Organization, Programs, and Activities of the Geologic Division, U.S. Geological Survey

U.S. GEOLOGICAL SURVEY CIRCULAR 1000

COVER: Locations and regional boundaries of major Geologic Division offices.

Organization, Programs, and Activities of the Geologic Division, U.S. Geological Survey

By Robert E. Davis

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Organization, Programs, and Activities of the Geologic Division, U.S. Geological Survey

By Robert E. Davis

This circular presents information about the organization, programs, and activities of the Geologic Division of the U.S. Geological Survey. A directory of mailing addresses, office locations, and telephone numbers for the major organizational units also is included, as well as a summary of authorizing legislation.

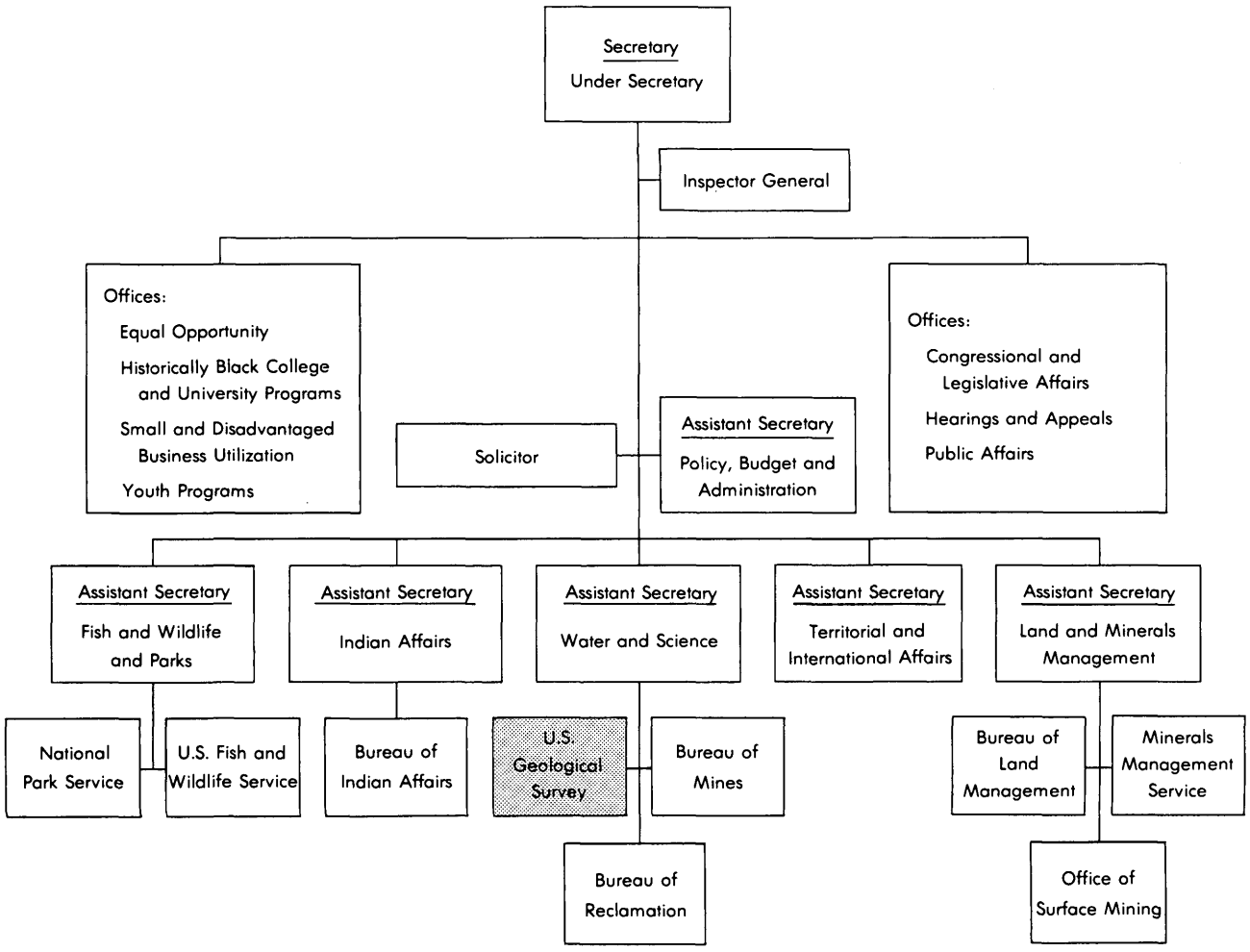
INTRODUCTION

The U.S. Geological Survey (USGS) was established by an act of Congress in 1879 as an agency of the Department of the Interior (DOI). That Organic Act charged the USGS to conduct an "examination of the geological structure, mineral resources, and products of the national domain." Thus, the agency was defined primarily as a scientific fact-finding and research organization, as contrasted to a developmental or regulatory one. It is now the principal source of scientific and technical expertise in the earth sciences within the Department of the Interior and the Federal Government. As the accompanying organization chart of the Department shows, the Director of the USGS currently reports to the Assistant Secretary—Water and Science. The USGS is headquartered at its National Center in Reston, Virginia, about 25 miles west of Washington, D. C.

The U.S. Geological Survey is organized into a directorate and five subordinate divisions. Three of these are major program divisions—National Mapping, Water Resources, and Geologic—and the other two are support divisions—Administrative and Information Systems. Each of the divisions has its own set of responsibilities in support of the overall agency mission.

U.S. Geological Survey National Center, Reston, Virginia.

GENERAL ORGANIZATION
U.S. DEPARTMENT OF THE INTERIOR



- The National Mapping Division (NMD) provides geographic and cartographic information, maps, and technical assistance and conducts related research responsive to National needs.

- The Water Resources Division (WRD) provides information on the occurrence, quantity, quality, distribution, and movement of surface and underground waters that constitute the Nation's water resources.

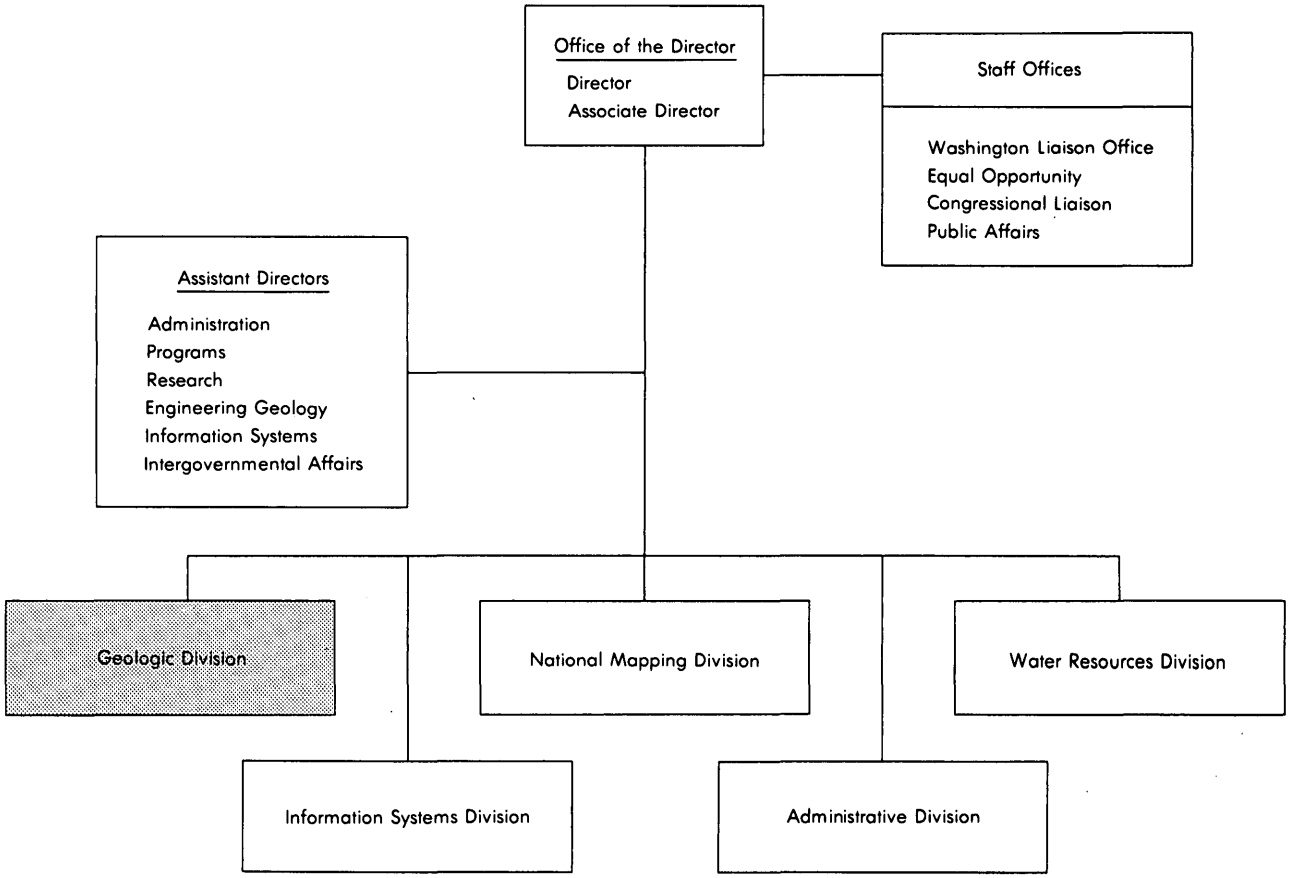
- The Geologic Division (GD) provides geologic, geophysical, and geochemical information on land resources, energy and mineral resources, and geologic hazards of the Nation and its territories. The mission of the Geologic Division is described in more detail in the following section.

- The Administrative Division (AD) provides finance, personnel, contract negotiation and administration, property and space management, organization and methods, management analysis, and other administrative services to the Geological Survey as a whole.

- The Information Systems Division (ISD) provides guidance and advice to the Geological Survey and to the Department of the Interior on all matters relating to USGS information technology and automatic data processing.

The agency employs about 7,900 permanent full-time scientific, technical, administrative, and clerical personnel, whose approximate distribution among the major organizational units is as follows: Director's Office, 70 employees (1 percent); National Mapping Division, 1,910 (24 percent); Water Resources Division,

ORGANIZATION OF THE GEOLOGICAL SURVEY



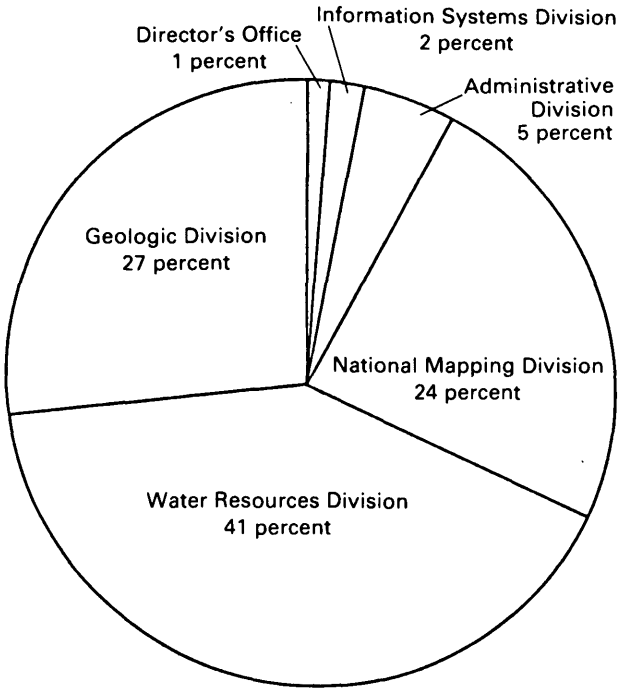
3,270 (41 percent); Geologic Division, 2,100 (27 percent); Administrative Division, 400 (5 percent); and Information Systems Division, 150 (2 percent). The permanent full-time staff is augmented by 3,500 part-time and temporary employees.

Funds for the agency, $579.9 million in fiscal year 1984, come principally from direct appropriations ($423.9 million in FY 84) and from reimbursements from other agencies. The allocation of directly appropriated fiscal year 1984 funds was as follows: National Mapping Division, $91.0 million (21.5 percent); Water Resources Division, $129.4 million (30.5 percent); Geologic Division, $164.4 million (39 percent); and facilities, administration, and all other activities $39.1 million (9 percent). Details of Geological Survey funding for fiscal year 1984 and several years prior can be found in the publication "United States Geological Survey Yearbook, Fiscal Year 1984."

MISSION

The Geologic Division conducts a broad spectrum of earth-science investigations mainly in the United States and its territories and on its continental shelves in order to: determine the geologic structure and the nature of geologic processes affecting these lands; assess the energy and mineral resources of the Nation; establish the geologic factors that bear on the use of the land and continental shelves and on the maintenance of environmental quality; and understand the nature and mitigate the impacts of geologic hazards such as earthquakes, volcanic eruptions, and landslides. The Division carries out its mission responsibilities by means of a general range of activities that include:

- Geologic, geophysical, and geochemical mapping to determine the composition and structure of rocks at and beneath the Earth's surface;
- Investigations of geologic principles and processes, including specialized research in many earth-science disciplines, to provide guidance for geologic interpretations;
- Development and assessment of new exploration techniques to aid in the increasingly difficult search for new sources of energy and mineral commodities;



TOTAL: APPROXIMATELY 7,900

Permanent full-time U.S. Geological Survey employees, by organization.

