

**THE GEOLOGICAL SURVEY OF WYOMING**  
Gary B. Glass, State Geologist

**FIFTY-SEVENTH ANNUAL REPORT**  
of the  
**GEOLOGICAL SURVEY OF WYOMING**

**For Fiscal Year 1990**  
**July 1, 1989 to June 30, 1990**

by

**Gary B. Glass and Susanne G. Bruhnke**



**Laramie, Wyoming**  
**October, 1990**

# THE GEOLOGICAL SURVEY OF WYOMING

Gary B. Glass, *State Geologist and Director*

## GEOLOGICAL SURVEY BOARD

### Ex Officio

Mike Sullivan, *Governor*  
Terry P. Roark, *President, University of Wyoming*  
Donald B. Basko, *Oil and Gas Supervisor*

### Appointed

D.L. Blackstone, Jr., *Laramie*  
Michael Flynn, *Sheridan*  
Jimmy E. Goolsby, *Casper*  
Robert S. Houston, *Laramie*  
Bayard D. Rea, *Casper*

## STAFF

### Administrative Services

Susanne G. Bruhnke - *Secretary*  
Rebecca S. Hasselman - *Bookkeeper*

### Coal Division

Richard W. Jones - *Head*

### Geologic Hazards Division

James C. Case - *Head*

### Industrial Minerals and Uranium Division

Ray E. Harris - *Head*

### Laboratory Services

Jay T. Roberts - *Laboratory Technician*

### Metals and Precious Stones Division

W. Dan Hausel - *Deputy Director and Head*

### Oil and Gas Division

Rodney H. DeBruin - *Head*

### Publications Division

Sheila Roberts - *Editor and Head*  
Teresa L. Beck - *Publications Assistant*  
Frances M. Smith - *Sales Manager*  
Fred H. Porter, III - *Cartographer*  
Phyllis A. Ranz - *Cartographer*

### Stratigraphy Division

Alan J. VerPloeg - *Head*

First printing of 200 copies by Wyoming Department of Administration and Fiscal Control, Central Duplicating Section.

The Geological Survey of Wyoming  
P.O. Box 3008, University Station  
Laramie, Wyoming 82071-3008  
(307) 766-2286

# CONTENTS

|  |    |
|--|----|
| INTRODUCTION .....   | 1  |
| Statutory authority .....  | 1  |
| Agency mission .....   | 1  |
| Agency goals .....   | 1  |
| Information dissemination .....  | 1  |
| Geologic framework .....   | 1  |
| Mineral and energy resource assessment .....                             | 1  |
| Mineral and energy resource processes .....                              | 1  |
| Hazards identification and prediction .....                              | 1  |
| Timely reporting of events and conditions .....                          | 1  |
| Coordination .....   | 2  |
| Mission support .....  | 2  |
| Agency accomplishments .....   | 2  |
| ORGANIZATION .....   | 2  |
| Administration Program .....   | 2  |
| Publications Program .....   | 3  |
| MAJOR ACCOMPLISHMENTS OF THE ADMINISTRATION PROGRAM .....                | 3  |
| Objectives .....   | 3  |
| Accomplishments .....  | 3  |
| Services .....   | 3  |
| General .....  | 4  |
| Ongoing assistance to State and local government entities .....          | 4  |
| Spot assistance to State and local entities .....                        | 6  |
| Assistance to Federal entities, foreign entities, and other states ..... | 7  |
| Talks and briefings .....  | 8  |
| Investigations .....   | 8  |
| Coal Division .....  | 8  |
| Geologic Hazards Division .....  | 8  |
| Industrial Minerals and Uranium Division .....                           | 9  |
| Metals and Precious Stones Division .....                                | 9  |
| Oil and Gas Division .....   | 9  |
| Stratigraphy Division .....  | 10 |
| Miscellaneous .....  | 10 |
| Public files .....   | 11 |
| MAJOR ACCOMPLISHMENTS OF THE PUBLICATIONS PROGRAM .....                  | 12 |
| Objectives .....   | 12 |
| Accomplishments .....  | 12 |
| Publishing .....   | 12 |
| Sales and distribution .....   | 14 |
| Technical support .....  | 15 |
| SUMMARY OF PERMANENTLY ASSIGNED VEHICLES .....                           | 16 |

## INTRODUCTION

### STATUTORY AUTHORITY

The office of State Geologist was established in 1890 with the Wyoming State Constitution (Art. 9, Sec. 6) and modified by legislative enactment in 1969, 1975, 1977, 1979, and most recently Laws 1982, Ch. 62, §3 (Title 9, Ch. 2, Art. 8, W.S. 9-2-803).

The Geological Survey of Wyoming, which was created by the Legislature in 1933, has since been modified by legislative enactment in 1957, 1969, 1977, 1979, and most recently Laws 1982, Ch. 62, §3 (Title 9, Ch. 2, Art. 8, W.S. 9-2-803 through 9-2-809).

### AGENCY MISSION

The mission of the Geological Survey is to provide information on the geology and mineral and energy re-

sources of the State, particularly as they relate to the citizenry and economy of Wyoming.

### AGENCY GOALS

The Geological Survey of Wyoming's goals, which are listed below, link the Survey's activities and programs to the State's needs:

**INFORMATION DISSEMINATION — PROVIDE TIMELY, ACCURATE, AND ACCESSIBLE INFORMATION ABOUT THE STATE'S GEOLOGY AND MINERAL AND ENERGY RESOURCES.**

This goal is achieved by publishing geologic maps and general interest, scientific, and technical reports on geology and mineral and energy resources; by making technical files available to the public; and by operating a public information service that provides answers to inquiries or enables inquirers to readily identify and obtain existing information.

**GEOLOGIC FRAMEWORK — INCREASE KNOWLEDGE OF THE GEOLOGIC STRUCTURE AND GEOLOGIC FORMATIONS IN THE STATE TO PROVIDE THE SCIENTIFIC FRAMEWORK FOR INVESTIGATIONS OF MINERAL RESOURCES AND GEOLOGIC HAZARDS AND TO MEET ANTICIPATED FUTURE RESPONSIBILITIES.**

This goal is achieved through geologic mapping; through structural, stratigraphic, and paleontologic field studies; through the testing of conceptual models; and through laboratory investigations of the petrologic, physical, and chemical properties of rocks and minerals.

**MINERAL AND ENERGY RESOURCE ASSESSMENT — INCREASE KNOWLEDGE OF THE DISTRIBUTION, RESERVES, AND QUALITY (PETROGRAPHIC, CHEMICAL, AND PHYSICAL CHARACTERISTICS) OF THE STATE'S MINERAL AND ENERGY RESOURCES TO PROMOTE THEIR DEVELOPMENT AS WELL AS TO PROVIDE FACTUAL INFORMATION FOR POLICY DECISIONS AFFECTING THE AVAILABILITY AND USE OF THE STATE'S LAND, MINERAL, AND ENERGY RESOURCES.**

This goal is achieved by using the techniques of resource evaluation including geologic mapping, reconnais-

sance exploration, and field and laboratory studies of rocks and minerals.

**MINERAL AND ENERGY RESOURCE PROCESSES — ENHANCE THE ABILITY TO DISCOVER HIDDEN OR AS YET UNRECOGNIZED MINERAL AND ENERGY RESOURCES BY DEVELOPING INFORMATION ON THE NATURAL PROCESSES BY WHICH MATERIALS IN THE EARTH ARE FORMED, TRANSPORTED, AND CONCENTRATED.**

This goal is achieved through field investigations, laboratory analysis, and the construction of conceptual models.

**HAZARDS IDENTIFICATION AND PREDICTION — IDENTIFY POTENTIAL GEOLOGIC HAZARDS AND IMPROVE THE ABILITY TO PREDICT THE LOCATION, TIME, AND SEVERITY OF NATURAL AND MAN-MADE HAZARDS SO THAT LOSS OF LIFE AND PROPERTY IS MINIMIZED IF NOT ELIMINATED.**

This goal is achieved through geologic mapping, field investigations, aerial photographic interpretation, and the application of geologic principles related to dynamic Earth processes.

**TIMELY REPORTING OF EVENTS AND CONDITIONS — PROVIDE FORECASTS OF MINERAL PRODUCTION AND VALUES AS WELL AS TIMELY REPORTS ON IMPORTANT HYDROLOGIC AND GEOLOGIC EVENTS AND CONDITIONS OF IMMEDIATE CONCERN TO THE PUBLIC AND TO GOVERNMENTAL BODIES.**

This goal is accomplished by ongoing analysis of mineral- and energy-related activities, including man-related projects and the geologic conditions surrounding those projects, and the timely dissemination of relevant information to include warnings. Similarly, natural events are also monitored, particularly in regard to how they might affect the State's citizenry.

**COORDINATION — IMPROVE THE COORDINATION OF EARTH-SCIENCE DATA COLLECTION, RESEARCH, AND MAPPING TO MINIMIZE DUPLICATION OF EFFORT, INCREASE DATA ACCESSIBILITY, AND REDUCE COSTS.**

Coordination is carried out by sharing and/or exchanging plans, technologies, and data bases with appropriate entities and by striving to standardize information formats.

**MISSION SUPPORT — IMPROVE THE SURVEY'S ABILITY TO EFFECTIVELY CARRY OUT ITS MISSION.**

This is accomplished by providing new training or continuing education opportunities for employees; by replacing and upgrading obsolete field, laboratory, and publication-related equipment; by acquiring computer software and/or hardware to enhance the operations and management of the Agency; and by implementing innovative ideas that increase output from available resources.

## AGENCY ACCOMPLISHMENTS

In FY90, the Geological Survey of Wyoming:

— provided data, advice, and assistance to both in-state and out-of-state inquiries, responding to more than 18,428 inquiries related to geology and mineral and energy resources (6,349); to the effective use of earth-science techniques, products, and information (398); and to requests for Survey publications and information on publications (11,681).

