H. Gondlatch is the volume's editor.]

Nilsen, T. H., Moore, T. E., Brosgé, W. P., Dutro, J. T., Jr., Balin, D. F., and Johnson, S. V., 1981, Allochthonous Upper Devonian fluvial strata, northern Alaska [abs.]: International Symposium on Arctic Geology, 3rd, Calgary, Alberta, Canada, 1981 [Programme with Abstracts], p. 96.

Nokleberg, W. J., Zehner, R. E., Lange, I. M., and Tripp, R. B., 1981, Metallogeny of accreted Andean-type and island arc terranes, Mount Hayes quadrangle, eastern Alaska Range, Alaska [abs.]: Geological Association of Canada Abstracts, v. 6, p. A43.

Patton, W. W., Jr., and Moll, E. J., 1981, A geologic transect between the Alaska Range and Norton Sound, western Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 13, no. 7, p. 527.

Saleeby, J. B., and Eberlein, G. D., 1981, An ensimatic basement complex and its relation to the early Paleozoic volcanic-arc sequence of southern Prince of Wales Island, southeastern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 13, no. 2, p. 104.

Smith, T. N., and Petering, G. W., 1981, Petroleum potential of Shelikof Strait based on outcrops in Katmai National Monument, Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 65, no. 5, p. 994.

Vallier, T. L., Hein, J. R., McLean, Hugh, Scholl, D. W., and Friesen, W. B., 1981, Igneous rocks of Amlia Island: Implications for the early volcanic and tectonic histories of the Aleutian Island arc [abs.]: Eos (American Geophysical Union Transactions), v. 62, no. 45, p. 1092.

[Members of the U.S. Geological Survey also contribute to reports by the Alaska Division of Geological and Geophysical Surveys (DGGS). DGGS Information Circular IC-11 lists recent publications.]

Yearbook

U.S. Geological Survey, 1981, United States Geological Survey yearbook, fiscal year 1980, 137 p.

———1982, U.S. Geological Survey Activities, fiscal year 1981: U.S. Geological Survey Circular 875, 161 p.

Special Geologic Map

Guild, P. W. [chairman of North American Metallogenic Map Committee and chief compiler], and others, 1981, Metallogenic map of North America: U.S. Geological Survey, 4 sheets.

BUREAU OF MINES, 1980

Information Circulars

Berg, A. W., and Carrillo, F. V., 1980, MILS: The Mineral Industry Location System of the Federal Bureau of Mines: Bureau of Mines Information Circular 8815, 24 p.

Open-File Reports (OFR)

Barker, J. C., 1980, Occurrences and potential of lead and zinc mineralization in the Mount Schwatka region, Alaska: Bureau of mines OFR 70-80, 51 p.

Bureau of Mines, Alaska Field Operations Center, 1980, Mineral appraisal of the [proposed] Utukok and Colville Wild and Scenic Rivers—A summary report: Bureau of Mines OFR 37-80, 8 p.

———1980, Mineral deposits of the Cape Krusenstern area, Alaska: Bureau of Mines OFR 42-80, 22 p.

Colp, D. B., 1980, Fortymile placer district, Resource inventory, Alaska: Bureau of Mines OFR 43-80, 16 p.

Jansons, Uldis, and Baggs, D. W., 1980, Mineral investigations of the Misheguk Mountain and Howard Pass quadrangles, National Petroleum Reserve, Alaska: Bureau of Mines OFR 38-80, 76 p.

Cooperative publications—Wilderness studies of the Bureau of Mines with the U.S. Geological Survey. [On reference at Alaska Field Operations Center, Juneau Bureau of Mines Library.]

Stablein, N. K., 1980, Report on the mineral resource investigations of six areas of central and northeastern Alaska: [Report no.] 33(80), 186 p.

Tysdal, A. K., 1980, Uranium/thorium determinations on samples collected from seven quadrangles in eastern Alaska: [Report no.] 158(80), 32 p. and appendix.

Reports by Bureau of Mines authors in non-bureau publications

Carnes, D. R., 1980, Alaska's minerals: A look at 1979: Alaska Construction and Oil, v. 20, no. 1, p. 40-43.