- Collation and synthesis of geologic information on energy and mineral resources to develop a comprehensive background of knowledge upon which to base resource and resource-potential assessments; and

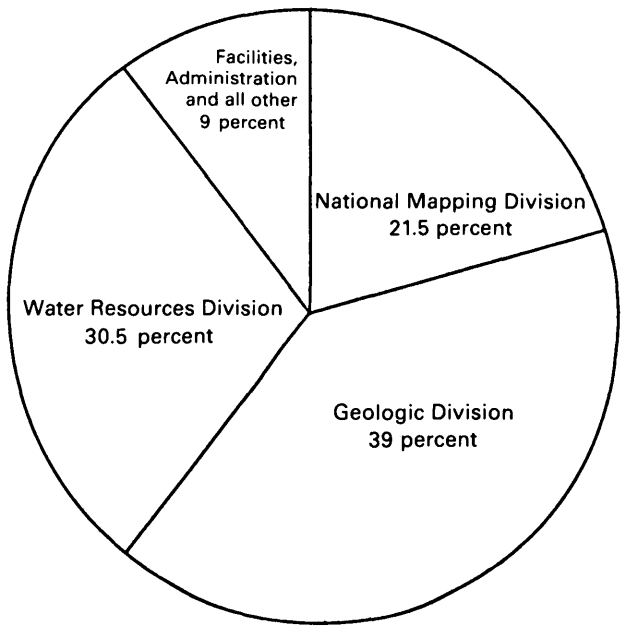
- Operation of seismological networks and geomagnetic and volcano observatories to monitor and aid in understanding geologic processes and events that have a potential for risk to life and property.

The Division carries out extensive basic research as an important component of all activities both in direct support of its mission and in order to maintain the capability necessary to respond to emerging national problems. The results of investigations are published in U.S. Geological Survey professional papers, bulletins, circulars, and geologic and related map series, in reports printed by cooperating agencies, and in outside technical and scientific journals. In addition, many reports and maps, mostly preliminary in nature, are released in the USGS open-file series and are available to users only on specific request.

AUTHORITY AND SOURCE OF FUNDS

Authority to carry out the activities of the Geologic Division derives basically from the Organic Act of 1879. Through the years, this initial authority has been refined by numerous subsequent legislative acts relating to earthquake hazards, dam safety, nuclear safety, strategic and critical minerals, wilderness, and various aspects of energy, to cite but a few. Each of these pieces of legislation expands, more clearly defines, or re-emphasizes the basic responsibilities of the Survey as outlined in the Organic Act. A summary of pertinent legislation is included as a separate section of this circular.

Approximately 80 percent of the Geologic Division's annual budget comes through direct appropriation from the Congress. The remainder comes largely through reimbursement from other Federal agencies such as the Department of Energy, the Department of Defense, and the National Aeronautics and Space Administration for work performed on their behalf and from organizations such as the Agency for International Development, the Department of State, the United Nations, and some foreign governments to support international geologic programs. In a few instances, programs are supported by some combination of direct funding and reimbursable funding. A small amount of support comes also from State agencies through cooperative activities.

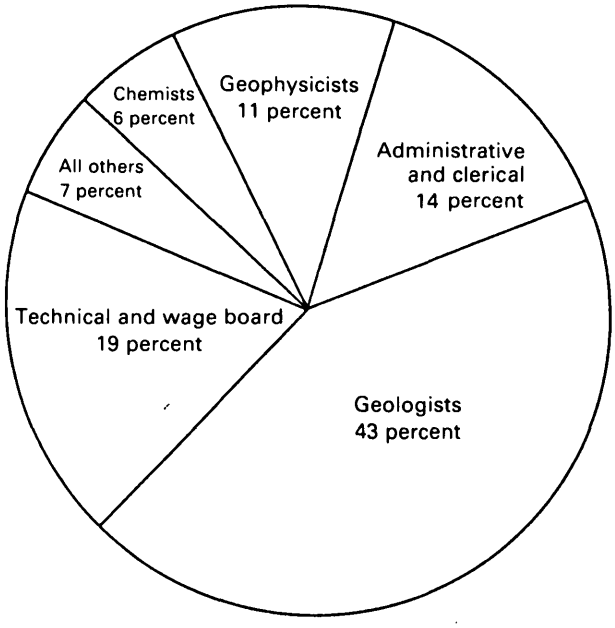


TOTAL: APPROXIMATELY $424 MILLION
(Fiscal Year 1984)

Allocation of U.S. Geological Survey appropriated funds, by division.

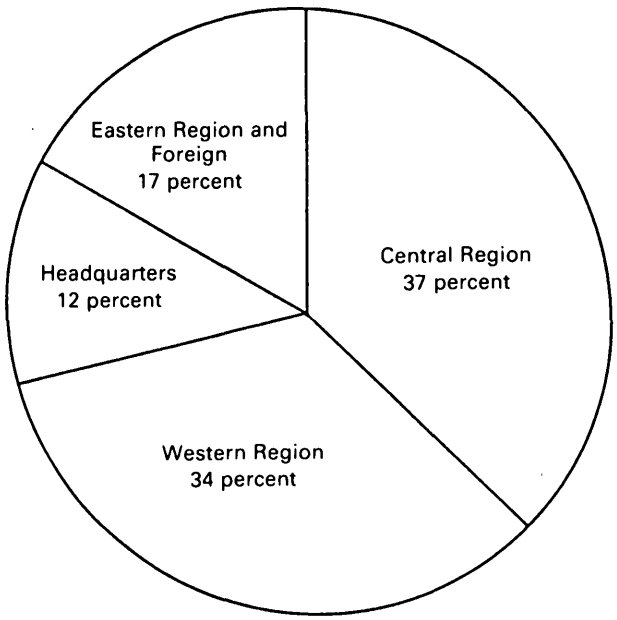
ORGANIZATION

The permanent full-time staff of the Geologic Division comprises approximately 2,100 professional, technical, administrative, and clerical personnel. In addition, about 1,800 people are employed on a part-time or temporary basis. Of the permanent full-time staff, more than 1,200 are geologists, geophysicists, or chemists. With almost 900 geologists, the Division ranks probably as the largest single employer of geologists in the United States.



TOTAL: APPROXIMATELY 2,100

Permanent full-time Geologic Division employees, by occupation.



TOTAL: APPROXIMATELY 2,100

Permanent full-time Geologic Division employees, by location.

The accompanying organization chart shows that the Geologic Division is organized largely along functional (programmatic) lines into six line offices and 29 subordinate branches. Overall management is centralized in a headquarters organization and is implemented at branch and project level by a field organization.

The **Headquarters Organization** is located at the U.S. Geological Survey's National Headquarters in Reston, Va., and comprises the Office of the Chief Geologist and the Offices of Mineral Resources; Energy and Marine Geology; Regional Geology; Earthquakes, Volcanoes, and Engineering; International Geology; and Scientific Publications. The chief of each office is responsible for the general management of a specified group of activities and the allocation of financial and personnel resources identified with those activities. Each office chief reports directly to the Chief Geologist.

Program activities are carried out through the **Field Organization**, which consists basically of the 29 branches, variously headquartered at or near the Regional Centers in Reston, Va., Lakewood (Denver/Golden area), Colo., and Menlo Park, Calif., as well as at Field Centers in Woods Hole, Mass., Flagstaff, Ariz., and Anchorage, Alaska. Branch chiefs, who report directly to their respective office chiefs, are responsible for the design and coordination of scientific programs that meet branch objectives, for the conduct of program activities within the branch, and for the management of branch budgets and personnel.

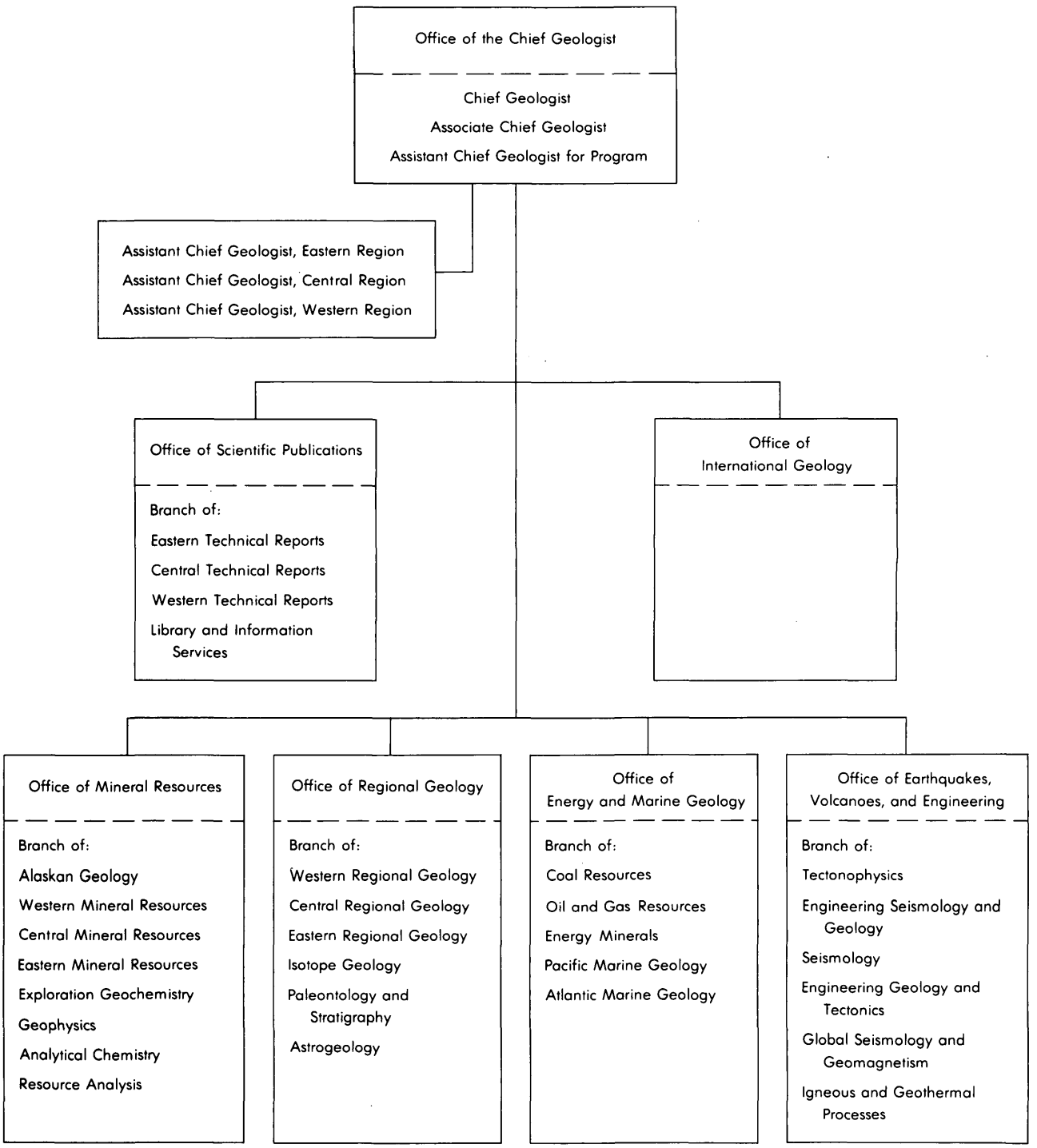
Functional statements that describe the responsibilities of each office and branch are given below; headquarters location is listed for each branch. For many of the branches whose name indicates a topical rather than a geographic orientation, some personnel and projects are located at centers or field offices other than the listed branch headquarters.

Office of the Chief Geologist consists of the **Chief Geologist**, the **Associate Chief Geologist**, and the **Assistant Chief Geologist for Program** who, with the assistance of immediate staff, exercise the general authority delegated by the Director for the initiation, planning, execution, and evaluation of programs. Matters related to personnel, policy and budget coordination, and administration are the responsibility of the Deputy Chief Geologist for Scientific Personnel, the Policy and Budget Officer, and the Administrative Officer and their respective staffs.

The Chief Geologist's Office also includes the **Assistant Chief Geologists for the Eastern, Central, and Western Regions**, who act for the Chief Geologist in furthering the general objectives, policies, and procedures of the Division. Each Assistant Chief Geologist serves as Chairman of a Division committee made up of branch chiefs and designated branch representatives located in the respective Regions, as representative for the Chief Geologist on the Survey committee for the Region, and as Geologic Division liaison with the Director's Designated Representative for the Region. In addition, the Assistant Chief Geologists serve as the Division's principal liaison and point of contact for the State Geologists in their respective Regions.

Office of Mineral Resources is responsible for assessing the nonfuel-mineral resource potential of the Nation through the use of geologic, geophysical, and geochemical studies; conducting research on the mode of occurrence and origin of mineral deposits; devising

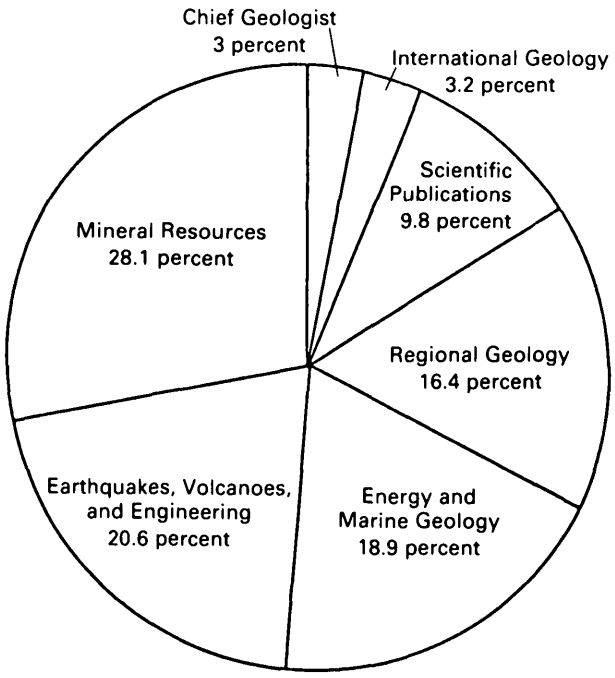
ORGANIZATION OF THE GEOLOGIC DIVISION



concepts and techniques to aid in the search for new deposits; and conducting geophysical investigations to determine the structure of rocks at and beneath the Earth's surface. The Division's principal onshore activities in Alaska and the general chemical laboratories of the Division are managed by this Office.