— prepared 142 new reports or maps that communicate information on the State's geologic and mineral and energy resources, and published those reports for dissemination through the Publications Sales Section.

— maintained and expanded public files and data bases on the State's geologic and mineral and energy resources.

— identified and evaluated geologic hazards in Wyoming associated with earthquakes, landslides, subsidence, shrinking-swelling clays, active faults, windblown sands, and naturally-occurring toxic elements.

— assessed mineral and energy resources, documented their occurrences, and determined their origins and manners of occurrence through more than 13 field and laboratory investigations.

— increased knowledge of the State's stratigraphic framework through seven geologic mapping and/or geologic investigations.

## ORGANIZATION

To accomplish its mission and achieve its goals, the Geological Survey operates under two programs (Figure 1):

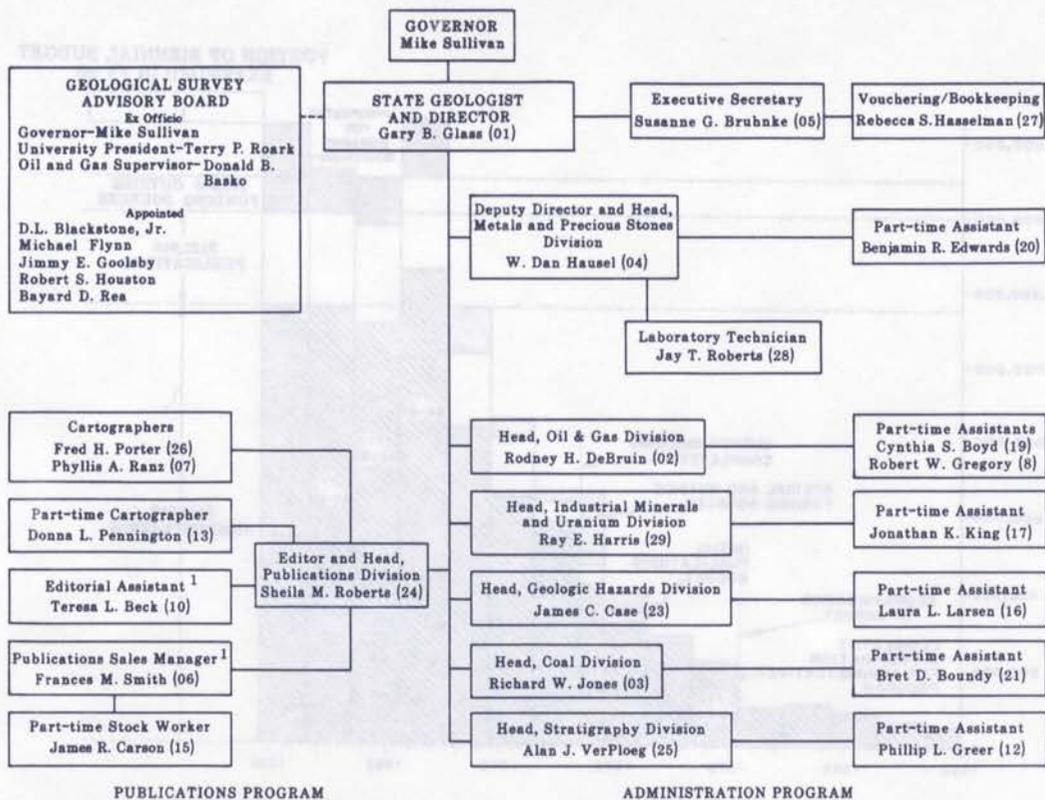
**ADMINISTRATION PROGRAM (001)** - Since 1969, when the Agency was reorganized and expanded, efforts of the Administration Program have been directed at geological factors that directly or indirectly affect the State's citizenry, State-owned lands, communities, new mineral discoveries, mineral development, items of scientific importance, and natural or man-induced geologic hazards.

In FY90, the staff of the Administration Program consisted of 13 full-time and 9 part-time employees. Seven full-time geologists and 7 part-time geologic assistants form the backbone of this program, which is tasked with the major objectives of the Agency. The Director and two other full-time employees (executive secretary and bookkeeper) in the Administration Program provide the truly administrative, budgetary, and fiscal support for the Agency. In addition, 3 full-time (Editor and two cartographers) and 2 part-time (cartographer and stockworker) members of this program provide editorial, cartographic, and other support to the Publications Program. Although these latter five positions are currently funded from the Administration Program, they will be transferred to the Publications Program in FY91. Their activities are discussed in the Publications Program.

In support of the Administration Program, the Agency solicits and receives some funds from outside sources (State, local, or Federal grants) to augment General Fund appropriations. In FY90, these augmenting funds totaled \$134,457.95, of which \$48,995.23 were expended in that fiscal year. Although the projects funded by these grants become part of the Administration Program, their continuation into future years is speculative as they are only funded on an annual basis.

**PUBLICATIONS PROGRAM (002)** - This is the publishing arm of the Agency. The program is also charged with selling and distributing the Agency's publications. The Publications Program, which includes the salaries for two full-time employees (Publication Sales Manager and Editorial Assistant) as well as funds for supplies, equipment, commercial printing, and travel related to publication activities, is funded by General Fund appropriations.

The Publications Program consists of a Publications Division, which is headed by the Editor. This Division includes a Cartographic Section, an Editorial Section, and a Publications Sales Section. The Cartographic Section puts all illustrative materials (drawings, maps, charts, etc.) into publishable form and makes proof copies and printer-ready negatives. The Editorial Section edits and puts all manuscripts



<sup>1</sup> These are the only positions currently paid out of the Publications Program

Figure 1. Organization chart for the Geological Survey in FY90.

into printer-ready formats, writes printing specifications, and sees that reports are satisfactorily printed. The Publications Sales Section sells Survey publications over-the-counter, by mail, and by phone, keeps an inventory of publications, and mails exchange publications. Revenues from the sale of publications in FY90 was \$75,709, a 10 percent increase from the previous year. As mentioned earlier, the Adminis-

tration Program funds five positions, which support the Publications Division. These positions will be transferred into and funded by the Publications Program in FY91.

The biennial appropriations for these two programs are shown in Figure 2 along with FY90 expenditures.

## MAJOR ACCOMPLISHMENTS OF THE ADMINISTRATION PROGRAM

### OBJECTIVES

The Administration Program is implemented by the State Geologist, six geologic Divisions (Coal, Geologic Hazards, Industrial Minerals and Uranium, Metals and Precious Stones, Oil and Gas, and Stratigraphy), and the Laboratory Section. To accomplish the Agency's mission

and goals as listed earlier, this program has three major objectives: (1) provide geologic information, advice, and assistance, (2) prepare geologic reports and maps based on office, field, and laboratory investigations, and (3) maintain records on geologic, mineral, and energy resources.

### ACCOMPLISHMENTS

For each of these three major objectives, the activities and accomplishments of the Administration Program in FY90 are described below:

**SERVICES:** Provide information, advice, and assistance for all inquiries on the State's geologic, mineral, and energy resources.

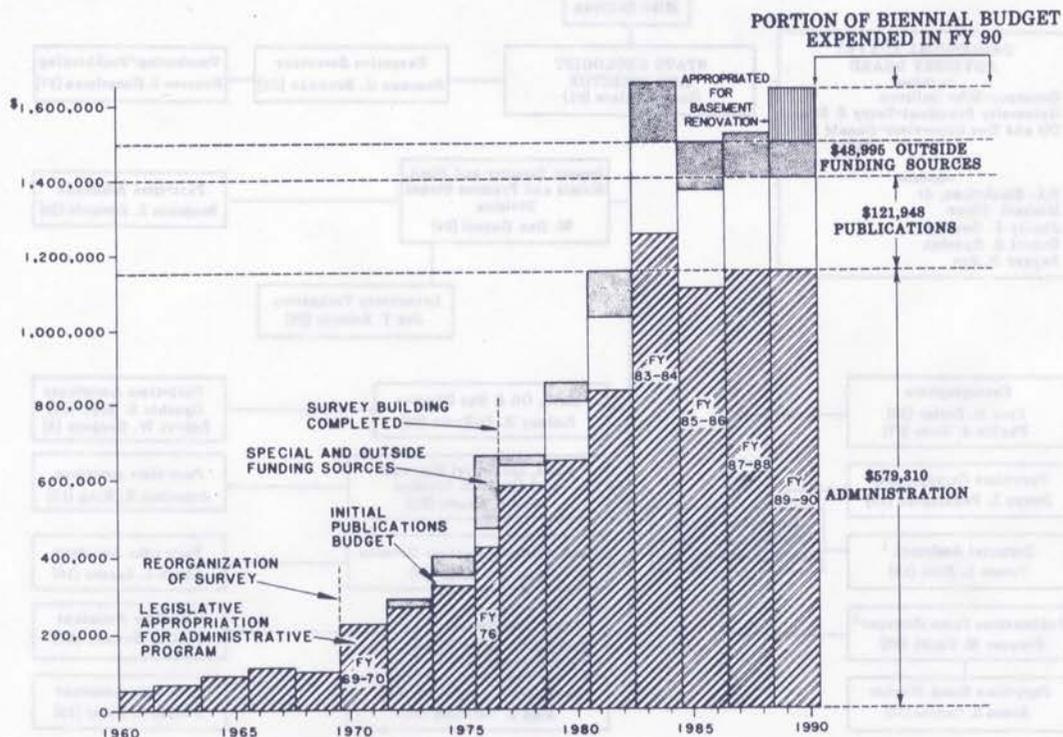


Figure 2. Biennial appropriations for the Geological Survey (expenditures for FY90 are annotated to the right of the biennial appropriations).

