

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

FIFTY-FIFTH ANNUAL REPORT
of the
GEOLOGICAL SURVEY OF WYOMING

for Fiscal Year 1988
July 1, 1987 to June 30, 1988

by

Gary B. Glass



Laramie, Wyoming
October, 1988

THE GEOLOGICAL SURVEY OF WYOMING

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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 geologic and mineral and energy resources information that has a practical bearing on Wyoming's communities and people and that contributes to the wise management of the State's geologic and mineral and energy resources.

To accomplish its mission in FY 88, the Geological Survey:

- provided data, advice, and assistance to both in-state and out-of-state inquiries, responding to more than 19,430 inquiries related to geology and mineral and energy resources; to the effective use of earth-science techniques, products, and information; and to requests for Survey publications and information on publications.

- prepared 41 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, data bases, and a library on the State's geologic and mineral and energy resources.

- assessed mineral and energy resources, documented their occurrences, and determined their origins and manners of occurrence through more than 19 field and laboratory investigations.

- facilitated the judicious use of Wyoming's geologic and mineral and energy resources through the review of 121 planning documents.

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

GOALS

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

Geologic framework

INCREASE KNOWLEDGE OF THE GEOLOGIC STRUCTURE AND GEOLOGIC FORMATIONS IN THE

STATE TO PROVIDE THE SCIENTIFIC FRAMEWORK FOR MINERAL AND GEOLOGIC HAZARDS INVESTIGATIONS AND TO MEET UNFORESEEN FUTURE RESPONSIBILITIES.

This knowledge is acquired by geologic mapping; stratigraphic and paleontologic field studies; testing of conceptual models; and measurements of

petrologic, physical, and chemical properties of rocks and minerals.

Mineral and energy resource assessment

INCREASE KNOWLEDGE OF THE DISTRIBUTION AND QUALITY OF THE STATE'S MINERAL AND ENERGY RESOURCES SO THAT GOVERNMENT OFFICIALS AND THE PUBLIC CAN FORMULATE AND EVALUATE POLICIES, WHICH AFFECT THE LONG-TERM AVAILABILITY OF THESE RESOURCES, AND CAN MAKE INFORMED DECISIONS ABOUT THE USE OF THE STATE'S LAND, MINERAL, AND ENERGY RESOURCES.

This knowledge is obtained by using techniques of resource evaluation including geologic mapping, reconnaissance 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 knowledge is acquired by 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 TO MINIMIZE LOSS OF LIFE AND PROPERTY.

This knowledge is obtained by geologic mapping, field investigations, aerial photographic interpretation, and application of geologic principles related to dynamic Earth processes.

Timely reporting of events and conditions

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

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

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.

Information dissemination

PROVIDE THE PUBLIC AND PRIVATE SECTORS WITH ACCESSIBLE INFORMATION ABOUT THE STATE'S GEOLOGY AND MINERAL AND ENERGY RESOURCES.

This is achieved by publishing geologic maps and general interest, scientific, and technical reports on geology and mineral and energy resources; by making 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.

Mission support

IMPROVE PRODUCTIVITY OF THE SURVEY TO EFFECTIVELY CARRY OUT ITS MISSION.

This is accomplished by maintaining a

competent and innovative staff, by expanding computerized data bases, by expanding laboratory and field capabilities, and by deriving maximum benefits from available resources.

Organization

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

Administration (01) - Applies to the overall programs and activities of the Agency with 13 full-time employees. Some funds from outside sources (State and Federal grants) are solicited to augment General Fund appropriations for the Administrative Program. In FY 88 these augmenting funds totaled \$101,320. The projects funded by these grants are part of the Administrative Program, and their continuation into future years is speculative as they are only funded on an annual basis.

Publications (02) - Applies to the sale and(or) distribution of all publications prepared or handled by the Geological Survey, with two full-time employees. This program, which includes funds for supplies, equipment, commercial printing, and travel related to publication activities, is funded by General Fund appropriations.