BUREAU OF MINES, 1981

Information Circulars

Barker, J. C., Still, J. C., Mowatt, T. C., and Mulligan, J. J., 1981, Critical and strategic minerals in Alaska—Cobalt, the platinum-group metals, and chromite: Bureau of Mines Information Circular 8869, 8 p.

Peterson, G. R., Bleiwas, D. I., and Thomas, P. R., 1981, Cobalt availability, domestic—A minerals availability system assessment: Bureau of Mines Informations Circular 8848, 31 p.

Open-File Reports (OFR)

Barker, J. C., 1981, Mineral investigations in the Porcupine River drainage, Alaska: Bureau of Mines OFR 27-81, 189 p.

———1981, Mineral investigations of certain lands in the eastern Brooks Range: Bureau of Mines OFR 37-81, 288 p.

———1981, Coal and uranium investigations of the Yukon Flats Cenozoic basin: Bureau of Mines OFR 140-81, 63 p.

Clautice, K. H., and Mowatt, T. C., 1981, Trona occurrences within the Yukon Flats basin, Alaska: Bureau of Mines OFR 69-81, 34 p.

Foley, Jeff, and Barker, J. C., 1981, Tungsten investigations near VABM Bend, eastern Alaska: Bureau of Mines OFR 29-81, 24 p.

Hansen, Eric, and others, 1981, Preliminary report on the mineral potential of the Alaskan Peninsula: Bureau of Mines OFR 36-81, 39 p. [Contract report.]

Hoekzema, R. B., 1981, Placer sampling and related Bureau of Mines activities on the Kenai Peninsula, Alaska: Bureau of Mines OFR 138-81, 28 p.

———1981, Billings Glacier molybdenum-copper occurrence, Whittier, Alaska: Bureau of Mines OFR 141-81, 27 p.

Jansons, Uldis, 1981, Preliminary evaluation of sample data from the proposed Chukchi Imuruk National Reserve (now Bering Land Bridge Preserve), Alaska: Bureau of Mines OFR 28-81, 8 p.

Jansons, Uldis, 1981, 1979 Bureau of Mines sampling sites and analytical results for samples collected in the Chugach National Forest, Alaska: Bureau of Mines OFR 83-81, 229 p.

Jansons, Uldis, and Parke, M. A., 1981, 1978 Mineral investigations of Misheguk Mountain and Howard Pass quadrangles: Bureau of Mines OFR 26-81, 195 p.

McDermott, M. M., Foley, J. Y., and Southworth, D. D., 1981, Investigation of a copper occurrence in the Rampart diorites: Bureau of Mines OFR 143-81, 23 p.

Still, J. C., and Weir, K. R., 1981, Mineral land assessment of the west portion of western Chichagof Island, southeast Alaska: Bureau of Mines OFR 89-81, 168 p.

Reports of Investigation

Dahlin, D. C., Rule, A. R., and Brown, L. L., 1981, Beneficiation of potential platinum resources from southeastern Alaska: Bureau of Mines Report of Investigations RI 8553, 14 p.

Cooperative publications

Averitt, W. [Bendix Field Engineering Group], and Barker, J. [Bureau of Mines], 1981, Report of analyses from mineral resource investigations in central and eastern Alaska, Final Report: Grand Junction, Colo., Bendix Field Engineering Corp. [for the Bureau] GJBX 178(81), 148 p.

Reports by Bureaus of Mines authors in non-Bureau publications

Barker, J. C., 1981, Reconnaissance of rare metal occurrences associated with the Old Crow batholic, eastern Alaska-northwestern Canada Alaska Division of Geological and Geophysical Surveys Special Paper, Annual Short Notes on Alaskan Geology, p. 43-51.

Pittman, Tom, 1981, Mining picks up across the State. Gold was the glamor metal: Alaska Construction and Oil, v. 22, no. 6, p. 28, 30, 31, 34.

[The Bureau of Mines publishes a yearbook, "Metals, Minerals and Fuels," that contains listings by commodity with yearly production figures for all States. These volumes are available for 1932 through the present year.

The Bureau also prints annually "Mineral Commodity Summaries." The 1981 edition contains information for 1980 on the nonfuel mineral industry, Government programs, tariffs, and 5-year statistics for 89 minerals and metals. World resource data are provided by the U.S. Geological Survey.]