## General

Because the Geological Survey is primarily a service-oriented organization, its geologic staff responds to many thousands of requests for information and assistance each year. Figure 3 illustrates the percentages of these inquiries received by the various Geologic Divisions of the Survey over the last three fiscal years. Most significantly, the Geologic Hazards, Industrial Minerals and Uranium, and Metals and Precious Stones Divisions had the most inquiries in FY90. This has been the case for the last four years.

Since at least FY81, inquiries directed to the geologic staff have increased every year. In FY90, inquiries increased about 5 percent (from 6,019 in FY89 to 6,349 in FY90); this level equates to 3.1 inquiries per geologist per work day (254 work days in a year). More importantly, this current level of inquiry is 233 percent greater than it was in FY81 (Figure 4). Figure 4 also shows the categories of inquirers requesting information and assistance from the geologic staff. Between FY89 and FY90, inquiries from business and industry increased the most, i.e., increasing from 31 percent to 36 percent.

### Ongoing Assistance to State and Local Government Entities

In regard to inquiries from State agencies and local jurisdictions, the Geological Survey's services are divisible into routine ongoing assistance and spot requests for assistance. Ongoing and substantial spot assistance were pro-

vided to 22 State and local government entities in FY90. The assistance provided these entities is described below:

**Archives, Museums, and Historical Department** — As the Associate Curator of Mineralogy for the Wyoming State Museum, the Survey's Deputy Director continued to provide materials and information for the museum on request.

**Consensus Revenue Estimating Group (CREG)** — The State Geologist is a member of CREG, a group that makes revenue estimates for use by the Governor and the Legislature, prior to each Legislative Session. With advice and information provided by the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Divisions, the State Geologist provided forecasts and continually apprised CREG of the minerals situation throughout FY90.

**Department of Administration and Fiscal Control (DAFC), Division of Research and Statistics** — (1) The State Geologist and Heads of the Coal, Industrial Minerals and Uranium, Oil and Gas, and Metals and Precious Stones Divisions provided information on the prices of oil, coal, and metals; maps; production statistics; and forecasts related to mineral and energy resources throughout the year for use in economic forecasting; and (2) the State Geologist reviewed and commented on a revised version of the Wharton Economic Forecasting Model and participated as a member of a committee tasked with forecasting mining economics in Wyoming.

**Department of Administration and Fiscal Control (DAFC), Personnel Division** — The State Geologist participated as a member of the Executive Management Advisory Council.

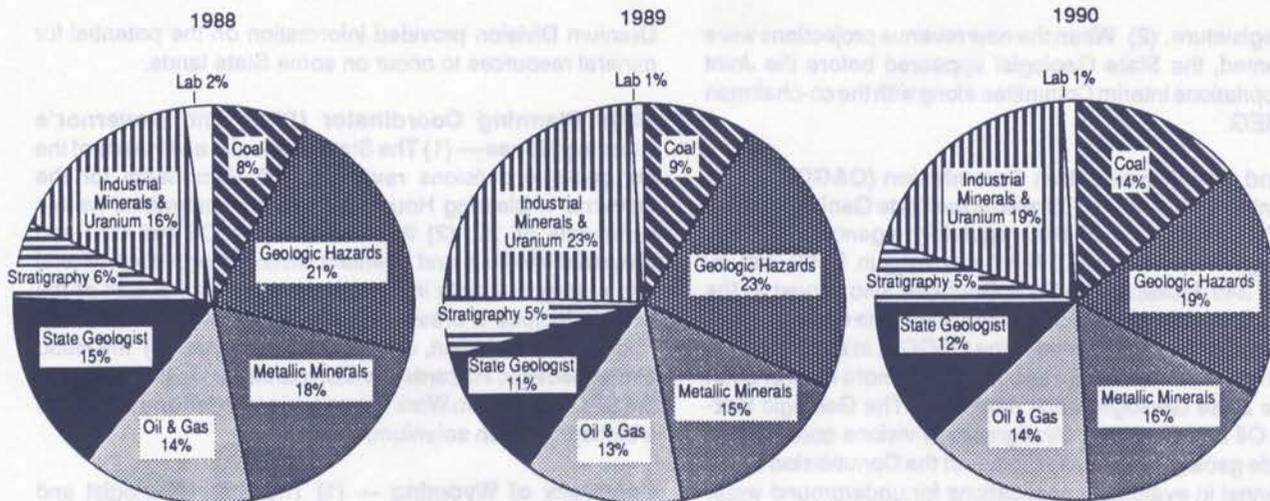


Figure 3. Percentage of inquiries directed to each of the Geologic Divisions, Fiscal Years 1988-1990.

**Department of Environmental Quality, Land Quality Division (DEQ-LQD)** — (1) The Heads of the Coal, Industrial Minerals and Uranium, and Metals and Precious Stones Divisions continued to review and make recommendations on Abandoned Mined Land Reclamation Projects (AML); (2) the Head of the Coal Division participated as a member of the DEQ's Selection Committee for Procurement in the AML Program; and (3) under the Survey's Memorandum of Understanding with the DEQ-LQD, the Head of the Geologic Hazards Division reviewed one paleontologic survey included in a new mining application.

**Department of Health and Social Services (DHSS)** — The Geologic Hazards Division continued to participate in radon-related projects of the DHSS and the U.S. Environmental Protection Agency by providing guidance for placement of radon-detection canisters in selected schools in Wyoming.

**Economic Development and Stabilization Board (EDS Board)** — (1) The State Geologist and Heads of the Coal, Industrial Minerals and Uranium, and Metals and Precious Stones Divisions of the Survey provided information on mines, mineral-related projects, production trends, and markets for mineral and energy resources to the staff of the EDS Board; and (2) the Head of the Industrial Minerals and Uranium Division assisted the EDS Board staff in their evaluations of some grant proposals.

**Governor's Office** — (1) The Head of the Industrial Minerals and Uranium Division briefed the Governor on resources of silica sand and decorative stone in Wyoming; and (2) the State Geologist commented on several documents provided by the Governor or his staff.

**Industrial Siting Administration (ISA)** — (1) The Survey reviews siting applications when they are submitted; and (2) the Head of the Oil and Gas Division provided information

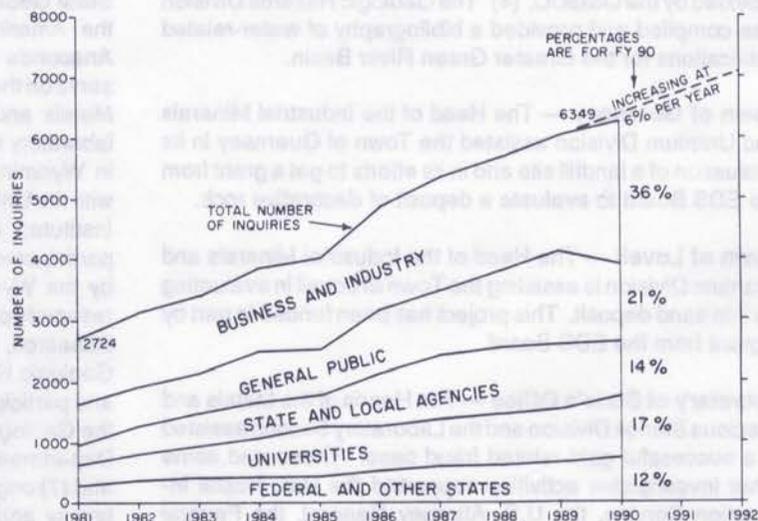


Figure 4. Number of inquiries directed to the Geologic Divisions by category and fiscal year.

on oil and gas activities and production on the Wind River Indian Reservation.

**International Trade Office** — (1) The Head of the Industrial Minerals and Uranium Division referred several interested parties to the Trade Office in FY90; and (2) the Head of the Coal Division provided information on Wyoming's coal resources to answer an inquiry by a Korean electrical utility company.

**Legislative Service Office** — (1) In October, the State Geologist and the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Divisions estimated the production and prices for minerals produced in the State. The Survey's estimates and those of several other State agencies were used to reach a consensus on future mineral production and prices. Later these consensus estimates were used by the Consensus Revenue Estimating Group (CREG) to provide a forecast of mineral revenue for use by both the Governor and

the Legislature. (2) When the new revenue projections were presented, the State Geologist appeared before the Joint Appropriations Interim Committee along with the co-chairmen of CREG.

**Oil and Gas Conservation Commission (O&GCC)** — (1) Wyoming Statute 30-5-103 makes the State Geologist one of the Commissioners of this regulatory agency. Monthly hearings were routinely 0.5-1.0 day long in FY90 and involved 349 dockets. The State Geologist also served as the Acting Chairman of the Commission when the Governor was not present. Matters related to the O&GCC, in addition to the hearings, routinely require another two or more days of effort by the State Geologist each month. (2) The Geologic Hazards, Oil and Gas, and Stratigraphy Divisions continued to provide geologic information to assist the Commission's field personnel in evaluating applications for underground water disposal or injection sites as well as sites for disposal pits. (3) The Geologic Hazards and Oil and Gas Divisions are continuing to edit a computerized oil and gas data base provided by the O&GCC. (4) The Geologic Hazards Division also compiled and provided a bibliography of water-related publications for the Greater Green River Basin.

**Town of Guernsey** — The Head of the Industrial Minerals and Uranium Division assisted the Town of Guernsey in its evaluation of a landfill site and in its efforts to get a grant from the EDS Board to evaluate a deposit of decorative rock.

**Town of Lovell** — The Head of the Industrial Minerals and Uranium Division is assisting the Town of Lovell in evaluating a silica sand deposit. This project has been funded in part by a grant from the EDS Board.

**Secretary of State's Office** — The Heads of the Metals and Precious Stones Division and the Laboratory Section assisted in a successful gold-related fraud case. These and some other investigative activities supported the U.S. Postal Inspection Service, the U.S. Attorney General, the Federal Bureau of Investigation, and the U.S. Securities and Exchange Commission.

**State Auditor's Office** — The State Geologist participated as a member of the User's Advisory Group for the new computerized accounting system (WIN) being implemented by the State Auditor's Office.