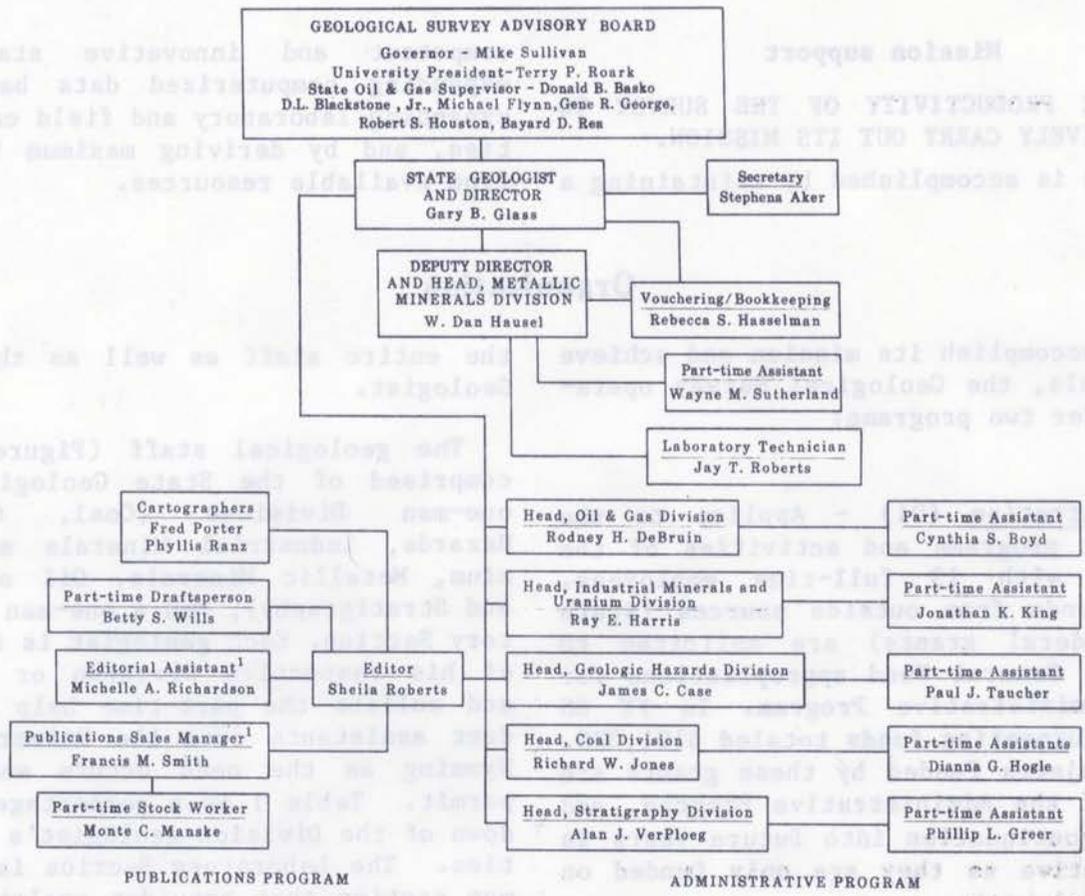
For operational purposes, the Agency's personnel are divided into professional staff (geologists and editor) and their respective supporting staffs (Figure 1). Because the Division geologists are experts in their field of geology, they are expected to initiate their own investigations and projects on the basis of priority of need. About 90 percent of the projects are undertaken by individual Division geologists with assistance from the supporting staff. The remaining 10 percent are handled on a team basis that occasionally involves

the entire staff as well as the State Geologist.

The geological staff (Figure 1) is comprised of the State Geologist, six one-man Divisions (Coal, Geologic Hazards, Industrial Minerals and Uranium, Metallic Minerals, Oil and Gas, and Stratigraphy), and a one-man Laboratory Section. Each geologist is the head of his respective Division or Section and enlists the part-time help of student assistants from the University of Wyoming as the need occurs and funds permit. Table 1 is a percentage breakdown of the Division geologist's activities. The Laboratory Section is a one-man section that provides analytical as well as field support to the other geological staff.

The Agency has a Publications Division headed by the Editor. This Division consists of 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 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 FY 88 were \$69,522.

The biennial appropriations for these two programs are shown in Figure 2 along with FY 88 expenditures.



¹ These positions are paid out of the Publications Program.

Figure 1. Organization chart for the Geological Survey in FY 88.

Table 1. Percentage breakdown of Division geologists' activities.