Special publications

Mattson, M. J., 1981, Index of Bureau of Mines publications on Alaska [1911-1981] in the Bureau of Mines library at Juneau, Alaska: Bureau of Mines, 63 p.

NATIONAL PARK SERVICE, 1980

National Park Service, Denver Service Center, 1980, Environmental overview and analysis of mining—Kantishna Hills, Denali National Monument, Alaska: 147 p.

Streveler, G. P., Worley, I. A., and Molina, B. F., eds., 1980, Lituya Bay environmental survey; Final report CX-9000-

7-0045; Volume I, text, and Volume II, appendixes: Fairbanks, Cooperative Park Studies Unit, 348 p. and 103 p., respectively.

NATIONAL PARK SERVICE, 1981

National Park Service, Denver Service Center, 1981, Environmental overview and analysis of mining effects—Denali National Park and Preserve, Alaska: 184 p. and maps.

[The National Park Service, with the University of Alaska's Alaska Cooperative Park Studies Unit in Fairbanks, prepares a final report on each calendar year's activities. These reports are available from the Unit, 210 Irving Building, on the Fairbanks Campus of the University. A list of National Park Service publications is available from the National Park Service's Anchorage office at 540 West Fifth Avenue.]

BUREAU OF LAND MANAGEMENT, 1980

Bureau of Land Management, 1980, BLM land use plan for south-central Alaska—A summary: Bureau of Land Management, Anchorage District Office, 40 p.

BUREAU OF LAND MANAGEMENT, 1981

Bureau of Land Management, 1981, Proposed land use plan summary, Southwest Planning Area: Bureau of Land Management, Anchorage District Office [not paginated].

———1981, Annual report to Congress—Oil and gas leasing program for non-North Slope Federal lands in Alaska; required under Section 1008 of the Alaska National Interest Lands Conservation Act: Bureau of Land Management [transmitted December 1981], 3 p. and attachments.

Bureau of Land Management, National Petroleum Reserve in Alaska, 1981, Draft Environmental Assessment, Federal Oil and Gas Lease Sale: Anchorage, 148 p. [June].

———1981, Final Environmental Assessment, Federal Oil and Gas Lease Sale: Anchorage, 153 p. [Sept.].

Madison, R. J., 1981, Effects of placer mining on hydrologic systems in Alaska—Status of knowledge: U.S. Department of the Interior, Bureau of Land Management BLM-Alaska Technical Report 7 [BLM/AL/TR-81/07], 32 p. [Also available from National Technical Information Service. A compilation of several hundred references to related books and articles, many abstracted, is in the Bureau's FAMULUS computer file. For information about access to this system, contact the Alaska Resources Library, Federal Building, 701 C Street, Anchorage, Alaska.]

DEPARTMENT OF AGRICULTURE, FOREST SERVICE, 1980 AND 1981

Forest Service, 1981, Draft Environmental Impact Statement; Road access and bulk sampling at the U.S. Borax Quartz Hill molybdenum claims, Tongass National Forest, Alaska: Volume 1, text [four sections, summary and references, individually paginated], Volume 2, appendices [five appendixes, individually paginated].

DEPARTMENT OF ENERGY, 1980 AND 1981

Dennis, B. M., Graham, William, and Schmidt, James, 1982, Index of Open File Reports from the Department of Energy, Grand Junction Area Office, January 1982: Department of Energy, Preliminary Map PM-36, Alaska, 1 oversize sheet.

National Uranium Resource Evaluation Reports

[All reports are available from the Department of Energy, P.O. Box 2657, Grand Junction, or from Bendix Field Engineering Corporation, P.O. Box 1569, Grand Junction, CO 81502. Some are in microfiche form only.]