**State Crime Laboratory** — Survey personnel continued to provide technical and laboratory assistance to investigators from the State Crime Lab when requested.

**State Land and Farm Loan Office** — (1) The Survey's Oil and Gas Division provided (a) weekly reports of oil and gas activities on or near State lands, (b) oil and gas tract evaluations to assist with selecting tracts for the lease auction every other month, and (c) an updated computerized listing of oil and gas potential and sale results on State lease tracts; (2) the State Geologist (a) reviewed and made recommendations on all commercial and scientific fossil-collecting permits (there were 8 applications in FY90), (b) conducted field inspections of several fossil quarries, and (c) provided some information regarding proposed land exchanges involving State lands; and (3) the Industrial Minerals and

Uranium Division provided information on the potential for mineral resources to occur on some State lands.

**State Planning Coordinator (SPC) and Governor's Clearing House** — (1) The State Geologist and Heads of the six geologic divisions reviewed 166 documents for the Governor's Clearing House in FY90 and submitted written comments on 29; (2) the Heads of the Oil and Gas and Industrial Minerals and Uranium Divisions provided mineral and energy resource information for use by the staff of the SPC to include a breakdown of oil and gas production on Federal, State, Indian, and private lands; and (3) the Head of the Geologic Hazards Division continued to participate in the SPC's Selenium Work Group and compiled and published a bibliography on selenium.

**University of Wyoming** — (1) The State Geologist and several of the Survey's Division Heads continued to provide quarterly minerals outlook articles for publication in the Survey Research Center's *Wyoming quarterly update*; (2) the State Geologist and Deputy Director remained members of the American Heritage Center's Advisory Board for the Anaconda Collection; (3) the State Geologist continued to serve on the College of Agriculture's Advisory Council; (4) the Metals and Precious Stones Division continued field and laboratory research into diamond-bearing kimberlite deposits in Wyoming, partially funded by a cooperative agreement with the University's Mining and Mineral Resources Research Institute; (5) the Head of the Geologic Hazards Division participated in a videotaped "water talk" seminar sponsored by the Wyoming Water Research Center and reviewed a research proposal on selenium prepared by the Office of Research; (6) the Heads of the Metals and Precious Stones, Geologic Hazards, and Publications Divisions assisted with and participated in the Rocky Mountain Sectional meeting of the Geological Society of America, which was hosted by the Department of Geology and Geophysics and held in Jackson; and (7) ongoing assistance and information was provided to faculty and students from many other departments of the University.

**Wyoming Emergency Management Agency (WEMA)** — The Head of the Geologic Hazards Division is the Survey's liaison to WEMA. He is also a member of the Governor's Multi-hazard Task Force and the Governor's representative to the Western States' Seismic Policy Council (WSSPC). As the Governor's representative to the WSSPC, he attended the annual meeting, which was held in Idaho. In addition, educational materials on earthquakes were provided to several schools as well as to Northwest Wyoming Community College.

### Spot Assistance to State and Local Government Entities

In addition, spot requests for assistance were received from 55 other State and local government entities in FY90. The following is a list of these entities:

Agriculture Department  
Albany County School District  
Attorney General's Office

Campbell County Economic Development Corp.  
 Carbon County Planning and Development Office  
 Central Wyoming Community College  
 City of Rock Springs  
 Civil Air Patrol  
 Data Services (DAFC)  
 Department of Labor  
 Education Department  
 Environmental Quality - Air Quality Division  
 Environmental Quality - Solid Waste Management Division  
 Game and Fish Department  
 Goshen County Cooperative Extension Service  
 Goshen County Weed and Pest District  
 Highway Department  
 Johnson County Commissioners  
 Kemmerer Office of Planning and Development  
 Laramie City Engineer's Office  
 Laramie County Community College  
 Laramie Economic Development Council, Inc.  
 Lincoln County Planning Department  
 Lincoln County School District  
 Meadowlark Elementary School  
 Natrona County Commissioners  
 Northwest Wyoming Community College  
 Public Service Commission - Transportation Division  
 Public Service Commission - Utilities Division  
 Recreation Commission  
 Representative John J. Hines  
 Representative Mark Harris  
 Revenue and Taxation Department  
 Rock Springs Department of Public Utilities  
 Sheridan College  
 Sheridan County Commissioners  
 Sinks Canyon State Park  
 Star Valley High School  
 State Archaeologist's Office  
 State Engineer  
 State Inspector of Mines  
 State Treasurer's Office  
 State Veterinary Laboratory  
 Sweetwater County Department of Planning and Development  
 Teton County Commissioners  
 Tongue River Elementary School  
 Town of Superior  
 Town of Thermopolis  
 Travel Commission  
 Tri-City Community Education, Guernsey  
 Uinta County Planning Office  
 Water Development Commission  
 Western Wyoming Community College  
 Wyoming National Guard  
 Wyoming Safety Council

Department of Energy  
 Energy Information Administration  
 Environmental Protection Agency  
 F.E. Warren Air Force Base  
 Federal Bureau of Investigation  
 Federal Emergency Management Agency  
 Fish & Wildlife Service  
 Forest Service  
 General Accounting Office  
 Idaho National Energy Laboratory  
 Inspector General  
 Internal Revenue Service  
 Jet Propulsion Laboratory  
 Minerals Management Service  
 National Earthquake Information Center  
 National Park Service  
 Nuclear Regulatory Commission  
 Office of Surface Mining  
 Occupational Safety and Health Administration  
 Representative Thomas' Office  
 Securities and Exchange Commission  
 Senator Wallop's Office  
 Soil Conservation Service  
 Tennessee Valley Authority  
 U.S. Geological Survey  
 U.S. Postal Inspection Service

**Foreign**

Bureau de Recherches (France)  
 China Ministry of Geology  
 Geological Society of China  
 GeoMinero de Espona, Spain  
 IMGRE (USSR)  
 India National Oil Company  
 Reserve Geologique de Haute Provence  
 Saskatchewan Geological Survey  
 Sierra Leone Ministry of Mines  
 Tianjin Geological Academy (China)  
 University Libre de Bruxelles  
 University of Adelaide (Australia)  
 University of Western Australia  
 Uppsala University (Sweden)  
 Urals Gold Mining Company (USSR)  
 USSR Gold & Diamond Enterprise  
 USSR Institute for Precious Metals

**Government Entities and Universities in Other States**

Alaska Oil and Gas Commission  
 Arizona Geological Survey  
 Baylor University  
 California Water Resources Board  
 Central Missouri State University  
 Chadron State College  
 Colorado Geological Survey  
 Colorado School of Mines  
 Colorado State University  
 Columbia University  
 Hamilton College  
 Hawaii Civil Defense Agency  
 Idaho Emergency Management Agency  
 Idaho Geological Survey  
 Idaho State University  
 Illinois State Geological Survey  
 Indiana Geological Survey  
 Indiana University  
 Iowa Geological Survey Bureau  
 Iowa State University  
 Kentucky Geological Survey  
 Los Angeles Department of Water & Power  
 Louisiana Geological Survey  
 Minnesota Geological Survey  
 Missouri Department of Natural Resources

**Assistance to Federal Entities, Foreign Governments, and Government Entities and Universities in Other States**

Requests for information and assistance were also received and answered for 116 Federal, foreign, or government entities in other states as listed below:

**Federal Entities**

Attorney General's Office  
 Bureau of Indian Affairs  
 Bureau of Land Management  
 Bureau of Mines  
 Bureau of Reclamation  
 Bureau of the Census  
 Defense Nuclear Agency  
 Department of Agriculture  
 Department of Agriculture-Poison Plant Research Institute

Montana Bureau of Mines and Geology  
 Montana Oil and Gas Commission  
 Montana State University  
 Nebraska Conservation and Survey Division  
 Nevada Bureau of Mines & Geology  
 New Mexico Bureau of Mines & Mineral Resources  
 North Dakota Geological Survey  
 Northern Arizona University  
 Oberlin College  
 Oklahoma Geological Survey  
 Oregon Department of Geology and Mineral Industry  
 Oregon State University  
 Pennsylvania Bureau of Topographic and Geologic Survey  
 Pennsylvania State University  
 San Bernardino County Museum  
 Sir Sandford Fleming College  
 South Dakota Geological Survey  
 South Dakota State University  
 Southern Illinois University  
 Stanford University  
 State University of New York at Buffalo  
 Texas Bureau of Economic Geology  
 University of California-Davis  
 University of Colorado  
 University of Florida  
 University of Idaho  
 University of Minnesota at Duluth  
 University of Missouri  
 University of Texas at Austin  
 University of Utah  
 University of Vermont  
 Utah Geological and Mineral Survey  
 Utah State University  
 Virginia Polytechnic Institute  
 West Virginia Department of Mines  
 Western Michigan University  
 Western Montana Tech  
 Western Technical University  
 Wisconsin Geological and Natural History Survey  
 Wright State University

### Talks and Briefings

As an extension of this service-related function, the State Geologist, Division Heads and staff, and the Editor collectively presented 35 talks, field trips, or briefings on mineral resources, geology, or geologic hazards to the following groups:

Association of Earth Science Editors, Ottawa, Ontario, Canada  
 Broken Hill Mining-Utah International, Salt Lake City, Utah  
 Cheyenne Gem and Mineral Society, Cheyenne  
 Cody Archaeology Club, Cody  
 Cyprus Coal Company, Laramie  
 Denver Coal Club, Denver, Colorado  
 Geological Society of America, South Pass  
 International Association of Drilling Contractors, Casper Chapter, Casper  
 International Geological Congress (28th), Casper  
 KGWN-TV, Cheyenne  
 KUWR radio talk show, Laramie (2 talks)  
 National Oil Company of India, Laramie  
 Newmont Mining Company, South Pass  
 NORD Resources, South Pass  
 Petroleum Association of Wyoming and U.S. Bureau of Land Management, Casper (2 talks)  
 Prospectors of Wyoming, Cody (2 talks)  
 Rock River Elementary School, Rock River  
 Society of Mining, Metallurgy & Exploration, Salt Lake City, Utah  
 Southern Illinois University, Carbondale, Illinois  
 Tri-Cities Community Education, Guernsey  
 University of Missouri Geology Field Camp, Rawlins  
 University of Wyoming, Center for Teaching and Learning, Laramie  
 University of Wyoming, College of Agriculture, Gillette  
 University of Wyoming, College of Engineering, Laramie