	Range	Average
Services to the general public, State agencies, Federal agencies, and others	40-60%	45.0%
Field and laboratory projects	10-20%	15.0%
Data organization	10-25%	17.5%
Report writing and editorial reviews	10-20%	15.0%
Administration	3-5%	4.0%
Other activities	2-5%	3.5%

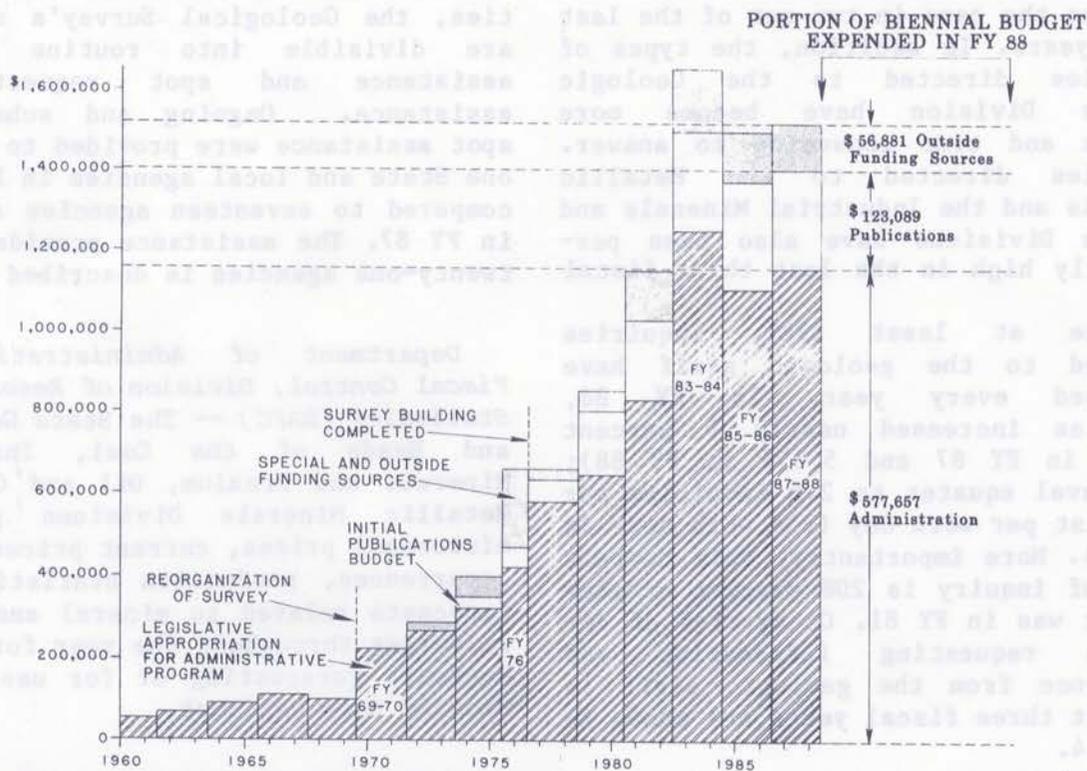


Figure 2. Biennial budgets for the Geological Survey (expenditures for FY 88 are annotated to the right of the biennial budgets).

Major accomplishments of the Administration Program

OBJECTIVES

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

goals as listed earlier, this program has four major objectives: (1) provide geologic information, advice, and assistance, (2) conduct field and laboratory investigations, (3) prepare and publish reports and maps, and (4) maintain records on geologic and mineral and energy resources.

ACCOMPLISHMENTS

For each of these major objectives, the activities and accomplishments of the Administrative Program of the Survey in FY 88 are described below:

1. PROVIDE INFORMATION, ADVICE, AND ASSISTANCE FOR ALL INQUIRIES ON THE STATE'S GEOLOGIC AND MINERAL AND ENERGY RESOURCES.

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 Division

had the most inquiries in FY 88. This has been the case in two out of the last three years. In addition, the types of inquiries directed to the Geologic Hazards Division have become more complex and time consuming to answer. Inquiries directed to the Metallic Minerals and the Industrial Minerals and Uranium Divisions have also been persistently high in the last three fiscal years.

Since at least 1981, inquiries directed to the geologic staff have increased every year. In FY 88, inquiries increased nearly 6 percent (5,327 in FY 87 and 5,655 in FY 88); this level equates to 2.8 inquiries per geologist per work day (254 work days in a year). More importantly, this current level of inquiry is 208 percent greater than it was in FY 81. Categories of inquirers requesting information and assistance from the geologic staff in the last three fiscal years are shown in Figure 4.