Branch of Alaskan Geology (Anchorage) makes geologic surveys and investigations to determine the geologic composition and structure of Alaska, to determine and appraise the energy and mineral resources in compliance with the Alaska National Interest Lands Conservation Act of 1980, to establish the geologic factors that bear on the use of the land with special emphasis on the engineering problems of frozen ground, and to reduce loss of life and property from earthquakes, landslides, and volcanic eruptions. Activities designed to meet these objectives include: geologic mapping; research into geologic processes, including specialized studies in geochemistry, tectonics, volcanology, and engineering geology; research into the tvpes and models of mineral and hydrocarbon deposits; and collation and synthesis of geologic knowledge of energy and mineral resources. Although the headquarters of the Branch is in Anchorage, a large part of the workforce is in Menlo Park.

Branches of Eastern, Central, and Western Mineral Resources (Reston, Lakewood, and Menlo Park) assess mineral resource potential of lands in their respective Regions by means of geologic, geochemical, geophysical, geochronologic, isotopic, and remote-sensing studies. The Branches conduct research on mineral deposits, utilizing deposit types found within their Regions, to achieve improved understanding of their mode of occurrence and genesis and to contribute to new exploration models. Branch personnel also occasionally carry out land assessments and research outside their own Regions, as required to fulfill nationwide program needs. The Branches maintain comprehensive files on mineral occurrences in their Regions and use these data for studies relating mineral potential and ore-forming processes to petrogenesis and tectonics on a regional scale.



TOTAL: APPROXIMATELY 2,100

Permanent full-time Geologic Division employees, by office.

Branch of Exploration Geochemistry (Golden) conducts multidisciplinary research on the geochemical concepts and techniques used in the search for mineral deposits, especially "concealed" deposits. This responsibility is met by maintaining a state-of-the-art capability in modeling geochemical systems related to mineral deposits, by advancing analytical techniques, and by interpreting field methods of geochemical exploration in the light of plausible deposit models and configurations.

Branch of Geophysics (Golden) conducts a broad range of geophysical investigations to aid in determining the resources, structure, and nature of rocks at and beneath the Earth's surface by means of gravity, magnetic, electrical, radiometric, borehole, seismic, and remote-sensing techniques. It provides support to other elements of the Geologic Division by carrying out studies related to resource assessments, geologic framework, and geologic hazards. The Branch also carries out research on new geophysical methods and instrumentation which, when operational, can be used by industry to aid in the exploration for energy and mineral resources.

Branch of Analytical Chemistry (Reston) provides analytical support to those programs of the Geologic Division that require chemical information and conducts research in analytical chemistry in accordance with Division program objectives to advance the state-of-the-art of existing methods and to develop new methods of analysis. It maintains expertise in a broad spectrum of analytical techniques. Results of Branch activities are applicable to the solution of fundamental geologic problems relating to the origin of mineral deposits and fossil fuels, as well as to the distribution of elements and their mechanisms of transport. Analytical laboratories are located in Arvada (Denver area), Colo., and Menlo Park, as well as in Reston.

Branch of Resource Analysis (Reston) integrates the principles of economic geology, geochemistry and mineralogy, metallogenesis, mineral economics, and statistical analysis to develop techniques to assess the mineral resource potential of the United States. Another major supporting function of the Branch is the collection, storage, and analysis of data on mineral occurrences, production, and resources. The development and use of models of ore deposit occurrence and the identification of these in geologic terranes are central elements in the assessment process. The resulting assessments range from estimates of

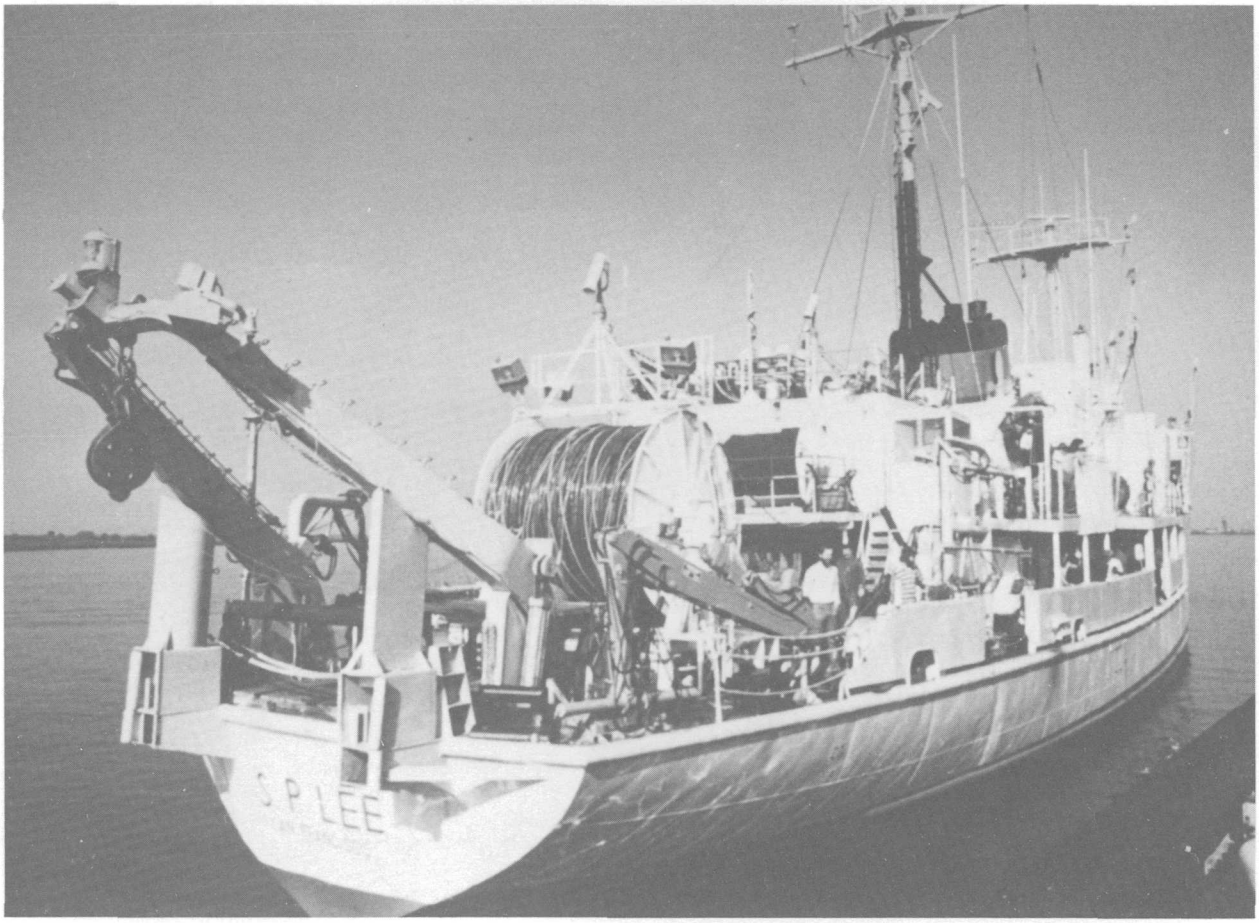
potential sources of supply for single and multiple mineral commodities to general assessments of the mineral resource potential of regions. Studies relating to the exhaustion of mineral commodities are also produced by means of many of the same techniques.

Office of Energy and Marine Geology is responsible for assessing the hydrocarbon, energy-mineral, and associated nonmetallic-mineral resource potential of the Nation and its continental shelves by means of geologic, geophysical, and geochemical studies; conducting research on the mode of occurrence and origin of hydrocarbons, energy minerals, and seafloor nonfuel-mineral deposits; devising concepts and techniques to aid in the search for new deposits; and conducting research on the geologic framework of the Nation's offshore domains and on geologic processes that operate beneath the seafloor and along its margins.

Branch of Coal Resources (Reston) collects and analyzes geologic data about the quantity, quality, and mineability of the Nation's principal coal deposits in order to develop an understanding of the formation, distribution, and economic resource characteristics of coal. It provides regional and national coal resource assessments and maintains a national coal-data system. In addition, the Branch assesses the geologic hazards and engineering geologic factors associated with coal extraction.

Branch of Oil and Gas Resources (Lakewood) conducts research on the origin and migration of petroleum, the geologic characteristics of source and reservoir rocks, the methodology of petroleum resource assessment, and the character and occurrence of unconventional hydrocarbon resources. It carries out geophysical investigations, particularly in seismic-data processing and interpretation, and uses these data to analyze potential oil- or gas-bearing geologic basins and other areas. Data and interpretations are used to make periodic regional or national assessments of domestic oil and gas resources.

Branch of Energy Minerals (Golden) conducts field and laboratory research on the nature, geochemical characteristics, and modes of occurrence of uranium and thorium minerals, oil shale, and sedimentary minerals such as clays, phosphate, potash, and salines. The work involves geologic mapping, stratigraphic and structural studies, geochemical and petrologic investigations, and maintenance of computer-based resource-data banks.



U.S. Geological Survey Research Vessel Samuel P. Lee.

Branch of Pacific Marine Geology (Menlo Park) conducts research on the geologic framework, mineral resources, and geologic hazards of the coastal zone and continental shelf in U.S. Pacific and Arctic waters. To carry out this mission, it operates oceanographic research vessels to acquire marine geologic, geophysical, and geochemical data. It maintains a facility for processing and interpreting marine seismic records. Investigations are focused on the nature of the geologic framework of the outer continental shelf, on the formation and character of ocean hydrocarbon and mineral resources, and on marine deposits and sedimentary dynamics related to seafloor character, hazards, and resources. The Branch cooperates with other Federal agencies in the geologic study of other oceanic areas of mutual interest.

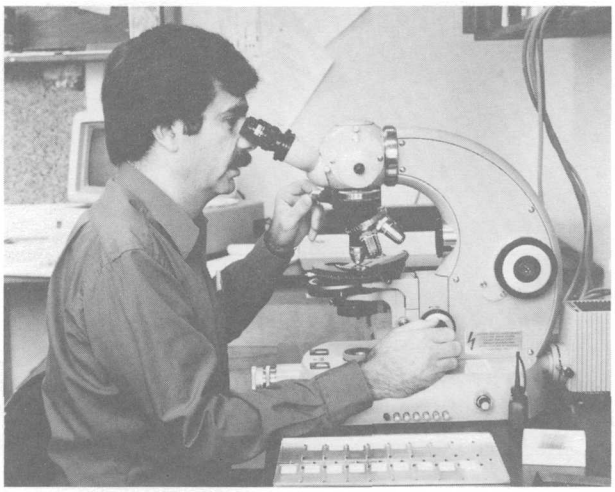
Branch of Atlantic Marine Geology (Woods Hole) is responsible for offshore geologic investigations of the Atlantic and Gulf of Mexico coastal zone and continental shelf. These investigations are focused on the nature of the geologic framework of the outer continental shelf, on the formation and character of ocean hydrocarbon and mineral resources, and on marine deposits and sedimentary dynamics related to seafloor character, hazards, and resources. The work involves the collection and analysis of offshore geophysical data, study of seafloor rocks and sediments, analysis of cores from offshore wells, and paleontologic research. The Branch cooperates with other Federal agencies in the geologic study of other oceanic areas of mutual interest.

Office of Regional Geology manages multipurpose geologic investigations and analyses conducted to determine the geologic framework of the United States and to provide a basis for assessing the land as a resource. Activities to accomplish these objectives include large-, medium-, and small-scale geologic mapping; general appraisal of land-use potential; research on surface and near-surface geologic processes; development and application of paleontologic and other geochronologic methods of age determination; acquisition and interpretation of basic geologic data needed for preservation of the environment; conduct of lunar and planetary investigations including the operation of a field center for astrogeologic studies at Flagstaff, Ariz., sponsored by the National Aeronautics and Space Administration; studies of earth-science problems that have impact upon existing and future nuclear reactors; and studies of nuclear test sites, studies for safe disposal of radioactive wastes, and studies relative to peacetime applications of atomic energy on behalf of the Department of Energy and the Nuclear Regulatory Commission.

Branches of Eastern, Central, and Western Regional Geology (Reston, Golden, and Menlo Park) are responsible for multipurpose geologic mapping and regional geologic studies in the States in their respective Regions. Principal activities of the Branches include geologic mapping of selected areas; regional studies to determine the larger features of stratigraphy and geologic structure; topical studies to understand geologic processes; syntheses of various types of geologic data in order to develop new hypotheses, theories, and principles for a better understanding of the geologic framework of the Nation; and preparation of technical reports and maps that make available to the public and to other Government agencies the results of the Branches' field and laboratory investigations. The Branch of Central Regional Geology has the additional responsibility for carrying out investigations and assessments of sites for the safe disposal of radioactive wastes and for underground nuclear testing.