University of Wyoming, Department of Geography and Recreation and the Center for Curriculum and Instruction, Laramie  
 University of Wyoming, University School, Centennial  
 University of Wyoming, Wyoming Water Research Center, Laramie  
 Western States Seismic Policy Council, Boise, Idaho  
 Wyoming Geological Association, Casper (4 talks)

**INVESTIGATIONS: Conduct office, field, and laboratory investigations and prepare geologic reports and maps that (a) increase understanding of the geologic, mineral, and energy resources of the State and (b) have a practical bearing on Wyoming's communities and people.**

Arranged by Geologic Division, the following 39 investigations, projects, or studies were ongoing or completed in FY90:

### Coal Division

- **Coalbed methane potential in Wyoming** (ongoing as a joint effort with the Oil and Gas Division; two talks were presented; one paper was published by the Wyoming Geological Association; and the draft of another paper was submitted for publication by the Survey).
- **National Coal Resources Data System** (ongoing; compiled coal data for inclusion in a computerized national data base; prepared and submitted a paper on the stratigraphic framework of coal-bearing rocks in the Wind River Basin to the Rocky Mountain Association of Geologists; partially funded by a grant from the U.S. Geological Survey's Branch of Coal Resources).
- **Characterization of Wyoming coals** (ongoing; began assembling data on the chemical composition and physical properties of Wyoming coal for entry into a computerized data base; began with the Wyodak coal in the Powder River Coal Field).
- **Federal coal drilling in Wyoming to include coal analyses** (ongoing; prepared reports on some drilling records from both the Bighorn and Wind River Coal Fields for publication by the Survey; partially funded by the U.S. Bureau of Land Management).
- **Coal resources map of the Powder River Coal Field** (completed and in press; partially funded by a grant from the U.S. Geological Survey's Geologic Division).
- **Coal resources map of Wyoming** (ongoing; submitted for publication by the Survey).

### Geologic Hazards Division

- **Selenium** (ongoing; continued as a member of the State Planning Coordinator's Selenium Work Group; collected and organized a small library of 800 articles on selenium; completed and published a bibliography on selenium; and gave two public presentations).
- **Landslide mapping and classification** (ongoing; completed landslide maps of 200 (1:24,000-scale) quadrangles; published 110 Preliminary Landslide Maps (1:24,000-

scale); prepared draft versions of ten 1:250,000-scale regional maps of landslides; gave one talk on landslides; and began a text on slope movements).

- **Earthquakes and seismicity** (ongoing; represented Wyoming on the Western States Seismic Policy Council; gave five public presentations; continued to distribute earthquake education and awareness materials to schools; and helped organize and coordinate three geologic field trips related to seismic risk in Wyoming).
- **Underground disposal or injection of produced water** (ongoing; compiled and published a bibliography on the hydrology of the Greater Green River Basin; provided subsurface geologic information on sites for underground disposal or injection of water and for pit sites; acquired and began editing Petroleum Information's oil and gas data base for Wyoming; and assisted in modifying some existing manipulative software; partially funded with a grant from the Wyoming Oil and Gas Conservation Commission).

### Industrial Minerals and Uranium Division

- **Map of uranium, other metals, and precious stones in the Powder River Basin** (revised and submitted for publication; a joint effort with the Metals and Precious Stones Division; partially funded with a grant from the U.S. Geological Survey's Geologic Division).
- **Industrial minerals and construction materials** (ongoing; completed and published an investigation of the geology and mineral resources of the upper Patten Creek area, which was partially funded by a grant from the Town of Guernsey; continued gathering information and samples of decorative stone and aggregate; continued to map the geology and industrial minerals in the Guernsey 7 1/2-minute Quadrangle, and published Open File Reports on graphite, anorthosite, rutile, vermiculite, and natural zeolites).
- **Silica sands** (ongoing; assisted the Town of Lovell in an evaluation of a silica sand deposit; and preparing a report on the results of that investigation for publication by the Survey).
- **Radioactive mineral occurrences in Wyoming** (ongoing; preparing a bulletin on uranium mines and uranium occurrences in Wyoming for publication by the Survey; and examined unconformity-related uranium anomalies in the Shirley Mountains and began a literature search on uranium deposits associated with black shales and phosphorites).
- **Surficial background gamma radiation maps of Wyoming** (ongoing; continued to prepare the Cheyenne 1° X 2° Quadrangle for publication and took readings in areas on the Ashton, Casper, Driggs, Rawlins, and Rock Springs sheets).

### Metals and Precious Stones Division

- **Precious metals** (ongoing; continued to evaluate the gold potential in the State's banded iron formations).
- **Economic geology of the South Pass-Atlantic City mining district** (ongoing; prepared and published a small-

scale regional map of the South Pass granite-greenstone belt; prepared and submitted a final report on the district for publication by the Survey; and led five field trips through the district for scientific societies and companies; was initially partially funded by a grant from the U.S. Geological Survey's COGEMAP Program).

- **Economic geology of the Seminoe Mountains mining district** (ongoing; began field investigations and geologic mapping of the district; and led several field trips through the district).
- **Strategic and rare metals and minerals** (ongoing; completed and published an Open File Report on titanium deposits in Wyoming).
- **Kimberlites and other potentially diamond-bearing rocks** (ongoing; continued exploring for kimberlite pipes through the collection and examination of stream-sediment samples; partially funded through a cooperative agreement with the University of Wyoming's Mining and Mineral Resources Research Institute).

- **Lapidary and gemstone resources** (ongoing; preparing a report on Wyoming's lapidary and gemstone resources for publication by the Survey).

- **Map of uranium, other metals, and precious stones in the Powder River Basin** (revised and submitted for publication; a joint effort with the Industrial Minerals and Uranium Division; partially funded with a grant from the U.S. Geological Survey's Geologic Division).

### Oil and Gas Division

- **Heterogeneity classification of Wyoming oil reservoirs** (ongoing; 50 of 160 Wyoming oil reservoirs in the Department of Energy's TORIS Data Base were classified; 54 of another 95 oil reservoirs in Colorado, Utah, and Montana were also classified; the Geological Survey of Wyoming is coordinating this multi-state effort, which includes the state geological surveys of Colorado, Utah, and Montana; the project is partially funded by a grant from the Geoscience Institute for Oil and Gas Recovery Research, The University of Texas at Austin).
- **Characterization of oil and gas composition and properties** (ongoing; initiated project by entering published data into a computerized data base).
- **Coalbed methane potential in Wyoming** (ongoing; a joint effort with the Coal Division; for details see the discussion under the Coal Division).
- **Tight gas sands in the Frontier Formation of Wyoming** (ongoing; providing technical assistance in a cooperative project with the Texas Bureau of Economic Geology (TBEG); and preparing an oil and gas map of the Greater Green River Basin; partially funded by a grant from TBEG).
- **Oil and gas map of the Powder River Basin** (completed and published).

- **Oil and gas map of Wyoming** (ongoing; submitted for publication).
- **Estimations of oil and gas resources and reserves** (ongoing; initiated a study of the resources and reserves of carbon dioxide in Wyoming).

### Stratigraphy Division

- **Geologic mapping in the southern Bighorn Mountains** (ongoing; two 1:24,000-scale geologic maps were field checked and published as open files; seven other photogeologic maps were completed so that they could be field checked; was initially partially funded by a grant from the U.S. Geological Survey's COGEOMAP Program).
- **Index maps depicting geologic mapping in Wyoming** (ongoing; four index maps were published and another one was completed and submitted for publication).
- **Bibliographies of Wyoming geology** (ongoing; a bibliography of out-of-state theses and dissertations was completed and published).
- **1:100,000-scale geologic maps** (ongoing; began preparation of the Nowater Creek Quadrangle).
- **Stratigraphy of the Frontier and Lower Cretaceous formations in the Bighorn Basin** (ongoing; began assembling subsurface logs and picking the tops of pertinent formations).
- **Stratigraphic nomenclature chart for Wyoming** (ongoing; joint project with the U.S. Geological Survey).

### Miscellaneous

- **Rock and mineral identifications and analyses** (ongoing; the Metals and Precious Stones Division and the Laboratory Section provided free rock and mineral identifications for at least 85 persons; and the Laboratory Section conducted 717 analyses and tests on 269 samples in support of the Geologic Divisions).
- **Educational Series of publications** (ongoing; the Head of the Publications Division began revising a separate booklet of activities for the classroom, which augments the *Wyoming geomaps* publication).
- **Articles written for publication by outside publishers** (ongoing; in FY90, the State Geologist, Division geologists, or the Head of the Publications Division prepared the following 34 papers or articles for outside publication):

#### Coal Division

Jones, R.W., 1989, Coal update *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 6-9.

Jones, R.W., 1989, Coal update *in* Fall minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 1, p. 7-10.

Friedman, S.A., Jones, R.W., Treworgy, C.G., Ashton, K.C., and Aylsworth, J.A., 1989, Developments in coal in 1988: American Association of Petroleum Geologists Bulletin, Volume 73, no. 10B, p. 354-365.

Jones, R.W., 1990, Coal update *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 10-14.

Harris, R.E., Hausel, W.D., and Jones, R.W., 1990, Wyoming [exploration in 1989]: Mining Engineering, Volume 42, no. 5, p. 458-460.