In Figure 4, the circle diameters are proportional to the number of inquiries received in a given year (there was a 17 percent increase in inquiries between fiscal years 1986 and 1988). The most significant change occurred in FY 1986 when inquiries from State and local agencies alone increased 38 percent from the previous year.

In regard to State and local entities, the Geological Survey's services are divisible into routine ongoing assistance and spot requests for assistance. Ongoing and substantial spot assistance were provided to twenty-one State and local agencies in FY 88 as compared to seventeen agencies assisted in FY 87. The assistance provided these twenty-one agencies is described below:

Department of Administration and Fiscal Control, Division of Research and Statistics (DAFC) -- The State Geologist and Heads of the Coal, Industrial Minerals and Uranium, Oil and Gas, and Metallic Minerals Divisions provided historical prices, current prices, maps, occurrences, production statistics, and forecasts related to mineral and energy resources throughout the year for use in economic forecasting or for use in the *Wyoming Data Handbook*.

Department of Agriculture -- The Geological Survey's Cartographic Section provided a major service by scribing and making a color proof of the *Land inventory map of Wyoming*. This was the culmination of several years of effort. The Survey's Editor also assisted by preparing the printing bid and attending the actual press run on this jointly published map.

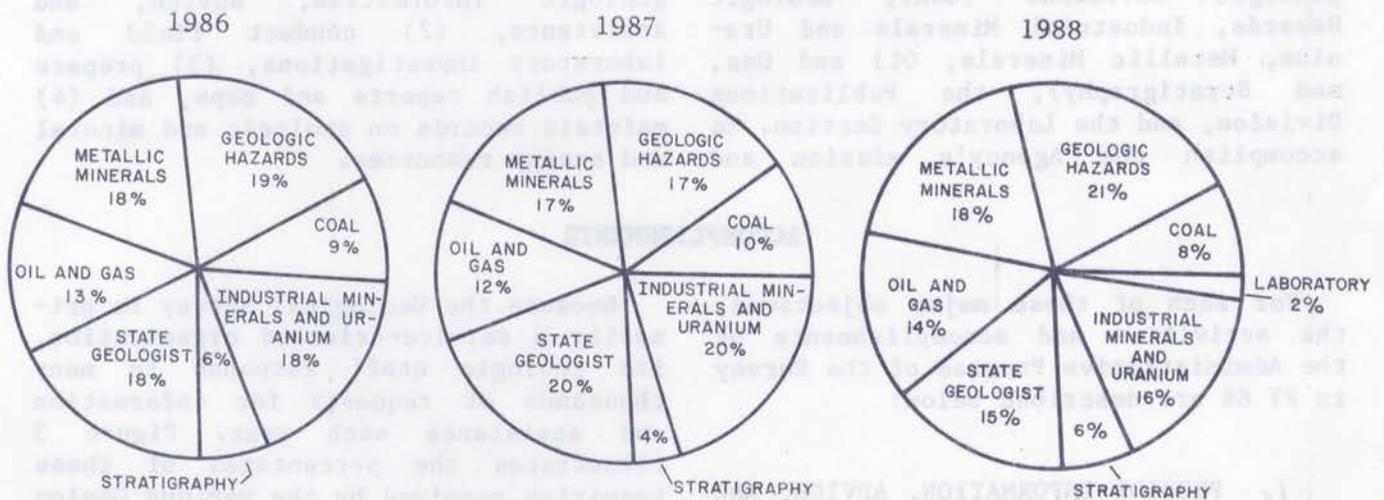


Figure 3. Percentage of Inquiries directed to each of the Geologic Divisions, Fiscal Years 1986-1988.

1986
(4,837 INQUIRIES)

1987
(5,327 INQUIRIES)

1988
(5,655 INQUIRIES)