Branch of Paleontology and Stratigraphy (Reston) is responsible for fundamental research in such fields as biostratigraphy and paleobiology. It evaluates the potential of various organisms for paleoecologic purposes and systematically studies fossils and stratigraphic sequences of rocks that contain them throughout the United States, its territories, and elsewhere in the world as a basis for correlation of strata and the interpretation of geologic history. The Branch also provides services in the field of paleontology and stratigraphy in support of geologic mapping and research to other units in the Survey and the Federal Government.

Branch of Astrogeology (Flagstaff) is responsible for the major part of the U.S. Geological Survey's program of scientific research into the geologic nature and history of the planets. The purpose of this program is to develop an understanding of the processes involved in the formation and evolution of the planets, and to characterize their surfaces and interiors. This program encompasses a wide variety of scientific and engineering disciplines including geology, geophysics, chemistry, mathematics, physics, computer science, electronics, cartography, and photogrammetry. The research involves development of many new theoretical concepts and techniques of scientific observation of the planets, data collection, and interpretation. The products of the research are used to advance basic knowledge, as well as to provide the guides for future planetary exploration by unmanned and manned spacecraft.

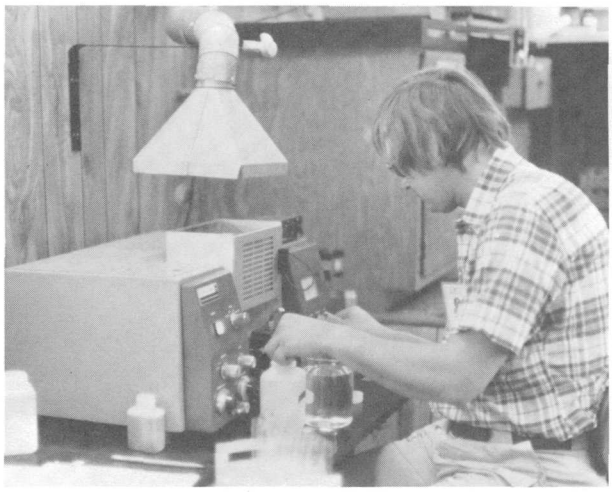


Paleontologist studies microfossils in the laboratory.

Branch of Isotope Geology (Lakewood) is responsible for conducting research in: geochronology, radiation, isotopic fractionation, and paleomagnetism for the purpose of developing new theoretical concepts as applied to geologic problems; scientific instruments for measurement of isotopes; and new techniques for scientific observation and data interpretation. This research has a wide range of applications to programs within the Geologic Division including studies of geologic framework, mineral resources, and geologic hazards related to earthquakes, volcanoes, and landslides.

Office of Earthquakes, Volcanoes, and Engineering manages the geologic, geophysical, and engineering investigations that include: the assessment of hazards from earthquakes, volcanoes, and ground failure; research on the mechanism and occurrence of earthquakes and volcanic activity and the nature of the dynamic behavior of the crust and upper mantle; development of methods for predicting the time, place, and magnitude of earthquakes; evaluation of earthquake potential; assessment of risk from geologic hazards; acquisition of earthquake data needed for improvement of structural design of buildings to withstand strong shaking; determination of earthquake occurrence, location, and size for release to the general public; research on igneous and geothermal processes and the assessment of geothermal systems; engineering geologic studies on ground failure and construction hazards relative to highway construction, selection of damsites and other special-purpose sites, and urban development; and operation of the worldwide networks of standard seismographs, the geomagnetic observatories, and the volcano observatories.

Branch of Tectonophysics (Menlo Park) obtains definitive geophysical data on the mechanics of crustal deformation, heat flow, and rock physics to better understand the nature of faulting and the mechanisms of earthquakes. These objectives are obtained by measuring and interpreting geodetic strain, elevation changes, and geochemical parameters and physical properties such as stress, temperature, pore pressure, and seismic-wave velocity and attenuation. These data permit the identification of short-term precursors of moderate to large earthquakes, which is necessary for developing the capability to predict earthquakes, and the evaluation and mitigation of induced seismicity.



Analyst operating atomic-absorption equipment in a mobile field laboratory.

Branch of Engineering Seismology and Geology (Menlo Park) acquires and disseminates data on strong ground motion for engineering design, develops the capability to predict damaging shaking from earthquakes, and conducts research on surface faulting and earthquake-induced ground failure. Activities include analyzing data from strong-motion networks, studying earthquake-source physics and seismic-wave propagation, numerically synthesizing seismograms, investigating the character and distribution of active faults, and determining the origin and mechanics of earthquake-generated landslides and liquefaction. Data and interpretations are used to make probabilistic assessments of earthquake recurrence, to determine the consequences of damaging earthquakes, and to improve the design of earthquake-resistant structures.

Branch of Seismology (Menlo Park) conducts research on earthquake mechanics, Earth structure, and seismic-source parameters; monitors regional earthquake activity; and develops instrumentation and collects observational data for the reduction of earthquake hazards. Activities designed to meet these objectives include: the operation of seismic networks; collection and analysis of seismic-network, -refraction, and -reflection data; seismic monitoring of volcanic and geothermal systems; and the measurement of strain and tilt. These activities contribute toward the reduction of earthquake and volcanic hazards through the development of earthquake-prediction methodologies; the delineation of seismic-source zones, deep Earth structure, and tectonic processes; and an understanding of volcanic and geothermal systems.

Branch of Engineering Geology and Tectonics (Golden) conducts research on ground failure, the engineering properties of rock and soil, geologic site suitability, regional tectonics and seismicity, active geologic structures, seismic risk, and seismic-wave attenuation. Activities designed to meet the research objectives include geotechnical field and laboratory investigations, geologic mapping to complement engineering studies, investigation of active faults, documentation of regional variations in ground-motion attenuation, and the determination of tectonic histories. These studies lead to: an understanding of the geologic processes and conditions that affect engineering, development, and construction; the delineation of seismic-source zones; and the mitigation of geologic hazards and risk.

Branch of Global Seismology and Geomagnetism (Golden) collects, analyzes, and disseminates information on the effects of earthquakes, and monitors and interprets perturbations and anomalies in the Earth's magnetic field. The Branch operates global

Monitoring activity at Mount St. Helens volcano, Washington.

seismograph networks to detect and locate earthquakes, collects and interprets detailed information on earthquake mechanisms and seismic-wave propagation, and conducts research in global seismology and tectonics. It maintains a system of geomagnetic observatories, develops geomagnetic instrumentation, and conducts magnetic surveys. The Branch provides the public and the scientific community with information on earthquake location and damage, earthquakes that might produce seismic sea waves, and changes in the Earth's magnetic field.

Branch of Igneous and Geothermal Processes (Menlo Park) conducts basic research on the origin and composition of magmas, the chemical and physical interactions of magmas with ground water and rock, the nature and consequences of volcanic eruptions, and the origin and extent of geothermal resources. Activities include geologic, geochemical, and mineralogical studies of plutonic and volcanic rocks; experimental and field investigations and modeling of geochemical areas; and field investigations and seismic monitoring of active volcanic systems in Hawaii, the Cascades, and elsewhere. These data aid in the identification of potential volcanic hazards, the prediction of volcanic eruptions, the determination of ore-deposit models, and the identification and development of geothermal resources.

Office of International Geology manages and coordinates the Survey's international assistance in geologic studies and scientific-exchange programs on behalf of the Department of State and in cooperation with other agencies and governments, and provides guidance and representation to domestic and international agencies in international earth sciences and resources.

Office of Scientific Publications is responsible for planning, directing, and supervising the scientific-publications program of the Division including the evaluation of reports for appropriateness, completeness, and method of release; developing new concepts and techniques for preparation and release of scientific information; preparing final copy for the production of all USGS book publications; maintaining liaison with counterpart organizations in other divisions, with the Government Printing Office, with Department officials, and with commercial contractors on behalf of the USGS and the GPO; and preparing all general-interest leaflets and publications, exhibits, and other visualinformation materials for the USGS. The USGS library system is managed by this Office.

Branches of Eastern, Central, and Western Technical Reports (Reston, Lakewood, and Menlo Park) provide a variety of integrated consulting, editorial, graphics, and production services to facilitate publication of Division and Bureau research reports in the Eastern, Central, and Western Regions, respectively.

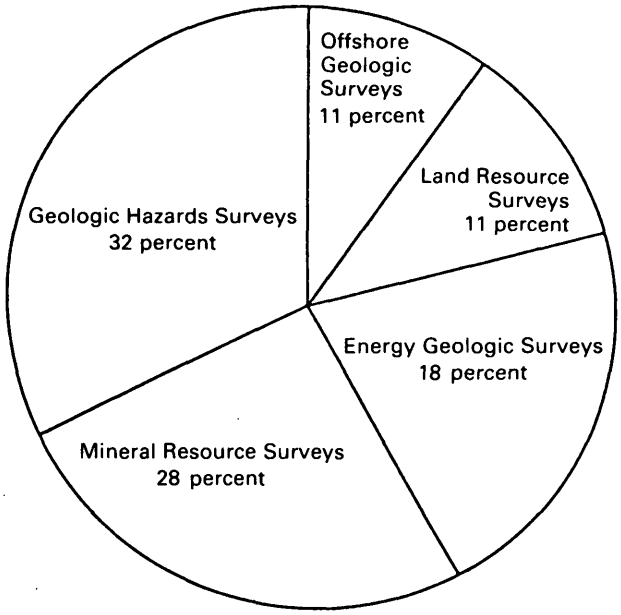
Branch of Library and Information Services (Reston) provides complete research and reference materials and information services to Geological Survey scientists and other personnel, the Department of the Interior, other Federal and State agencies, universities, research organizations, and the general public. Facilities are located in Reston, Golden, Menlo Park, and Flagstaff.

PROGRAMS AND ACTIVITIES

The programs of the Geologic Division generally may be categorized, depending on the source of funds, as **Directly Funded Programs** or **Reimbursable Programs,** although a few are supported by some combination of funding sources. Additionally, the Division carries out certain **Support Activities** that are used not only internally but also by other parts of the Geological Survey, by other Federal, State, and local agencies, and by the general public.

Directly Funded Programs

For budgetary purposes the program elements that are supported by direct Congressional appropriation are grouped into five subactivities: (1) **Land Resource Surveys,** (2) **Offshore Geologic Surveys,** (3) **Mineral Resource Surveys,** (4) **Energy Geologic Surveys,** and (5) **Geologic Hazards Surveys.** Collectively, these



TOTAL: APPROXIMATELY $164.4 MILLION
(Fiscal Year 1984)

Allocation of Geologic Division appropriated funds, by program.

subactivities constitute the budget activity Geologic and Mineral Resource Surveys and Mapping, which is a part of the Geological Survey's appropriation, entitled Surveys, Investigations, and Research (SIR). Objectives and activities of the program elements are synopsized in the paragraphs that follow.

Land Resource Surveys are conducted to acquire basic information on the Nation's geologic framework and the processes that have shaped it; to develop an understanding of climate change and its effects on land and water resources; and to measure changes in strength and direction of the Earth's magnetic field.

Geologic Framework Program — This program is designed to increase our understanding of the Nation's geologic framework and the processes that have shaped it; to provide geologic maps in order to better support national mission programs; to site energy-producing facilities and nuclear reactors safely; and to mitigate geologic hazards. These objectives are pursued through (1) geologic, geophysical, and geochemical investigations to determine the distribution and properties of rocks and their overlying unconsolidated materials; (2) studies to determine the absolute and relative ages of these materials in order to determine rates and frequencies of geologic processes; (3) studies of geologic processes responsible for the formation, modification, and distribution of these materials at and beneath the Earth's surface; and (4) site-specific investigations which bring basic research expertise to bear on problems associated with the safe siting of nuclear reactors and other critical energy facilities.

Climate Change Program — The objectives of this program are to acquire a basic understanding of the causes of climate changes and the past and future impacts of these changes; to establish the long-term history of the rates, frequencies, and magnitudes of climate change in order to determine the effects of climate change on natural resources; and to create and improve techniques for delineating climate history. These objectives are met through (1) studies of continuous sequences of sedimentary rocks in which detailed climate variations are recorded by fossils and by geochemical and isotopic changes; (2) investigations of the effects of climate changes on continental margins; and (3) studies of times and magnitudes of past variations in atmospheric carbon dioxide through a variety of techniques.