Jones, R.W., 1990, Coal update *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 10-16.

#### Geologic Hazards Division

Case, J.C., 1989, Wyoming State report: Proceedings of the 1989 Annual Conference, Western States Seismic Policy Council, Boise, Idaho, November 6-9, 1989, p. 299-300.

Case, J.C., 1990, Earthquakes and active faults: Wyoming Emergency Management Agency Preparedness Press, Summer, p. 12-13.

#### Industrial Minerals and Uranium Division

Harris, R.E., 1989, Industrial minerals update *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 9-10.

Harris, R.E., 1989, Uranium update *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 10-11.

Harris, R.E., 1989, Industrial minerals and uranium update *in* Fall minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 1, p. 10-12.

Starch, Karl, Hausel, W.D., and Harris, R.E., [1989], The mineral industry of Wyoming: U. S. Bureau of Mines Wyoming Minerals Yearbook-1988, 11 p.

Harris, R.E., 1990, Industrial minerals update *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 14-18.

Harris, R.E., 1990, Uranium update *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 18-20.

Harris, R.E., 1990, Industrial minerals update *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 16-20.

Harris, R.E., 1990, Uranium update *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 20-21.

Harris, R.E., Hausel, W.D., and Jones, R.W., 1990, Wyoming [exploration in 1989]: Mining Engineering, Volume 42, no. 5, p. 458-460.

### Metals and Precious Stones Division

Hausel, W.D., 1989, Metals and precious stones update *in* Fall minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 1, p. 12-15.

Hausel, W.D., 1989, Gold in Alaska [abstract]: The Contact Newsletter, Wyoming Geological Association, Volume 35, no. 9, p. 1.

Hausel, W.D., 1989, Structural control of Wyoming gold deposits [abstract]: The Contact Newsletter, Wyoming Geological Association, Volume 35, no. 10, p. 2.

Starch, Karl, Hausel, W.D., and Harris, R.E., [1989], The mineral industry of Wyoming: U. S. Bureau of Mines Wyoming Minerals Yearbook-1988, 11 p.

Hausel, W.D., 1990, Archean gold mineralization within the South Pass greenstone terrain, Wyoming *in* Hollister, V.T., editor, Case histories of gold deposits, Volume 2, Discoveries of valuable minerals and precious metals deposits related to intrusions and faults: Society for Mining, Metallurgy, and Exploration, Inc., Littleton, Colorado, p. 361-373.

Hausel, W.D., 1990, Metals and precious stones update *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 20-23.

Harris, R.E., Hausel, W.D., and Jones, R.W., 1990, Wyoming [exploration in 1989]: Mining Engineering, Volume 42, no. 5, p. 458-460.

Hausel, W.D., 1990, Metals and precious stones update *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 21-22.

### Oil and Gas Division

DeBruin, R.H., 1989, Oil and gas update *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 3-6.

DeBruin, R.H., 1989, Oil and gas update *in* Fall minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 1, p. 5-7.

DeBruin, R.H., 1990, Oil and gas update *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 5-9.

DeBruin, R.H., 1990, Oil and gas update *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 5-10.

### State Geologist

Rice, W.L., and Glass, G.B., 1989, The mineral industry of Wyoming: U. S. Bureau of Mines preprint from the 1987 Bureau of Mines Minerals Yearbook, 9 p.

Glass, G.B., 1989, Overview *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 3.

Glass, G.B., 1989, Metals and precious stones update *in* Summer minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 8, no. 4, p. 11.

Glass, G.B., 1989, Overview *in* Fall minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 1, p. 4-5.

Glass, G.B., 1990, Overview *in* Winter minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 2, p. 4-5.

Glass, G.B., 1990, Overview *in* Spring minerals update: Wyoming Quarterly Update, University of Wyoming, Volume 9, no. 3, p. 4.

Glass, G.B., in press, Wyoming [coal]: Keystone Coal Industry Manual, McGraw-Hill, Inc., New York, New York.

Glass, G.B., in press, Wyoming [Geological Survey activities]: The State Geologist's Journal, Volume XLII.

**PUBLIC FILES: Gather and continuously update and maintain files and libraries on all available reports, records, maps, and other data relating to the surface and subsurface geology and mineral resources of the State.**

In FY90, the Agency (1) enlarged its geologic hazards files, particularly in regard to selenium-related documents, (2) expanded its geologic, mineral, and energy resource files, and (3) added several thousand entries to its computerized data bases. The Survey also maintains a "Confidential" file of drilling records from holes drilled on State mineral leases, pursuant to Wyoming Statute 36-6-102.

With the exception of the "Confidential" drilling records mentioned above, files and libraries of the Survey are available to the public. A public-use area is provided on the second floor of the Wyoming Geological Survey Building. This area hosts microfiche, microfilm, and paper copies of many oil and gas well logs; aerial photographs; unpublished geologic and mineral reports; open file reports of the U.S. Geological Survey and the U.S. Bureau of Mines; and U.S. Department of Energy uranium reports for Wyoming. The Survey's extensive collection of Environmental Impact Statements, Industrial Siting Applications, and numerous other government documents are now kept in the Survey's first floor reference library.

In a concerted effort, the Coal and Oil and Gas Divisions continued to enter mineral resource data into the Survey's personal computers for easier management and manipulation of data. While the initial goals of these computerization efforts were the input of mineral production, market, and price information, the Divisions are now entering data on coal, oil, and gas composition.

# MAJOR ACCOMPLISHMENTS OF THE PUBLICATIONS PROGRAM

## OBJECTIVES

Publications are an essential part of the Survey's overall service function as mandated by law (W.S. 9-2-805, part a, subsections iv and v). The Publications Program, which is actually synonymous with the Publications Division, is both the publishing and sales arm of the Survey and performs an essential role in the sale and distribution of information to the public. This Program contains the funds for preparing and printing geological information collected and interpreted by Survey personnel or outside authors. Although the Program currently only has two full-time employees, five other positions in the Administration Program actually work in the

Publications Program. In FY91, these five positions will be moved into the Publications Program.

The major objectives of the Publications Program are three-fold: (1) to make information about Wyoming's geology and mineral and energy resources available in standard publication format, (2) to sell and distribute Survey publications, and (3) to provide technical support to the State Geologist, Division Heads, other Survey staff, and occasionally to outside entities.

## ACCOMPLISHMENTS

For each of these major objectives, the activities and accomplishments of the Publications Program in FY90 are described below:

**PUBLISHING: Make information about Wyoming's geology and mineral and energy resources available in standard publication format.**

The Editor and the State Geologist establish publishing priorities. The two graphs in Figure 5 summarize the general subject matter of Survey publications and the number of new publications completed each decade. In FY90, the Editorial Section prepared bid specifications for 19 printing jobs, and the Editor attended 9 press runs to assure the printed quality of these publications met Survey standards.

|                               |                      |      |
|-------------------------------|----------------------|------|
| TECHNICAL AND POPULAR GEOLOGY | 386 REPORTS AND MAPS | 66 % |
| MINERAL RESOURCES             | 203 REPORTS AND MAPS | 34 % |

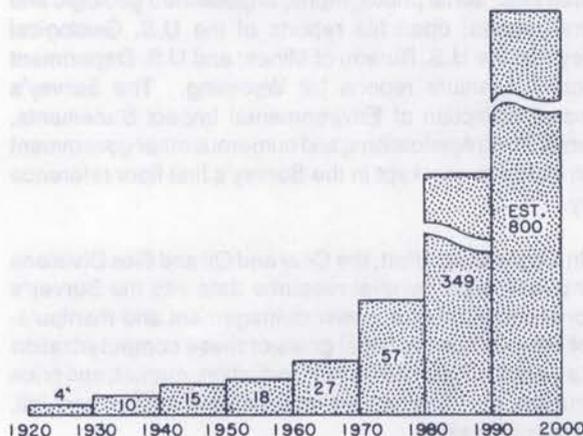


Figure 5. General content of Survey publications since FY20 (excludes publications lists and posters) and number of new titles by decade.

The 142 new titles published by the Survey in FY90 set a new record for publications completed in one year (Figure 6). This dramatic increase and other increases since FY82 are the result of a concerted effort to increase the number of new publications each year.

Level funding and small cuts in the appropriations for the Publications Program over the last five years, however, have necessitated some adjustments. The Division has been forced to pay for necessary equipment repairs and replacements out of money that could otherwise have been spent on printing. Each year, several prepared manuscripts are deferred from publication until the following year and an increasing number of publications are prepared as open file reports or preliminary maps rather than sent out for commercial printing. An open file report or preliminary map is one that is prepared in a reproducible format and is reproduced only as requested. The advantage to this procedure is the timeliness of release (it does not have to wait for available printing monies). The disadvantages are the often inferior reproduction; the inability to adequately illustrate the reports with photographs, color, and other special methods; and the sometimes high cost of reproduction on an individual basis, particularly if there are a number of large illustrations.

The 142 publications listed below represent the combined efforts of the Publications Division and the Geologic Divisions toward meeting the primary objective of the Publications Program:

### ANNUAL REPORT

*Fifty-sixth annual report of the Geological Survey of Wyoming, July 1, 1988 to June 30, 1989:* by G.B. Glass and S.G. Bruhnke (1989).

### BULLETIN

*Selected bibliography on selenium:* Bulletin 69, by J.C. Case, L.R. Zellmer, M.T. Harris, R.L. Anderson, and L.L. Larsen (1990).