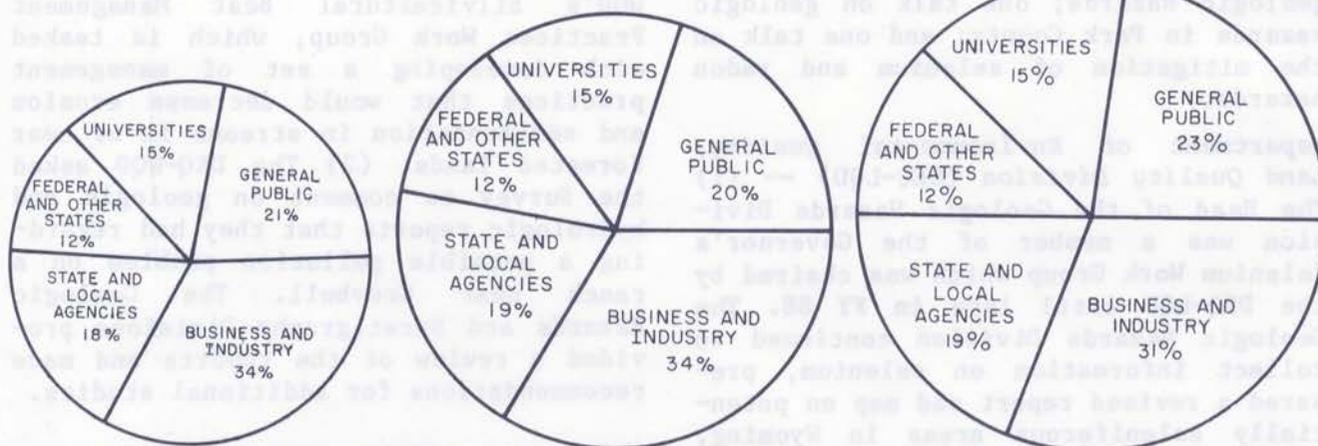


Figure 4. Percentage of Inquiries directed to Geologic Divisions, arranged by category of Inquirer, Fiscal Years 1986-1988. (The diameters of the diagrams are drawn in proportion to the total number of inquiries received each year).

Albany County Commissioners -- The Industrial Minerals and Uranium Division assisted Albany County in an evaluation of the quantity and grade of a silica sand deposit near Plumbago Creek in the Sybille Canyon area. The Survey provided technical advice for the drilling program and prepared and published a report on the deposit.

Archives, Museums, and Historical Department -- The Survey's Deputy Director, who is the Associate Curator of Mineralogy for the Wyoming State Museum, provided materials and information for a prehistory exhibit for the museum.

Wyoming Commission on the Bicentennial of the U.S. Constitution -- The Head of the Industrial Minerals and Uranium Division located a rock of suitable size for inclusion in a monument to the U.S. Constitution to be built in Philadelphia. He helped arrange for its pickup and transportation and spoke at the rock's dedication at Guernsey.

Consensus Revenue Estimating Group (CREG) -- The State Geologist is a member of CREG, the Consensus Revenue Estimating Group (CREG), which makes revenue estimates for use by the Governor and the Legislature, prior to each

Legislative Session. In FY 88, updated estimates of mineral production and revenue were also required just before the Legislative Session because of changing conditions. The State Geologist with advice and information provided by the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Divisions continually apprised CREG of the minerals situation throughout FY 88.

Economic Development and Stabilization Board (EDS Board) -- The State Geologist and Heads of the Coal, the Industrial Minerals and Uranium, and the Metallic Minerals 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.

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, a member of the Technical Committee planning a Wyoming Hazards Awareness Week in October of 1988, and the Governor's representative to the Western States' Seismic Policy Council.

At the request of WEMA in FY 88, the Head of the Geologic Hazards Division gave two talks to local officials on mitigating problems associated with geologic hazards; one talk on geologic hazards in Park County; and one talk on the mitigation of selenium and radon hazards.

Department of Environmental Quality, Land Quality Division (DEQ-LQD) -- (1) The Head of the Geologic Hazards Division was a member of the Governor's Selenium Work Group which was chaired by the DEQ-LQD until late in FY 88. The Geologic Hazards Division continued to collect information on selenium, prepared a revised report and map on potentially seleniferous areas in Wyoming, helped write and guide a Selenium Information Tour in the Kendrick/Casper-Alcova Irrigation District, and gave a talk on selenium to the Governor's Crisis Management Task Force. (2) At DEQ-LQD's request, the State Geologist and Heads of the Coal and Oil and Gas Divisions planned and supervised subsurface drilling at Rawhide Village near Gillette and interpreted the geology of the site based on that drilling. In addition, the State Geologist helped explain the conclusions of the Survey's and DEQ's joint efforts at a meeting with the Federal Emergency Management Agency (FEMA) in Washington, D.C. Subsequently, FEMA ruled that there was a serious health hazard at the subdivision due to the venting of explosive methane gas in the streets and homes in the area. (3) While the Metallic Minerals Division provided information and reclamation recommendations on 19 abandoned mine land reclamation projects, the Industrial Minerals and Uranium Division also reviewed a number of other Abandoned Mined Land Reclamation Projects (AML) and made comments and(or) recommendations on reclamation strategies for those projects. (4) The Head of the Geologic Hazards Division represented the Geological Survey in planning a jointly sponsored Symposium on Abandoned Mine Land Reclamation Technologies with the DEQ-LQD. The symposium is planned for 1989.