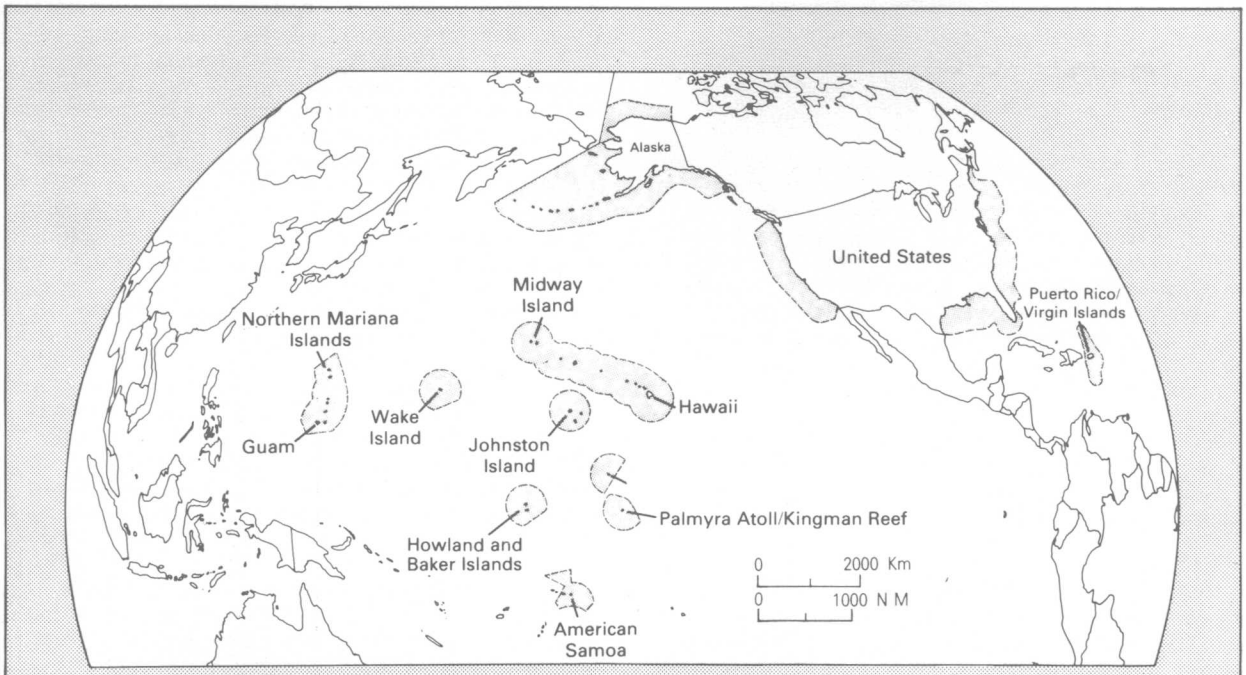
Geomagnetism Program — This program supports laboratories and observatories that measure changes in the strength and direction of the Earth's magnetic field. These data are used in the preparation and publication of navigational charts, topographic maps, and specialized magnetic surveys used by industry and by Federal and State agencies.

Offshore Geologic Surveys are regional investigations conducted for the purpose of developing and enhancing our knowledge of the offshore geologic framework; the potential for the occurrence of petroleum and mineral resources; the geologic conditions that may affect the exploitation of those resources; and how the formation of petroleum and mineral deposits in offshore areas can help in the search for analogous onshore deposits of economic significance.

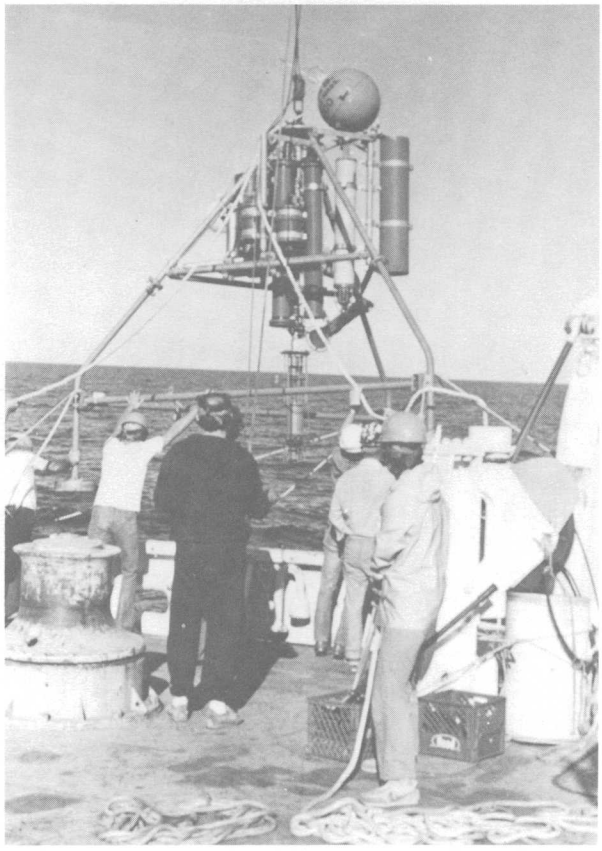
Offshore Geologic Framework Program — The objective of this program is to describe and develop a systematic understanding of geologic settings and conditions of the offshore areas of the United States and its territories, including the recently established exclusive economic zone (EEZ). Activities to meet this objective include (1) studies of active geologic processes that modify the seafloor and coastal zone and that can affect the development of offshore resources; (2) studies of regional stratigraphy, structure, seafloor seismicity, magmatism, and volcanism, all of which influence the formation of petroleum and mineral deposits; and (3) studies leading to a better understanding of the processes that govern the genesis of petroleum deposits and of metallic and nonmetallic mineral deposits.

Mineral Resource Surveys are conducted to assess the distribution, quantity, and quality of the mineral resources of the Nation by studying the geology of known mineral occurrences and potentially mineralized areas; by developing and improving exploration techniques and mineral-occurrence models necessary in the continuing search for new deposits; and by enhancing our knowledge and understanding of domestic and world resources of nonfuel minerals. Particular emphasis is placed on strategic and critical minerals, those minerals that are largely or entirely imported (strategic) or that are necessary to the economy of the United States (critical).

Alaska Mineral Resource Assessment Program — The objectives of this program are to systematically



The United States Exclusive Economic Zone.



Deploying a Sediment Transport System on the Outer Continental Shelf.

study those areas in Alaska that have significant mineral potential; to evaluate Alaska's mineral resources; to identify areas where new resources are likely to be found; and to provide mineral resource information for planning the use of Alaska lands and for assessing the Nation's total resource base. These objectives are met by (1) compilation and synthesis of published mineral resource information on a statewide basis; (2) specific topical studies designed to add to the knowledge of Alaska's mineral resource potential; and (3) multidisciplinary field studies by teams of geologists, geophysicists, geochemists, and mineral economists to produce quantitative probabilistic mineral resource assessments on a regional basis.

Conterminous United States Minerals Assessment Program — This program is designed to provide basic data on the resource potential of the conterminous States for the purpose of evaluating domestic mineral resources and for a variety of land-management and planning activities. Activities center around (1) compilation of all existing pertinent geoscience and resource data; (2) regional geologic, geophysical, geochemical, and remote-sensing field studies to obtain new data; and (3) interpretation and synthesis of all data to produce systematic assessments of the mineral resource potential of selected areas.

Wilderness Mineral Surveys Program — Mineral surveys in Wilderness and proposed Wilderness areas in Forest Service and Bureau of Land Management parts of the National Wilderness Preservation System insure that sufficient mineral resource-potential information is available to land planners and to the Congress on which to make informed decisions. Activities include

geologic mapping and geophysical and geochemical surveys. The program is carried out in cooperation with the U.S. Bureau of Mines, which is responsible for site-specific studies of mines and prospects and for the definition of ore reserves.

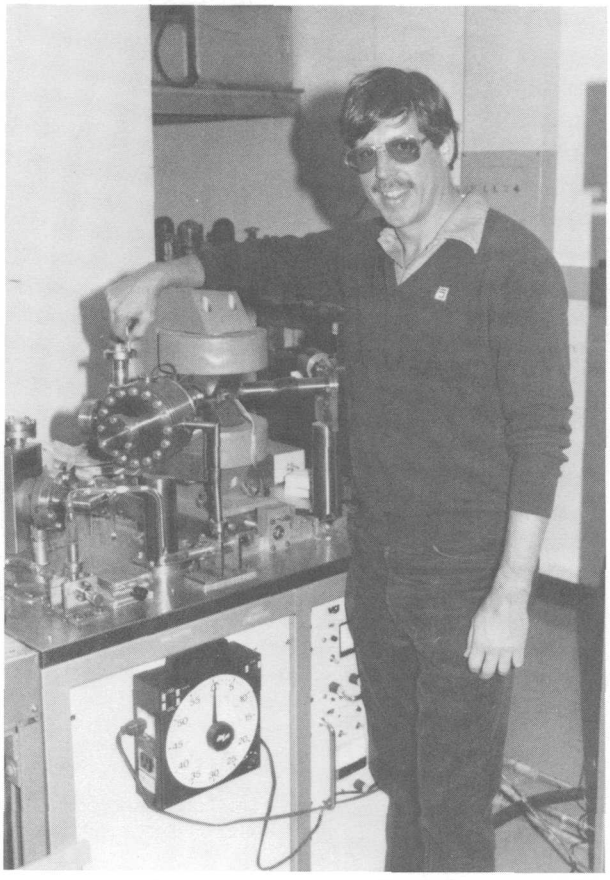
Strategic and Critical Minerals Program -- The objectives are to provide comprehensive information on domestic and world resources of the nonfuel minerals that are essential to a strong national economy and defense; to create systems to store, analyze, and present this information in the form needed for mineral-policy planning; and to create expertise in strategic and critical minerals to assist in the location and development of adequate and dependable supplies of these commodities. Activities include comprehensive literature and field research to identify deposits from which these minerals may be produced and to identify areas that are geologically favorable for the discovery of as-yet-unsuspected deposits of strategic minerals.

Development of Assessment Techniques Program -- The objectives of this program are to create concepts and techniques to improve the capability to identify and evaluate mineral resources. Field and laboratory investigations of known mineral districts, mineral provinces, and mineral-bearing environments are directed toward the recognition and understanding of the processes that form mineral deposits. Activities include (1) field studies in areas that have high potential for conventional types of mineral deposits; (2) studies of the factors that influence ore deposition in known mineral districts; (3) geochemical studies of the trace-element distribution in selected mineralized areas; (4) laboratory studies of ores and their host rocks; (5) research aimed at increasing the understanding and interpretation of geochemical and geophysical information as applied to resource problems; (6) investigations to improve existing geochemical and geophysical technology; and (7) development of new types of chemical and physical sensing equipment.

Energy Geologic Surveys are conducted to improve understanding of the nature, distribution, and size of the Nation's energy-related resources as a prerequisite to the formulation of effective national energy policy and optimum development of energy sources. Surveys of coal, oil and gas, oil shale, uranium and thorium, and geothermal resources all involve geologic, geophysical, and geochemical studies, construction of extensive data systems, and development of methodologies for arriving at reliable, credible, and scientifically based resource assessments.

Coal Investigations Program -- The objectives of this program are to conduct investigations of domestic coal deposits in order to assess U.S. coal resources; to develop predictive models of the origin, distribution, and chemical composition of coal; to create and maintain a computerized National Coal Resources Data System capable of producing accurate and timely coal resource assessments; and to determine the geologic, geophysical, and geochemical characteristics of the natural environment of coal deposits as an aid to planning the efficient and orderly development of domestic coal resources. These objectives are met through (1) field and laboratory studies and the portrayal of the results on regional-scale maps of coal basins; (2) acquisition of aggregated and point-source data on coal quantity and quality for entry into the publicly available computerized data base; and (3) regional geologic investigations pertinent to the development of coal-bearing regions to assist the Bureau of Land Management, Office of Surface Mining, Environmental Protection Agency, and State agencies in the formulation of coal-mining regulations.

Onshore Oil and Gas Investigations Program -- This program is designed to conduct fundamental and applied earth-science research into the habitat, generation, migration, and entrapment of oil and gas, and to use the acquired knowledge as a basis for oil and gas resource assessments for onshore public and private lands. These objectives are met by (1) field and laboratory studies aimed at understanding hydrocarbon generation and maturation and the geologic settings in which these processes occur; and (2) studies that deal with the difficult problems concerning the nature of stratigraphic traps such as their origins, character, location in time and space, and detection. Other studies are aimed in new directions that may help in evaluating frontier areas or in finding petroleum previously overlooked in known areas of occurrence.



Mass spectrometer in isotope laboratory, Reston, Virginia.

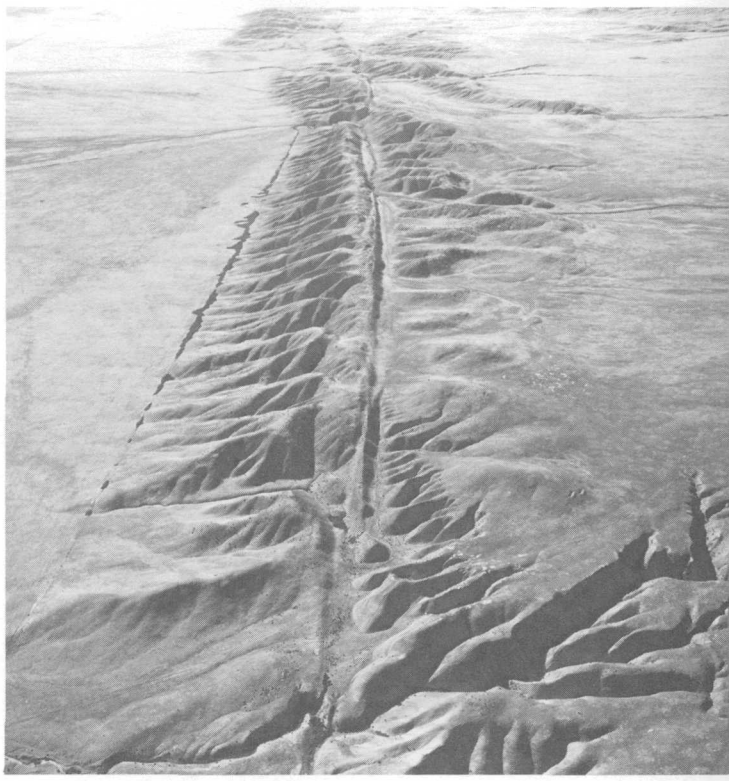
Oil-Shale Investigations Program -- The objectives of this program are to determine the geologic setting and the physical and chemical characteristics of domestic oil-shale deposits in order to provide an understanding of the oil-shale resources of the Nation, and the factors that affect their proposed exploitation, and to form a basis for making periodic assessments of this energy resource. Activities to meet these objectives include (1) stratigraphic studies and resource delineation and (2) geochemical and mineralogic studies focused chiefly on the rich deposits in Colorado, Utah, and Wyoming, but also dealing with organic-rich black shales of the Appalachian Basin and elsewhere.