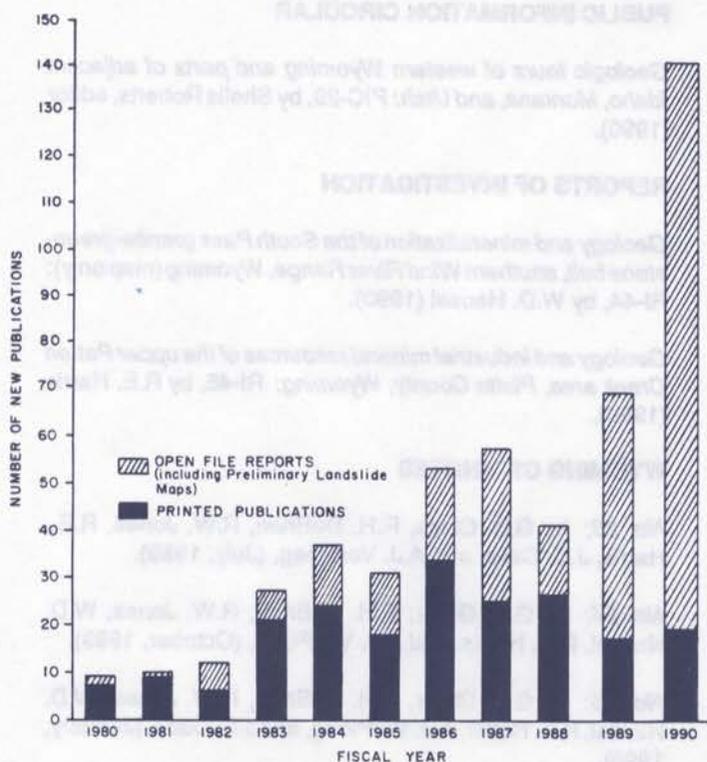


Figure 6. Number of new titles published each fiscal year (1980 through 1990).

#### MAP SERIES

*Geologic map of the Gillette 1 X 2 degree Quadrangle, northeastern Wyoming and western South Dakota:* MS-25G, by J.D. Love, A.C. Christiansen, L.W. McGrew, and J.K. King (1990).

*Precambrian basement map of Wyoming: outcrop and structural configuration, revised 1990:* MS-27, by D.L. Blackstone, Jr. (1990).

*Geologic map of the Leavitt Reservoir Quadrangle, Big Horn County, Wyoming:* MS-29, by Karen Noggle-Perrin (1989).

*Industrial minerals and construction materials map of the Powder River Basin and adjacent uplifts:* MS-30, by R.E. Harris and J.K. King (1989).

*Oil and gas fields map of the Powder River Basin:* MS-31, by R.H. DeBruin and C.S. Boyd (1990).

#### MEMOIR

*Illustrated geologic history of the Medicine Bow Mountains and adjacent areas, Wyoming:* M-4, by S.H. Knight (1990).

#### MISCELLANEOUS

*Bibliography and index of graduate theses and dissertations of the Department of Geology and Geophysics, University of Wyoming:* Information Pamphlet 3, by C.L. Van Burgh, G.B. Glass, and Sheila Roberts (1989).

*Geology of Wyoming: Information Pamphlet 2,* by G.B. Glass and D.L. Blackstone, Jr. (1990).

*Publications available from the Geological Survey:* by Sheila Roberts (June, 1989).

*Publications available from the Geological Survey:* by Sheila Roberts (June, 1990).

#### OPEN FILE REPORTS

*Preliminary geologic map of the Tallon Spring Quadrangle, Washakie and Johnson Counties, Wyoming:* OFR 89-5, by A.J. VerPloeg and P.L. Greer (1989).

*Preliminary geologic map of the Turk Springs Quadrangle, Washakie and Johnson Counties, Wyoming:* OFR 89-6, by A.J. VerPloeg and P.L. Greer (1989).

*Selected bibliography on selenium:* OFR 89-7, by J.C. Case, L.R. Zellmer, M.T. Harris, R.L. Anderson, and L.L. Larsen (1990).

*Mica in Wyoming:* OFR 89-8, by R.E. Harris (1989).

*Temporal distribution of the ultramafic-alkalic and alkalic rocks within the Russian, Siberian, and North American ancient platforms and their surroundings:* OFR 89-9, by E.I. Erlich, W.M. Sutherland, W.D. Hausel, and I.A. Zagruzina (1989).

*Precambrian geology of the Seminoe gold district, Bradley Peak Quadrangle, Carbon County, Wyoming:* OFR 89-10, by W.D. Hausel (1989).

*Graphite in Wyoming:* OFR 89-11, by R.E. Harris (1989).

*Anorthosite in Wyoming:* OFR 90-1, by R.E. Harris (1990).

*Rutile in Wyoming:* OFR 90-2, by R.E. Harris (1990).

*Vermiculite in Wyoming:* OFR 90-3, by R.E. Harris (1990).

*Natural zeolites in Wyoming:* OFR 90-4, by R.E. Harris and J.K. King (1990).

*Bibliography of ground-water hydrology within the Greater Green River Basin (Green River, Washakie, and Great Divide basins):* OFR 90-5, by B.D. Boundy and J.C. Case (1990).

*Bibliography of graduate theses and dissertations on the geology of Wyoming (exclusive of the University of Wyoming), 1899 through 1987:* OFR 90-6, by P.L. Greer and A.J. VerPloeg (1990).

#### PRELIMINARY LANDSLIDE MAPS

The following 110 quadrangles were completed in FY90 (authors of individual maps are not shown here):

|            |                     |
|------------|---------------------|
| Aladdin    | Antelope Gulch      |
| Alder Lake | Arrowhead Reservoir |
| Alva       | Bailey Lake         |

|                      |                     |
|----------------------|---------------------|
| Beartooth Butte      | Moore Hill          |
| Beulah               | Moose               |
| Black Hills          | Moran               |
| Blind Bull Creek     | Mount Bannon        |
| Blue Holes           | Mount Bonneville    |
| Browns Hill          | Mount Hancock       |
| Cache Creek          | Mount Sheridan      |
| Cambria              | Munger Mountain     |
| Camp Davis           | New Haven           |
| Carlisle             | Newcastle           |
| Cedar Ridge          | Osage SE            |
| Clifton              | Owens               |
| Colter Bay           | Park Creek          |
| Cottonwood Peak      | Pat O'Hara Mountain |
| Craig Pass           | Pedro               |
| Davis Hill           | Pfeiffer Hill       |
| Dead Indian Peak     | Pilot Peak          |
| Devils Run           | Prospect Peak       |
| Devils Tower         | Ramshorn Peak       |
| Downs Mountain       | Ranger Peak         |
| Duling Hill          | Red Canyon Creek    |
| Dunrud Peak          | Rendezvous Peak     |
| Eagle Creek          | Rock Lake Peak      |
| Edith Creek          | Rozet NE            |
| Fall Creek           | Savery              |
| Fanny Peak           | Schoolmarm Butte    |
| Fish Lake            | Seely               |
| Four Corners         | Sheldon Creek       |
| Gaff Creek           | Sherrard Hill       |
| Garland Hill         | Skull Creek         |
| Grand Teton          | Slaughter Reservoir |
| Grasshopper Butte    | Steamboat Mountain  |
| Greive Reservoir     | Stoney Point        |
| Gros Ventre Junction | Strawberry Hill     |
| Grover               | Sugarloaf Mountain  |
| Heart Lake           | Sundance East       |
| Huckleberry Mountain | Sundance West       |
| Hulett               | Sunlight Peak       |
| Inyan Kara Mountain  | Sunshine Reservoir  |
| Irish Rock           | Survey Peak         |
| Jackson              | Teton Village       |
| Jenny Lake           | Thayne East         |
| Kisinger Lakes       | The Notch           |
| Kruger Lake          | The Rocks           |
| Lava Mountain        | Tullis              |
| Linden               | Twin Peaks          |
| Man Peak             | Two Ocean Lake      |
| Middle Creek Butte   | Two Ocean Pass      |
| Milk Creek           | Whetstone Mountain  |
| Missouri Buttes      | Wonder View         |
| Mona                 | Wood Canyon         |
| Moon                 |                     |

## PUBLIC INFORMATION CIRCULAR

*Geologic tours of western Wyoming and parts of adjacent Idaho, Montana, and Utah: PIC-29, by Sheila Roberts, editor (1990).*

## REPORTS OF INVESTIGATION

*Geology and mineralization of the South Pass granite-greenstone belt, southern Wind River Range, Wyoming (map only): RI-44, by W.D. Hausel (1990).*

*Geology and industrial mineral resources of the upper Patten Creek area, Platte County, Wyoming: RI-45, by R.E. Harris (1990).*

## WYOMING GEO-NOTES

*No. 23: by G.B. Glass, R.H. DeBruin, R.W. Jones, R.E., Harris, J.C. Case, and A.J. VerPloeg, (July, 1989).*

*No. 24: by G.B. Glass, R.H. DeBruin, R.W. Jones, W.D. Hausel, R.E. Harris, and A.J. VerPloeg, (October, 1989).*

*No. 25: by G.B. Glass, R.H. DeBruin, R.W. Jones, W.D. Hausel, R.E. Harris, A.J. VerPloeg, and J.C. Case, (January, 1990).*

*No. 26 by G.B. Glass, R.H. DeBruin, R.W. Jones, R.E. Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (April, 1990).*

## SALES AND DISTRIBUTION: Sell and distribute survey publications.

In FY90, the Publications Sales Manager and Editorial Assistant responded to 872 written inquiries about publications, answered an average of 26 telephone inquiries and inquiries from visitors to the sales desk per work day, and received 4,205 publications sales.