Airborne gamma-ray spectrometer and magnetometer surveys released since January 1, 1980

Quadrangle	*Report number*	*Quadrangle*	*Report Number*
Norton Bay	GJBX-72 (80)	Wainwright	GJBX-296(81)
Nulato	GJBX-73 (80)	Meade River	GJBX-297(81)
Unalakleet	GJBX-74 (80)	Teshekpuk	GJBX-298(81)
Ruby	GJBX-75 (80)	Harrison Bay	GJBX-299(81)
Medfra	GJBX-76 (80)	Beechey Point	GJBX-300(81)
McGrath	GJBX-77 (80)	Point Lay	GJBX-301(81)
Ophir	GJBX-78 (80)	Utukok River	GJBX-302(81)
Sleetmute	GJBX-79 (80)	Lookout Ridge	GJBX-303(81)
Iditarod	GJBX-80 (80)	Ikpikpuk River	GJBX-304(81)
Kantishna River	GJBX-94 (80)	Umiat	GJBX-305(81)
Barrow	GJBX-295(81)	Sagavanirktok	GJBX-306(81)

Hydrogeochemical and stream-sediment reconnaissance reports issued between January 1, 1980, and March 1, 1982

Quadrangle	*Report number*	*Quadrangle*	*Report number*
Dixon Entrance and Prince Rupert D-6	GJBX-257(80)	Arctic	GJBX-253(81)
Healy	GJBX-88 (81)	Chandalar	GJBX-254(81)
Ihamna	GJBX-89 (81)	Survey Pass	GJBX-255(81)
Valdez	GJBX-90 (81)	Table Mountain	GJBX-256(81)
Mt. Hayes	GJBX-91 (81)	Wiseman	GJBX-257(81)
Seldovia	GJBX-92 (81)	Hughes	GJBX-258(81)
Cordova	GJBX-185(81)	Philip Smith Mountains	GJBX-259(81)
Icy Bay	GJBX-186(81)	Skagway	GJBX-260(81)
Nome	GJBX-187(81)	Yakutat	GJBX-261(81)
Solomon	GJBX-188(81)	Baird Mountains	GJBX-262(81)
Bering Glacier	GJBX-189(81)	Bradfield Canal	GJBX-376(81)
Fort Yukon	GJBX-201(81)	Nabesna	GJBX-377(81)
Gulkana	GJBX-202(81)	Beaver	GJBX-378(81)
Lake Clark	GJBX-203(81)	Ketchikan	GJBX-381(81)
Anchorage	GJBX-204(81)	McCarthy	GJBX-382(81)
Christian	GJBX-205(81)	Livengood	GJBX-2 (82)
Kenai	GJBX-206(81)	Prince Rupert	GJBX-3 (82)
Norton Bay	GJBX-207(81)	Tanacross	GJBX-4 (82)
Ambler River	GJBX-208(81)		

Hydrogeochemical and stream-sediment reconnaissance basic-data surveys issued between January 1, 1980, and March 1, 1982

Quadrangle	*Report number*	*Quadrangle*	*Report number*
Survey Pass	GJBX-150(81)	Chandler Lake	GJBX-155(81)
Arctic	GJBX-151(81)	Demarcation Point	GJBX-156(81)
Barter Island	GJBX-152(81)	Flaxman Island	GJBX-157(81)
Beaver	GJBX-153(81)	Hughes	GJBX-158(81)
Bradfield Canal	GJBX-154(81)	Juneau	GJBX-159(81)

Hydrogeochemical and stream-sediment reconnaissance basic-data surveys (continued)

Killik River	GJBX-160(81)	Utukok River	GJBX-250(81)
Lookout Ridge	GJBX-161(81)	De Long Mountains	GJBX-251(81)
Mount Fairweather	GJBX-162(81)	Harrison Bay	GJBX-252(81)
Philip Smith Mountains	GJBX-163(81)	Barrow	GJBX-272(81)
Skagway	GJBX-164(81)	Ikpikpuk River	GJBX-275(81)
Taku River	GJBX-165(81)	Misheguk Mountain	GJBX-276(81)
Atlin	GJBX-166(81)	Unalakleet	GJBX-277(81)
Wiseman	GJBX-171(81)	Petersburg	GJBX-278(81)
Chandalar	GJBX-172(81)	Sagavanirktok	GJBX-279(81)
Howard Pass	GJBX-193(81)	Ruby	GJBX-290(81)
Prince Rupert	GJBX-194(81)	Iditarod	GJBX-310(81)
Big Delta	GJBX-195(81)	St. Michael	GJBX-322(81)
Mt. Michelson	GJBX-196(81)	Ophir	GJBX-323(81)
Tanacross	GJBX-197(81)	Kantishna River	GJBX-337(81)
Bettles	GJBX-198(81)	Tanana	GJBX-338(81)
Yakutat	GJBX-199(81)	Black River	GJBX-339(81)
Circle	GJBX-220(81)	Melozitna	GJBX-340(81)
Nabesna	GJBX-221(81)	Nulato	GJBX-341(81)
Ketchikan	GJBX-222(81)	Port Alexander	GJBX-342(81)
Table Mountain	GJBX-223(81)	Craig	GJBX-343(81)
McCarthy	GJBX-226(81)	Sitka	GJBX-344(81)
Eagle	GJBX-227(81)	Coleen	GJBX-345(81)
Point Lay	GJBX-228(81)	Sumdum	GJBX-346(81)
Charley River	GJBX-235(81)	Kateel River	GJBX-360(81)
Wainwright	GJBX-236(81)	Shungnak	GJBX-369(81)
Point Hope	GJBX-245(81)		
Beechey Point	GJBX-246(81)		
Meade River	GJBX-247(81)		
Teshekpuk	GJBX-248(81)		
Umiat	GJBX-249(81)		