Uranium/Thorium Program -- The objectives of this program are to conduct fundamental research and investigations designed to refine the geologic concepts and research techniques needed to increase our understanding of the nature and distribution of regional, national, and foreign uranium and thorium resources so that improved methods may be developed for the discovery and assessment of uranium and other critical metals. Activities include (1) studies in the geochemistry and mineralogy of uranium and thorium; (2) studies of their occurrence in igneous, metamorphic, and sedimentary rocks; and (3) investigations of techniques for their exploration and assessment.

Geothermal Investigations Program -- This program is designed to describe the nature and to estimate the location and magnitude of geothermal resources of the Nation, and to develop an understanding of the geologic and hydrologic processes and conditions of geothermal systems. Activities to meet program objectives include (1) a wide variety of multidisciplinary investigations to determine the geologic and hydrologic factors that control the characteristics, occurrence, longevity, and size of all types of geothermal systems; (2) assessments of the location and magnitude of the Nation's geothermal resources with periodic updating as new information is acquired and assessment methodologies are refined; and (3) evaluation of the geoenvironmental effects that may result from extraction and injection of fluids during exploitation of the resource.

World Energy Resource Assessment Program -- This program is supported in part by SIR appropriation and in part by reimbursable funds. Its objectives are to provide geologic information and assessments on world energy resources, chiefly oil and gas, to be used by other agencies in national planning and decision-making processes relative to energy use, availability, ownership, international trade, and foreign policy. The objectives are met through literature investigations and studies of public information from multiple sources, with scientific support from the domestic energy resource programs.

Geologic Hazards Surveys are conducted to acquire data useful in delineating and predicting hazards from earthquakes and volcanoes and to identify engineering problems related to nuclear reactor siting and landslide hazards.



The San Andreas fault, Carrizo Plain, California.

Earthquake Hazards Reduction Program --The objectives of this program are to mitigate earthquake losses that can occur in many parts of the Nation by providing earth-science data and evaluations essential for land-use planning, engineering design, and emergency preparedness decisions. These objectives are met through (1) seismologic and geologic analyses of current seismic activity, active geologic faults, and earthquake potential of all seismic regions in the United States; (2) laboratory and theoretical studies and field experiments in selected areas to establish procedures and knowledge needed for the reliable prediction of the time, place, and magnitude of damaging earthquakes; (3) regional assessments of earthquake hazards from potential ground shaking and ground failure, and identification of specific assessment techniques unique to each region; (4) development and maintenance of computerized data bases on earthquake occurrence for use by the public, other Federal agencies, State and local governments, emergency-response organizations, and the scientific community; and (5) development of computerized data bases and data analyses on strong ground motion for use by other Federal agencies and the engineering community for the seismic-resistant design and construction of buildings, dams, and critical facilities. A significant part of the earthquake prediction and hazards activities is carried on outside the USGS through a grants and contracts program. Data and information services are carried out by the National Earthquake Information Service, in the

Damage to Veterans Administration Hospital at Sylmar, California, resulting from the February 9, 1971 San Fernando earthquake. (Photograph, Los Angeles Times.)

Branch of Global Seismology and Geomagnetism, Golden, Colo.

Volcano Hazards Program -- The objectives of this program are to reduce the loss of life, property, and natural resources that results from volcanic eruptions and related activity through (1) identification of potentially hazardous volcanoes and volcanic areas in the United States; (2) determination of the kind, magnitude, and extent of possible future volcanic eruptions; (3) delineation of zones of unusually high volcanic risk; (4) early detection of precursory activity of potentially active volcanoes by maintenance of seismic, geodetic, geophysical, geochemical, and hydrologic monitoring networks; (5) determination of flood-hazard potential by field investigations and modeling of hydrologic and geomorphic factors relative to eruption-induced erosion and filling of stream channels; and (6) collection, compilation, and dissemination of information on volcanic hazards to Federal, State, and local agencies.

Landslide Hazards Program -- The objectives are to reduce hazards to public safety and economic losses that result from ground-failure events, to provide a better scientific and technological basis for land-use decisions, and to develop reliable quantitative methods for evaluating risks from ground failures. Activities include (1) regional assessments of the distribution of areas of potential landslides; (2) development of soil-mechanics techniques to determine relative susceptibility of slopes to failure; (3) investigations in rock mechanics, including instrumentation for monitoring slope movements and rock deformation, measurement of rock properties, and case studies of rock types with regard to their behavior when used as foundation and construction material; and (4) investigations in Arctic engineering geology and permafrost.

Reimbursable Programs

In addition to those programs funded by direct SIR appropriations, the Geologic Division carries out a large number of activities on behalf of other Federal agencies as well as some non-Federal organizations. In general, these activities directly contribute to or otherwise complement the SIR programs of the Division, along with fulfilling the needs of the supporting agency. Collectively, funding for these programs totals about 20 percent of the Division budget. For convenience of discussion, these programs may be grouped into two categories: (1) **Other Federal Agency Programs,** and (2) **International Activities.**

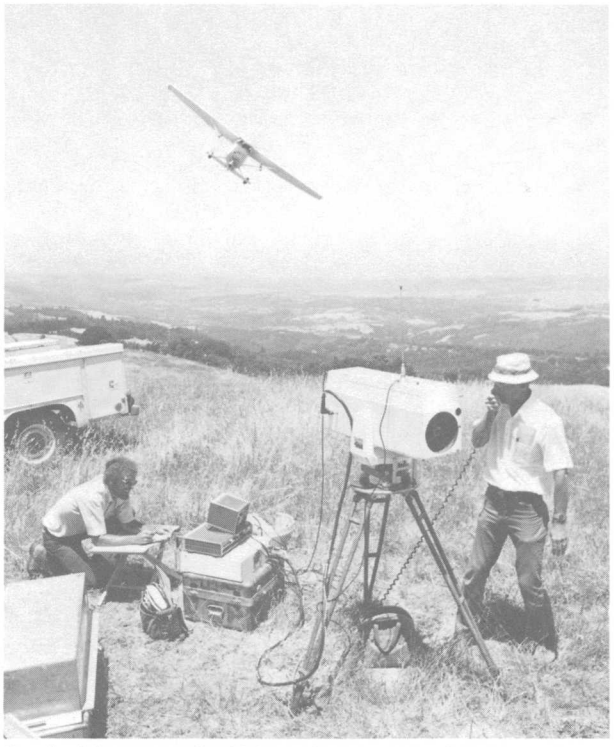
Other Federal Agency Programs (OFA) are those carried out by the Division on behalf of another agency and for which the Division is reimbursed by that agency. These activities range in levels of effort from a fraction of a man-year per year, as required for selected seismic or geochemical monitoring or for a small number of chemical analyses, to several tens of man-years per year over a number of years, as typified by the Astrogeology Program and the Hazardous-Waste Disposal Program, two of the Division's well-established long-term OFA programs.

Astrogeology Program -- This program, the Division's largest single OFA effort, is carried out almost entirely on behalf of the National Aeronautics and Space Administration (NASA). Its objectives are to understand better the origin and evolution of the Solar System and the individual planetary bodies, including the Earth; to formulate general theories to explain geologic processes that occur on the planets; to devise remote-sensing techniques to aid in geologic interpretation of planetary surfaces, including that of the Earth; and to insure that future exploration of the Solar System is conducted in a manner that will optimize geologic return. Activities include (1) research in a wide range of topical geologic subjects; (2) research in radar technology, photogrammetry, and image processing; (3) studies in impact-cratering mechanics; (4) interpretation and management of remotely sensed data obtained from spacecraft; and (5) compilation for publication of topographic, geologic, photographic, and air-brush map products derived from data obtained from spacecraft.

Hazardous-Waste Disposal Program -- This program is funded in part by direct SIR appropriation and in part by the Department of Energy (DOE); the Water Resources Division has the lead responsibility for the program. The Geologic Division's part of the program is divided into two elements: high-level nuclear-waste disposal and toxic-waste disposal.

High-Level Nuclear-Waste Disposal -- The objectives are to evaluate new screening methods and different geohydrologic environments for siting repositories; improve techniques for site identification and characterization, and for prediction of the effects of geologic and hydrologic processes and events that could affect the future integrity of a repository; provide advice to DOE on earth-science aspects of the program and review contractors' plans and products; and, through field investigations, assist DOE in identifying and characterizing potential sites for nuclear-waste repositories. Activities for DOE include (1) extensive geologic, geophysical, and seismic investigations of a potential repository site in Nevada; and (2) studies in support of the characterization of possible sites in Utah and Texas and evaluation of crystalline rocks in the Eastern United States. Directly funded activities include (1) in cooperation with several States, screening of large regions in the Western United States to identify new areas that have potential as waste repositories; (2) evaluation of the potential use as repository sites of shale and of crystalline rocks buried beneath sedimentary rocks; and (3) studies to develop or improve geophysical, geomechanical, and geochemical techniques used for the characterization of potential repository sites.

Toxic-Waste Disposal -- The objectives are to create earth-science guidelines for siting hazardous-waste disposal facilities; improve understanding of various processes affecting the fate of hazardous substances in the subsurface environment; and develop a national appraisal of ground-water quality. Activities of the Geologic Division include (1) testing geophysical techniques for tracing plumes of ground water contaminated by various types of pollutants; (2) studying the role of various clay minerals in the



Geophysicists measuring deformation along the San Andreas fault using laser-beam instruments; plane is monitoring temperature and humidity.

behavior of contaminants; (3) preparing maps showing the location and thickness of thick impermeable glacial-clay deposits in the Northeastern United States; and (4) studying the behavior in water, soils, and plants of various toxic metals in the natural and polluted environments.

Examples of other OFA activities are summarized briefly below.

Bureau of Indian Affairs -- Geologic, geophysical, and geochemical field studies for the assessment of energy and nonfuel mineral resources on Indian lands.

Bureau of Land Management -- Geologic, geophysical, and geochemical field studies for the assessment of mineral resource potential of selected BLM Wilderness and roadless areas; Arctic environmental studies.

Bureau of Mines -- Research investigations in borehole soundings and in borehole minerals-assaying technology.

Bureau of Reclamation -- Operation, maintenance, and monitoring of seismic networks at Auburn Dam, New Melones, and Mount Shasta, Calif., Glen Canyon, Utah, and Delores River, Colo.; studies in seismic-refraction analyses.

Central Intelligence Agency -- Assessment of world energy resources; military geology studies of critical areas.

Department of Defense

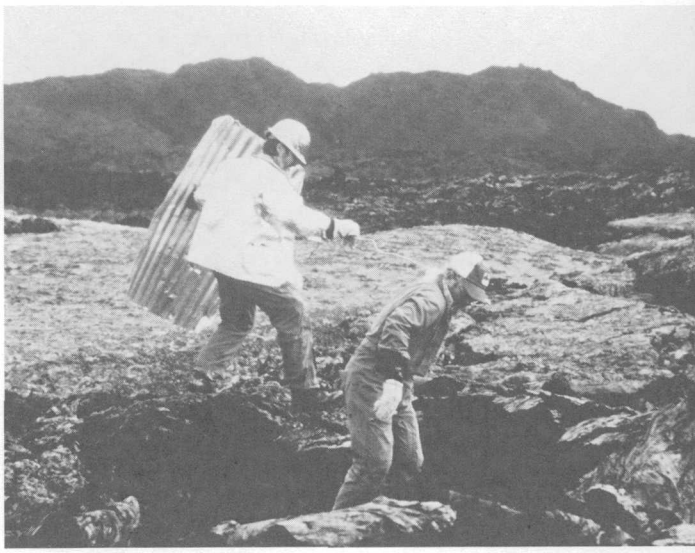
Army Research Office -- Studies of recovery rates of arid lands used for military maneuvers; studies of world deserts; convene International Desert Studies workshop.

Corps of Engineers -- Operation, maintenance, and monitoring of strong-motion networks at Success Dam, Isabella, and Terminus, Calif., Mud Mountain, Wash., and Garrison, N. Dak.; evaluation of stability of dam at Spirit Lake, Mount St. Helens, Wash.; sediment transport, deposition, and erosion studies in the marine environment.

Defense Nuclear Agency — Detailed geologic and geophysical studies of nuclear craters at Enewetak Atoll; evaluation of failure mechanisms and deformation processes in shock-loaded unconsolidated and medium consolidated geologic materials using petrographic, petrologic, and solid-state techniques; study of structural deformations and failure mechanisms in 40,000 feet of drill core from large Flynn Creek impact crater; participation in DNA-sponsored dry field explosion trials.

Defense Advanced Research Projects Agency — Development and installation of a digital seismic network for the People's Republic of China; global seismological studies; studies in military geology.

Defense Intelligence Agency — Studies in military geology.



Geologists measuring lava temperatures in Hawaii.

Defense Mapping Agency — Collection and interpretation of marine gravity data; preparation of bathymetric maps.