Figure 7 shows a percentage breakdown of revenues derived from the sale of publications over the last three fiscal

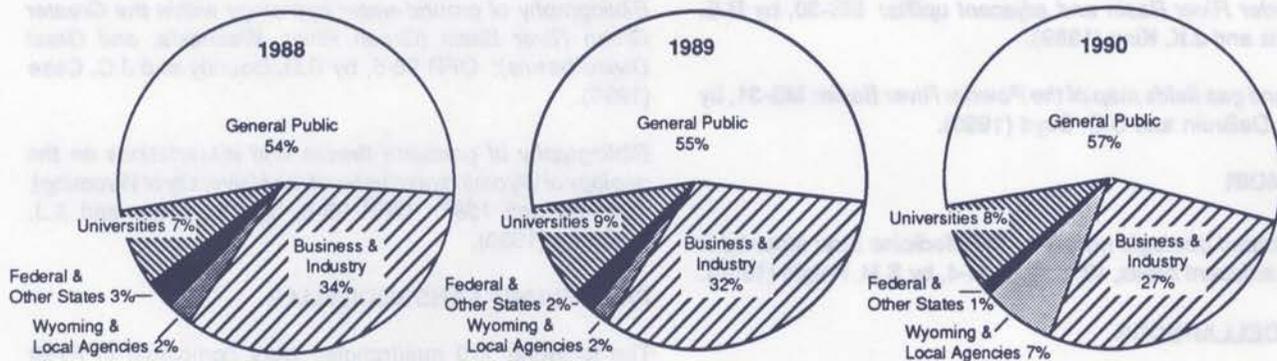


Figure 7. Percentage of publication revenue arranged by customer category (FY88 through FY90).

years, arranged by customer category. The revenues from sales to the general public have exceeded 50 percent of the total since FY86 and have continued to increase slightly over the last three years. In FY90, the largest increase in sales to the general public was in the Educational Series, but there was also a continuing significant increase in topographic map sales.

Table 1 shows the volume of receipted sales in each customer category and the revenues derived from that customer category.

**Table 1.** Breakdown of FY90 publication sales by customer category and by sales revenue.

| Category                            | Percent of Customers | Sales Revenue | Percent of Revenue |
|-------------------------------------|----------------------|---------------|--------------------|
| General Public and(or) unidentified | 76%                  | \$43,154      | 57%                |
| Business and Industry               | 18%                  | 20,441        | 27%                |
| Universities                        | 4%                   | 6,057         | 8%                 |
| Wyoming and Local Agencies          | 1%                   | 5,300         | 7%                 |
| Federal, Other States and Foreign   | 1%                   | 757           | 1%                 |
|                                     | 100%                 | \$75,709      | 100%               |

Revenues generated from the sale of publications are deposited in the General Fund. Table 2 summarizes the breakdown of revenue from publication sales by publication series for FY90.

**Table 2.** Breakdown of FY90's publication sales revenue by publication series.

|        |   |             |
|--------|---|-------------|
| 28.7%  | Topographic maps (all scales)   | \$21,753.00 |
| 22.5%  | Bulletins   | 17,007.00   |
| 11.7%  | Map Series  | 8,874.50    |
| 7.9%   | Open File Reports   | 5,981.00    |
| 6.5%   | Educational Series  | 4,950.00    |
| 4.6%   | Reports of Investigations   | 3,442.00    |
| 4.1%   | Public Information Circulars  | 3,124.00    |
| 2.8%   | Geologic Map of Wyoming   | 2,137.00    |
| 2.8%   | Geologic Highway Map  | 2,088.00    |
| 2.6%   | Reprints  | 1,936.00    |
| 1.3%   | Wyoming Geo-notes   | 972.50      |
| 1.3%   | Memoirs   | 961.00      |
| 0.7%   | Preliminary Reports   | 545.00      |
| 0.4%   | County Resource Series  | 325.00      |
| 97.9%  | Subtotal  | \$74,096.00 |
| 2.1%   | Miscellaneous publications and price difference for mailed publications | 1,613.00    |
| 100.0% | Grand Total   | \$75,709.00 |

As a general rule, sales income had been increasing until the peak year of FY81 (Figure 8). With the subsequent recession, sales declined substantially, dropping to \$48,878 in FY84. Although slumping sales jumped back up in FY85, they resumed a steady one percent a year decline until this fiscal year. In FY90, sales took a dramatic 10 percent increase, to \$75,709. Most of this increase in sales can be attributed to two categories, the new Educational Series (up \$4,375) and topographic maps of all scales (up \$1,962). In addition, Open File Reports and the Map Series each showed increases over \$1,000.

Responding to a request from the Geological Survey Board, the Publications Program has continued to look for new ways to make the public aware of valuable earth-science publications available from the Geological Survey of Wyoming. In addition to mailings of press releases describing new items, Survey publications were displayed and sold at 11 meetings of professional geologists, educators, rock and mineral collectors, and the general public, including the 28th International Geological Congress in Washington D.C. An effort to promote awareness of *Wyoming Geo-notes*, has approximately doubled subscriptions for this quarterly digest about Wyoming's geology and mineral and energy resources. Topographic map sales rose in FY90 because of increased public awareness of that service and because the Survey is now selling maps by mail and phone orders as well as over-the-counter.

Publications of the Geological Survey are distributed free-of-charge to libraries and archives throughout the State. Limited numbers of each publication are also provided to other State agencies and branches of government and to elected officials on request. In addition, the Survey participates in publication exchange programs with nearly all other state geological surveys, numerous foreign geological surveys, the U.S. Geological Survey, the U.S. Department of Energy, the U.S. Bureau of Mines, and other entities. These distributions do not add directly to sales revenue, but they provide an important service to the State and allow acquisition of publications from out-of-state agencies without direct charge. The publications acquired through the Survey's exchange agreements are subsequently donated to the University of Wyoming's Geology Library. In FY90, more than 1,500 publications were received in exchange for Survey publications.

**TECHNICAL SUPPORT:** Provide technical advice and support to the Director, Division Heads, other Survey staff, and occasionally to outside entities.

The Publications Division provides editing and drafting for maps and reports published by the Survey, creates illustrations for talks and displays, and generally assists in publication-related activities. The Editor also answers requests for information about Survey editing techniques, policies, and procedures from agencies, organizations, and consultants.

The cartographers frequently advise University of Wyoming faculty, staff, and students on drafting techniques. They also occasionally advise consultants and members of the general public as well as other State and Federal agencies.

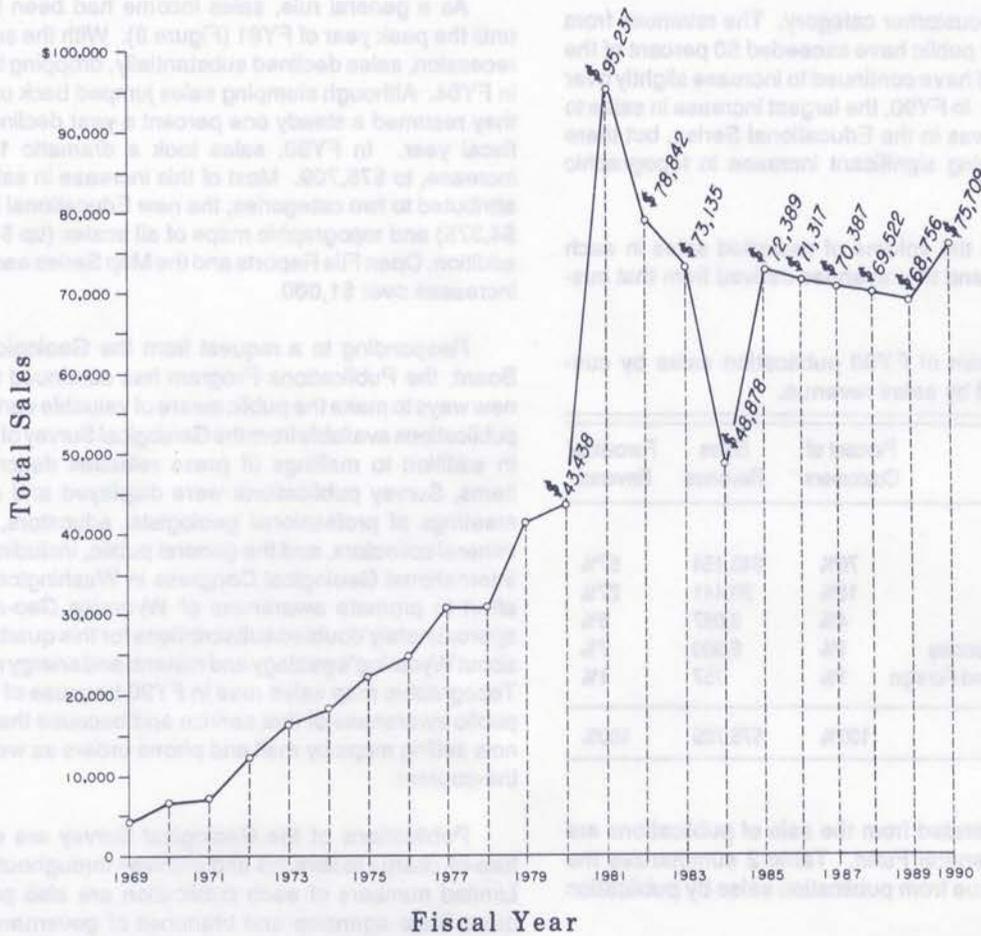


Figure 8. Fiscal year income to the General Fund from the sale of publications.

## SUMMARY OF PERMANENTLY ASSIGNED VEHICLES

The following list of motor vehicles is provided in accordance with W.S. 9-2-1014 revised:

| License Number | Assigned To      | Reason For Assignments   |
|----------------|------------------|--|
| S-131          | Sheila Roberts   | Sedan for travel to press runs; sold for \$930 at auction.             |
| S-168          | Richard W. Jones | Truck for off-road field work; sold for \$976 at auction.              |
| S-132          | Jay T. Roberts   | Truck for local use; sold for \$776 at auction.                        |
| S-799          | James C. Case    | Station wagon for light field work.                                    |
| S-656          | W. Dan Hausel    | Truck for off-road field work.   |
| S-126          | Ray E. Harris    | Truck for field work; stolen.  |
| S-326          | Ray E. Harris    | Truck for off-road field work; temporary replacement for stolen truck. |
| S-528          | Ray E. Harris    | Truck for off-road field work; permanent replacement for stolen truck. |