Preliminary Quadrangle Folios

Coleen	PJG-040(81)	Talkkeetna	PJG-058(81)
Black River	PJG-108(81)	Tyonek	PJG-059(81)
Charley River	PJG-106(81)	Lime Hills	PJG-057(81)
Circle	PJG-107(81)	Dixon Entrance	PJG-047(81)
Mt. McKinley	PJG-054(81)		

Aeromagnetic Anomaly Maps

Kotzebue	GJM-008(81)	Kwiguk	GJM-001(81)
Melozitna	GJM-004(81)	Holy Cross	GMJ-006(81)
Kateel River	GJM-005(81)	Marshall	GMJ-009(81)
Teller	GJM-010(81)	Hooper Bay	GJM-003(81)
Mt. McKinley	GJM-002(81)	Nunivak Island	GJM-011(81)
St. Michael	GJM-007(81)		

Miscellaneous Topics

Genesis of the Bokan Mountain, Alaska, uranium-thorium deposits	GJBX-38 (80)
Uranium/thorium determinations on samples collected from seven quadrangles in eastern Alaska	GJBX-58 (80)
Uranium-thorium concentrations in representative rocks from Alaskan crystalline terranes	GJBX 178(80)
Airborne gamma-ray spectrometer and magnetometer survey, Four Corners Detail Area, Alaska	GJBX 116(80)

MISCELLANEOUS GOVERNMENT PUBLICATIONS

1980 and 1981

U.S. National Research Council, 1980, Surface coal mining in Alaska—An investigation of the Surface Mining Control and Reclamation Act of 1977 in relation to Alaskan conditions: National Academy Press, 328 p.

U.S. General Accounting Office, 1980, Oil and gas potential in the William O. Douglas Arctic Wildlife Range: Washington, D.C., 10 p. [pamphlet].

———1981, Mining on National Park Service Lands—What's at Stake?: EMD-81-119, 50 p., and EMD-81-119S [supplement released in December 1981]. [The report does not deal with Alaska per se but with mining in other parts of the United States. The supplement is General Accounting Office commentary.]

SELECTED NON-FEDERAL SOURCES OF INFORMATION

National Geophysical and Solar-Terrestrial Data Center fliers

Alaska Construction and Oil

Oil and Gas Journal

Petroleum Engineer

Petroleum Information

American Association of Petroleum Geologists Bulletin

The Alaska Economic Report

Strategic Minerals Management (Nautilus Press, Inc.)

University of Alaska, Mineral Industry Research Laboratory and Arctic Environmental Information and Data Center

Papers presented at the annual meetings of the Alaska Miners Association and Alaska Geological Society

Geological literature on the North Slope of Alaska, 1974-80, published by the State of Alaska Division of Geological and Geophysical Surveys in 1982, and other State bibliographies

Newspapers, particularly the Anchorage Times, the Anchorage Daily News, and the Fairbanks News Miner

[The Arctic Environmental Information and Data Center's "Current Research Profile for Alaska 1980", published in 1981 by the University of Alaska, describes many Federal, State, and academic research projects in geology and other disciplines; some of these projects have not published results. Similar volumes are published annually.]