Department of Energy -- Studies related to the safe storage or disposal of hazardous wastes (see Hazardous-Waste Disposal Program); investigations of geochemical aspects of geothermal reservoir depletion at Cierro Prieto, Mexico, Larderello, Italy, and Klamath Falls, Oreg.; three-dimensional seismic studies of Newberry Crater, Oreg.; geodetic studies at the Hanford Site, Wash.; seismic-refraction surveys of the Columbia Basin, southeastern Washington; geologic and geophysical studies in support of the nuclear testing program at the Nevada Test Site; studies of rock stress, seismicity, and ground motion; research in tight-gas sands and deep-source hydrocarbons.

Agency for International Development — Studies in foreign geology; technical assistance to many nations (see International Activities); investigations of earthquakes in Africa, the Circum-Pacific, Latin America, and southeast Asia; investigations of volcanic hazards and installation of early-warning volcano-eruption equipment in the Far East.

Environmental Protection Agency — Studies of airborne geophysical techniques to develop methods for locating and tracing underground contaminants and toxic-waste plumes.

Federal Emergency Management Agency -- Studies of landslides and mudflows; synthesis of scientific and technical earth-science information for the Central United States; basic research in earthquake hazards and earthquake prediction to support earthquake preparedness program.

National Bureau of Standards -- Evaluation of thermodynamic and thermochemical data for chemical components, minerals, and rock materials.

National Park Service — Volcanological studies and earthquake, geothermal, and geochemical monitoring at Yellowstone National Park; seismic monitoring at Mount Lassen and studies of geological processes at Chaco Culture National Historical Park; environmental studies at Theodore Roosevelt National Monument; studies of stress changes in the walls of Lehman Caves, Calif.

National Aeronautics and Space Administration — See Astrogeology Program; studies of lunar rock samples; volcanologic and morphologic studies of crater walls of Hawaii and Cascade volcanoes.

National Science Foundation -- Fieldwork on the English Coast, Antarctica; studies of the Dufek intrusion, Antarctica; geochemical investigations of the Sonoran Desert.

National Oceanic and Atmospheric Administration — Investigations of seafloor stability, submarine sedimentary processes, offshore permafrost, and other aspects of the geology of the outer continental shelf related to the orderly and safe exploitation of offshore resources; bathymetric surveys; assist in monitoring carbon-isotope variations in atmospheric samples.

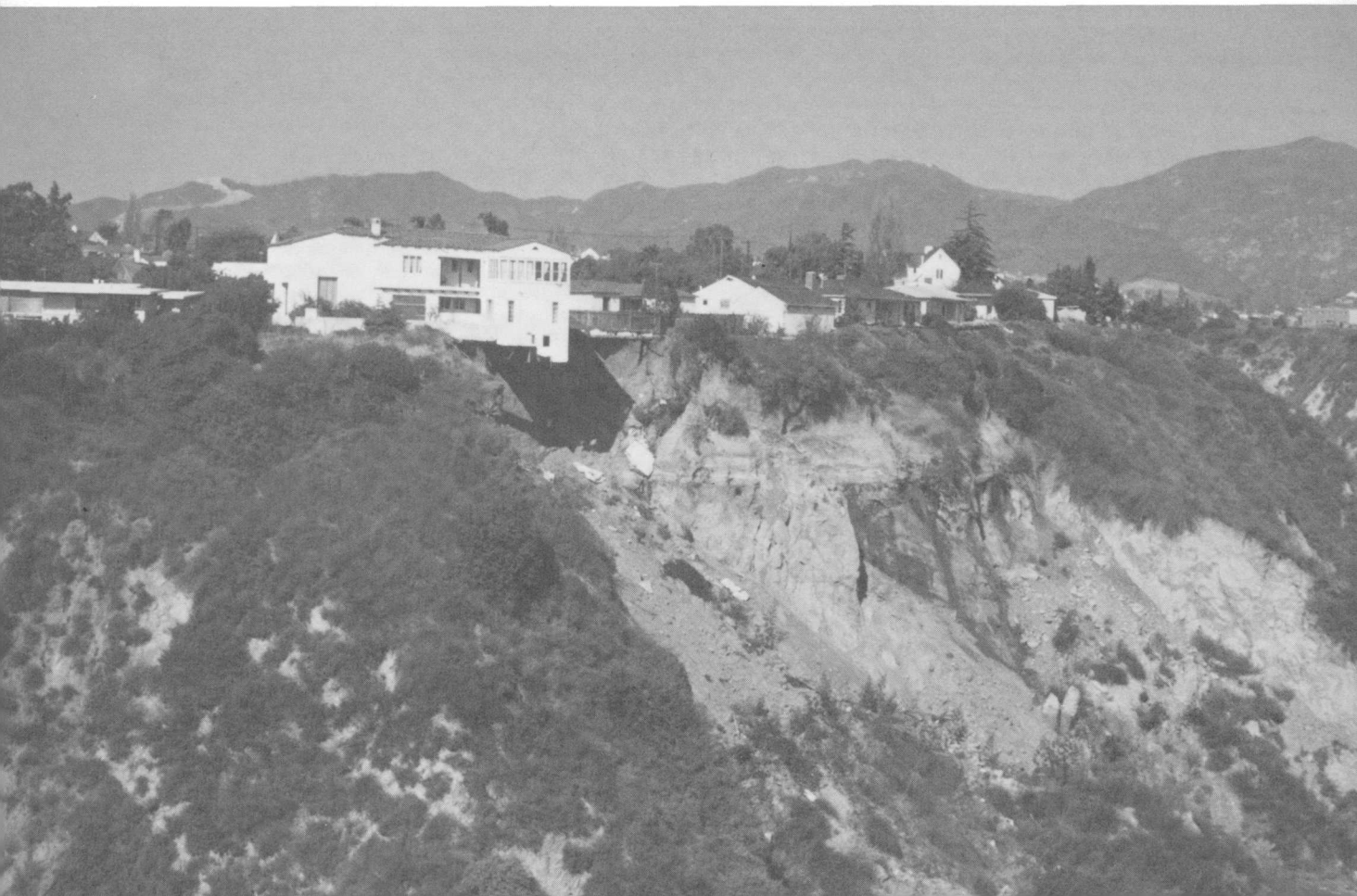
Nuclear Regulatory Commission -- Geologic and seismologic research related to the safe siting of nuclear reactors; development of ground-motion attenuation relationships; geologic and seismologic research in the vicinity of Charleston, S. C.

Fish and Wildlife Service -- Geologic, geophysical, geochemical, and remote-sensing investigations and hydrocarbon resource assessments of the Arctic National Wildlife Refuge; mineral resource survey of the Kofa National Wildlife Refuge, Arizona.

Department of the Interior, Office of the Assistant Secretary for Territorial and Intergovernmental Affairs -- Geologic and geochemical mapping of the islands of St. Thomas and St. John, U.S. Virgin Islands; organize and convene workshop on geologic hazards for Caribbean countries and territories; marine geologic studies off the Marshall Islands.

International Activities, in terms of total funding, constitute the largest reimbursable effort of the Division. Included is a wide variety of earth-science activities conducted principally, but not exclusively, in developing nations. Institution building and other technical assistance, national resource assessments, evaluation of natural hazards, cooperative research projects, representation and participation in multinational organizations, scientist exchange, and training of foreign scientists are major components of the international program. Proposals for projects may be initiated either within the Division as an extension of an ongoing domestic activity, at the request of another Federal agency such as the Department of State or the Agency for International Development, or at the

Landslide in the Pacific Palisades, southern California.



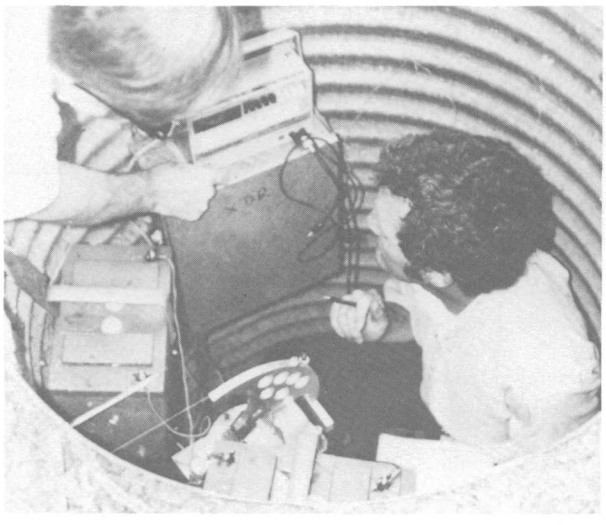
request of a foreign government or an international organization.

Funds generally are provided at least in part by the entity that initiates the proposal, although funding arrangements vary greatly. For example, technical assistance to developing countries is undertaken usually at the request of, and with funds provided by, the Agency for International Development or a specific foreign government. Scientific cooperation and exchange projects, on the other hand, may be at the initiative of the Geologic Division and might be funded in part by appropriated funds and in part by funds transferred from another agency or from a foreign government. In any instance, projects are selected and designed so as to provide maximum benefits both to the United States and to the cooperating agency or country.

Largest of the current programs is the Mission to Saudi Arabia, wherein several tens of earth scientists and support personnel are engaged in studies of the geology, mineral resources, and natural hazards of the Kingdom of Saudi Arabia. This program is funded entirely by the Saudi Arabian government. Other activities are being carried out in countries in Asia, the Mid-East, Europe, Africa, the Far East, and Central and South America, chiefly on behalf of the Agency for International Development.

Support Activities

Support activities are centered largely around publications, library services, development and operation of data bases, and other activities related primarily to the presentation and dissemination of information. Although carried out mainly to support the research programs of the Geologic Division or to fulfill related needs, these activities also support other parts of the Survey and, in many instances, provide services to organizations and individuals outside the Survey.



Seismologists installing creepmeter in central California.

Publications -- Since its inception, the U.S. Geological Survey has published the results of its investigations in the form of thematic maps, written reports, and written abstracts summarizing oral presentations given by members of its research staff. Geologic Division personnel author, on average, about 2,400 such publications each year. Reports are published through a variety of media, including the U.S. Geological Survey professional paper, bulletin, circular, and open-file report series and a large number of scientific and technical journals published by domestic or international professional societies. Thematic maps, however, are published almost exclusively in one of the USGS map series.

Whatever the form of publication, each product initiated within the Geologic Division undergoes peer technical review and, except for open files and outside journal articles, rigorous editorial review. An author's branch chief is responsible for the scientific quality of each report and map, and the Office of Scientific Publications is responsible for editorial and other aspects. The Office of Scientific Publications is responsible also for final preparation and printing of all reports published in USGS series not only for the Division but also for the rest of the Geological Survey. Final preparation and printing of USGS map-series products is the responsibility of the National Mapping Division.

Information on the kinds of reports published by the Geological Survey and their availability is given in USGS Circular 900, "A guide to obtaining USGS information," available free on request from Text Products Section, Eastern Distribution Branch, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Va. 22304-4658.

Libraries -- The U.S. Geological Survey Library System, administered by the Office of Scientific Publications, ranks probably as the foremost earth-science library system in the world. With more than a million holdings in the main library in Reston, and large holdings in the Golden, Menlo Park, and Flagstaff branches, it is not only a major research facility of the USGS but also serves other Federal and State agencies, universities, industry, and the general public. Service is provided by a staff of experienced reference librarians at each location and through an extensive interlibrary loan system. In addition to the normal collections, the library system holds for reference field-records, notebooks, manuscripts, and other background materials from completed projects, and the Photographic Library in Golden contains approximately 200,000 photographs taken during field studies dating back to 1869.

Further information on library facilities and services can be obtained by contacting the libraries at the telephone numbers listed in the directory section of this circular.

Data Bases and Data Systems -- As an adjunct to many program activities and as a major component of some others, information and data gathered are entered into computer-based data banks for storage and retrieval

Geologist studies rock outcrop in the field.

by the researchers who generated the data or by other potential users. Within the Geologic Division, on a variety of computing systems, about 150 such data bases and systems exist. They cover a multitude of subjects and range from large information systems on earthquakes, energy and mineral resources, rock analyses, and geologic maps to small specialized data files developed and used by only a small number of researchers to aid in their project work. Some files are available by direct access, whereas others require that information be requested from a contact person who is responsible for that particular file or system. A sampling of data bases and systems is given below with the name, acronym or abbreviation, and name of responsible branch or office.

National Coal Resources Data System (NCRDS; Branch of Coal Resources) — Information on coal quantity and quality in the United States.

Mineral Resources Data System (MRDS; Branch of Resource Analysis) — Set of records on mineral deposits and mineral commodities in the United States and, to a certain extent, the world.

Geologic Names of the United States (GEONAMES; Office of Scientific Publications) — List of rock stratigraphic names in good usage in the United States with distribution, age, and physical attributes.

Geologic Map Data (GEOMAPFIL; Office of the Chief Geologist) — Catalog of modern medium- and small-scale published geologic maps in the United States listing kinds of data displayed and generalized features such as dominant rock type, average elevation, selected man-made features, and so on.

Hypocenter Data File (HDF; Branch of Global Seismology and Geomagnetism) — Historical file of located earthquake hypocenters listing attributes (time, location, depth, and so on) of each earthquake.

Index to Geologic Maps (GEOINDEX; Office of Scientific Publications) — Catalog, by State, of published geologic maps of any scale.

National Uranium Resource Evaluation Data Base (NURE; Branch of Energy Minerals) -- File of

locations where uranium exploration has been carried out in the conterminous 48 States.

Petroleum Data System (PDS; Branch of Oil and Gas Resources) — File of U.S. oil and gas production by fields and pools, chemical analyses of crude oil and natural gas, and production history (Texas only).

Rock Analysis Storage System (RASS; Branch of Exploration Geochemistry) — Spectrographic and wet-chemical analyses of material samples collected in the United States by Geologic Division geologists and analyzed by Division chemists.

Further information on these particular files may be obtained by contacting headquarters of the branches listed for the name and telephone number of the contact person responsible. A comprehensive listing of USGS data bases and systems can be found in U.S. Geological Survey Circular 817, "Scientific and technical, spatial, and bibliographic data bases and systems of the U.S. Geological Survey, 1983."

Geologic Information Services — In addition to the library system, the Office of Scientific Publications manages information and other services provided by the Geologic Names Unit, the Geologic Inquiries Group, and the Visual Information Services Group. Telephone numbers for these groups, the principal offices of which are located in Reston, are listed in the directory under the Office of Scientific Publications.

The Geologic Names Unit is responsible for defining and recommending policy and rules governing the use of stratigraphic nomenclature for the USGS in accordance with the "Code of Stratigraphic Nomenclature" of the American Commission on Stratigraphic Nomenclature, for reviewing nomenclature usage by USGS authors, for approving and adjudicating any proposed changes in Survey usage, and for compiling information and publishing reports documenting changes in nomenclature usage by the USGS. In addition, the Unit is reponsible for the maintenance of a lexicon of geologic names used in the United States.

The Geologic Inquiries Group provides responses to inquiries on all aspects of geology, geologic maps, and mapping directed to the USGS by other Federal, State, and local agencies as well as from the general public. Teachers' packets of information on the earth sciences, tailored to specific purpose and grade level, and limited numbers of State Geologic Map Indexes, pamphlets on various geologic topics, and other preprinted materials are also available from the Geologic Inquiries Group.

The Visual Information Services Group prepares display panels for exhibits and for internal USGS purposes which illustrate specific work in geology, topographic mapping, water resources, and other aspects of USGS research and is responsible for final preparation of most of the general-interest pamphlets and brochures published by the Survey. Exhibit panels may be requested for display at professional meetings and technical conferences. Movies on certain earth-science topics also are available free from VISG on a short-term loan basis to professional and scientific societies, educational institutions, and civic and industrial groups.

DIRECTORY OF MAILING ADDRESSES, OFFICE LOCATIONS, AND TELEPHONE NUMBERS OF PRINCIPAL GEOLOGIC DIVISION ORGANIZATIONS

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Office of Regional Geology
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Office of Energy and Marine Geology
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Office of Earthquakes, Volcanoes, and Engineering
Chief, J. R. Filson
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Room: 3A-114
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Office of International Geology
Chief, A. T. Ovenshine
Mail Stop: 914
Room: 3B-416
Telephone: ext. 6047

Office of Scientific Publications
Chief, J. M. Aaron
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Geologic Names Unit
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Geologic Inquiries Group
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Branch of Analytical Chemistry
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Telephone: ext. 6200

Branch of Resource Analysis
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Room: 3B-404
Telephone: ext. 6125

Branch of Eastern Regional Geology
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Room: 3C-208
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Branch of Paleontology and Stratigraphy
Chief, R. Z. Poore
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Room: 4C-404
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Branch of Coal Resources
Chief, H. J. Gluskoter
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Room: 4C-234
Telephone: ext. 6401

Branch of Eastern Technical Reports
Chief, J. E. Fassett
Mail Stop: 903
Room: 2C-400
Telephone: ext. 4313

Branch of Library and Information Services
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Room: 4A-102
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Branch of Exploration Geochemistry
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Branch of Isotope Geology
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Branch of Global Seismology and Geomagnetism
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Branch of Engineering Geology and Tectonics
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Branch of Central Technical Reports
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Branch of Library and Information Services
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Branch of Igneous and Geothermal Processes
Chief, L. J. P. Muffler
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Branch of Western Technical Reports
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SUMMARY OF LEGISLATIVE AUTHORITY FOR CONDUCTING GEOLOGIC AND RESOURCE INVESTIGATIONS

The fundamental authorization for conducting geologic and resource investigations is the Organic Act of 1879, **43 USC 31(a).** The Organic Act authorizes the Geological Survey to conduct an

> "...examination of the geological structure, mineral resources, and products of the national domain."

Authority to perform work outside the "national domain" when it is determined to be in the national interest was provided by **43 USC 31(b)** and subsequent legislation.

In addition to this basic authorization, there is more recent legislative authority that is relevant to particular programs of the Geologic Division. Program-specific legislation may be grouped in accordance with the budget line items.

Geologic Hazards Surveys

42 USC 7701 et. seq. (P.L. 95-124)
The Earthquake Hazards Reduction Act of 1977 sets as a national goal the reduction in the risks to life and property from future earthquakes in the United States through the establishment and maintenance of a balanced earthquake program encompassing earthquake prediction, hazard reduction, and research.

42 USC 5201 et. seq. (P.L. 93-288)
The Disaster Relief Act of 1974, **Section 202(a),** states that "The President shall insure that all appropriate Federal agencies are prepared to issue warnings of disasters to State and local officials."

In addition, **Section 202(b)** states that "The President shall direct appropriate Federal agencies to provide technical assistance to State and local governments to insure that timely and effective disaster warning is provided." The Director of the Geological Survey through the Secretary of the Interior has been delegated the responsibility to issue disaster warnings "...for an earthquake, volcanic eruption, landslide, or other geologic catastrophe."

42 USC 4321 et. seq. (P.L. 91-190)
The National Environmental Policy Act of 1969 requires the Geological Survey to comply with **Section 102(2)(C)** which pertains to review of Environmental Impact Statements (EIS's) prepared by other agencies. The Survey reviews EIS's on sites for nuclear power plants and other critical facilities.

43 USC 506 et. seq. (P.L. 95-578)
The Reclamation Safety of Dams Act of 1978 requires the Geological Survey to participate in direct interchange of scientific information with other agencies. Geologic data developed under Geologic Hazards Surveys are applicable to dam-safety analyses.

Land Resource Surveys

15 USC 2901-2908; 31 USC 25 (P.L. 95-367)
The National Climate Program Act of 1978 requires that the Climate Change Program contribute information on the long-term natural variability of climate to the National Climate Program. This information is necessary for

understanding how the climate system works and for providing a basis for assessing possible effects of man's activities on climate and the environment.

42 USC 5845(c) (P.L. 93-438)
The Energy Reorganization Act of 1974 directs all other Federal agencies to "...(2)... furnish to the [Nuclear Regulatory] Commission...such research services as the Commission deems necessary and requests for the performance of its functions; and (3) consult and cooperate with the Commission on research and development matters of mutual interest and provide such information and physical access to its facilities as will assist the Commission in acquiring the expertise necessary to perform its licensing and related regulatory functions." The U.S. Geological Survey assists in the geologic mapping in areas where future nuclear reactor construction is anticipated, and conducts topical investigations of various geologic hazards that could imperil safe operation of the reactors.

22 USC 3201 et. seq. (P.L. 95-242)
The Nuclear Non-Proliferation Act of 1978 provides that under Title V—United States Assistance to Developing Countries--the Geological Survey assists through the Department of State and the Agency for International Development in evaluation of nuclear facilities sites in other countries.

42 USC 4321 et. seq. (P.L. 91-190)
The National Environmental Policy Act of 1969 requires the Geological Survey to comply with **Section 102(2)(C)** which pertains to review of Environmental Impact Statements (EIS's) prepared by other agencies. The Survey reviews EIS's on sites for nuclear power plants and other critical facilities.

Mineral Resource Surveys

50 USC 98 (P.L. 96-41)
The Strategic and Critical Materials Stockpiling Act of 1946 as amended by its Revision Act of 1979. **Section 8** of the Act supports the Survey's programs for exploration of domestic minerals, especially for strategic and critical minerals to complement the Federal mineral stockpile program.

16 USC 1131 (P.L. 88-577)
The Wilderness Act of 1964 and numerous subsequent related Acts require that the Geological Survey and Bureau of Mines assess the mineral resources of each area proposed as wilderness or established as wilderness if no prior mineral survey was done. The studies are to be on a planned and recurring basis.

30 USC 21(a) (P.L. 91-631); 30 USC 1601 et. seq. (P.L. 96-479)
The Mining and Minerals Policy Act of 1970 and the Materials and Minerals Policy, Research, and Development Act of 1980 re-emphasize the Survey's responsibility to assess the mineral resources of the Nation.

16 USC 1600 et. seq. (P.L. 94-588, P.L. 95-306)
The National Forest Management Act of 1976 (as amended 1978) and the Renewable Resources Extension Act of 1978. The Geological Survey is a party in a five-agency agreement calling for inventory of all resources on Federal land. The main consequence of these Acts to date has been the Forest Service RARE-II (Roadless Area Review Evaluation) wilderness reviews.

43 USC 1701 (P.L. 94-579)
The Federal Land Policy and Management Act of 1976 specifically requires that the Geological Survey and Bureau of Mines do a mineral survey by 1991 of each area that the Bureau of Land Management recommends for wilderness study.

16 USC 3141-3150, 3161
The Alaska National Interest Lands Conservation Act of 1980. **Section 1001** of the Act requires that the Geological Survey will assess the mineral potential of Federal lands north of 68 degrees North Latitude, east of the National Petroleum Reserve, and west of the Arctic National Wildlife Refuge, and participate in a review of the wilderness characteristics of the area. **Section 1010** of the Act requires that the Secretary of the Interior, who has delegated the responsibility to the Geological Survey, expand the minerals data base for all Federal lands in Alaska. **Section 1011** of the Act requires that an annual minerals report be presented to the Congress; the responsibility for preparing this report has also been delegated to the Geological Survey.

Energy Geologic Surveys

30 USC 201 (P.L. 94-377)
The Federal Coal Leasing Amendments Act of 1975 provides that no lease sale may be held on Federal lands unless the lands containing the coal deposits have been included in a comprehensive land use plan. The Act provides that the Secretary is authorized and directed to conduct a comprehensive exploratory program designed to obtain sufficient data and information to evaluate the extent, location, and potential for developing the known recoverable coal resources within the coal lands.

30 USC 1121 (P.L. 93-410)
The Geothermal Energy Research, Development, and Demonstration Act of 1974 provides that the Department of the Interior is responsible for the evaluation and assessment of the geothermal resource base, including the development of exploration technologies.

42 USC 4331 (P.L. 91-190)
The National Environmental Policy Act of 1969 requires that proponents of major Federal actions

sufficiently affecting the quality of human environment consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved.

16 USC 3141-3150, 3161 (P.L. 94-579)
The Alaska National Interest Lands Conservation Act of 1980. **Section 1001** of the Act requires that the Geological Survey will assess the oil and gas potential of Federal lands north of 68 degrees North Latitude, east of the National Petroleum Reserve, and west of the Arctic National Wildlife Refuge, and participate in a review of the Wilderness characteristics of the area. **Section 1002** of the Act requires that the Secretary of the Interior submit a report to Congress concerning the oil and gas potential of the coastal plain of the Arctic National Wildlife Refuge. The Geological Survey is authorized to submit an exploration plan if no other entity proposes an acceptable plan. **Section 1008** of the Act authorizes the Secretary to conduct studies, or collect and analyze information obtained by permittees, of the oil and gas potential of non-North Slope Federal lands.

42 USC 2210b, 2231 (P.L. 97-415)
This Act requires the Secretary of Energy to monitor and report to the President and the Congress on the viability of the domestic uranium industry. Under a memorandum of understanding between the Department of Energy and the Department of the Interior, the Geological Survey will provide information on domestic uranium resources to the Energy Information Agency.

Offshore Geologic Surveys

43 USC 31(a) and (b)
The Organic Act of 1879, which provided the basic authority for the Geological Survey to examine the geological structure, mineral resources, and products of the national domain was "expanded to authorize such examinations outside the national domain where determined by the Secretary [of the Interior] to be in the national interest."

16 USC 1451-1456 (P.L. 94-370)
The Coastal Zone Management Act Amendments of 1976 provides that each department, agency, and instrumentality of the Executive Branch of the Federal Government may assist the Secretary of Commerce , on a reimbursible basis or otherwise, in carrying out research and technical assistance for coastal zone management.

43 USC 1865 (P.L. 95-372)
The Outer Continental Lands Act Amendments of 1978 provides that the Secretary of the Interior shall conduct a continuing investigation, on the basis of data and information that he determines has been adequately and independently audited and verified, for the purpose of determining the availability of all oil and gas produced or located in the Outer Continental Shelf, including oil and natural gas resources. The Secretary has directed the Geological Survey to provide indirect support to the Minerals Management Service in meeting the objectives of the OCS Leasing Program.

30 USC 1419 et. seq. (P.L. 96-283)
The Deep Seabed Hard Mineral Resources Act of 1980 provides authorization for conducting a continuing program of ocean research that "shall include the development, acceleration, and expansion, as appropriate, of the studies of the ecological, geological, and physical aspects of the deep seabed in general areas of the ocean where exploration and commercial development are likely to occur..." The Geological Survey provides geologic and mineral resource expertise in responding to the requirements of the Act.

43 USC 1301 (P.L. 92-532)
The Marine Protection, Research, and Sanctuaries Act of 1972 provides that the Secretary of Commerce must consult with the Secretary of the Interior prior to designating marine sanctuaries. The Geological Survey provides information regarding the energy and mineral resource potential in areas being considered for designation as marine sanctuaries.

*U.S. GOVERNMENT PRINTING OFFICE: 1986-491-405:20135