Department of Environmental Quality, Water Quality Division (DEQ-WQD) -- (1) The Head of the Survey's Geologic Hazards Division is a member of the DEQ-WQD's Silvicultural Best Management Practices Work Group, which is tasked with developing a set of management practices that would decrease erosion and sedimentation in streams in or near forested lands. (2) The DEQ-WQD asked the Survey to comment on geologic and hydrologic reports that they had regarding a possible pollution problem on a ranch near Greybull. The Geologic Hazards and Stratigraphy Divisions provided a review of the reports and made recommendations for additional studies.

Governor's Office -- (1) The State Geologist and Head of the Geologic Hazards Division continued to serve on the Governor's Superconducting Super Collider Task Force as reviewers of the final proposal for the Laramie County site. (2) The Head of the Geologic Hazards Division was named the chairman of the Governor's Selenium Work Group very near the end of FY 88. (See Department of Environmental Quality-Land Quality Division for details of this Work Group's activities). Reorganization of the Work Group's activities began in very late FY 88.

Department of Health and Social Services -- The Geologic Hazards Division continued to participate in planning a radon monitoring project with the Department of Health and Social Services and the U.S. Environmental Protection Agency. The placement of an initial 800 radon detecting canisters, was based in part on the Survey's suggestions. A generalized geological analysis of the data collected was prepared and submitted to Health and Social Services along with recommendations for additional studies.

Industrial Siting Administration -- Although no siting applications were reviewed in FY 88, the Survey did respond to several inquiries from this agency.

Legislative Service Office -- In October, the State Geologist and the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Divisions estimated the production and assessed value 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 assessed values. 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.

Oil and Gas Conservation Commission -- (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 FY 88 and involved 380 dockets. The State Geologist is the Acting Chairman of the Commission when the Governor is absent. Matters related to the Oil and Gas Conservation Commission, in addition to the hearings, routinely require another two or more days of effort by the State Geologist each month. (2) The Geologic Hazards Division compiled, reorganized, and presented data on the geology and hydrology of the Powder River Basin in a format that would be helpful to the Commission's field personnel in evaluating sites for disposal pits.

Platte County Board of Commissioners -- The Industrial Minerals and Uranium Division assisted the Commissioners in an evaluation of the quantity and grade of a silica rock resource near Glendo. The Survey provided technical advice for the drilling program and prepared and published a report on the deposit.

Department of Public Lands -- The Survey's Oil and Gas Division provided the Department with (1) weekly reports of oil and gas activities on or near State lands, (2) oil and gas tract evaluations to assist with selecting tracts for the lease auction every other month, and (3) an updated computerized listing of oil and gas potential and sale results on

8,600 State lease tracts (this is a 20 percent increase over FY 87); the State Geologist (1) reviewed and made recommendations on all commercial and scientific fossil-collecting permits (there were 8 applications in FY 88) and inspected the quarries, (2) reviewed the State's fossil collecting rules and regulations and made recommendations for some needed changes, (3) provided an opinion on the oil shale potential on one decorative tile quarry, and (4) provided some information regarding proposed land exchanges involving State lands.

Public Service Commission -- The State Geologist provided technical information to the PSC in their protest of C & NW's proposed abandonment of rail service to Riverton.

Secretary of State's Office -- The State Geologist provided technical advice and information on several suspected cases of oil-related securities fraud, including testimony at one Grand Jury hearing; the Head of the Metallic Minerals Division provided similar assistance on several suspected cases of gold fraud, including one field investigation. These activities also supported the U.S. Postal Inspection Service, U.S. Attorney General, Wyoming Attorney General, and the U.S. Securities and Exchange Commission.

State Planning Coordinator and Governor's Clearing House -- (1) The State Geologist and Heads of the geologic and mineral divisions reviewed 121 documents for the Governor's Clearing House in FY 88 and submitted written comments on 47, (2) mineral and energy resource information was provided for use by Standard and Poors in regard to evaluating Wyoming's bond strength, and (3) technical information and comments were provided on the Amax/Kirwin proposed land exchange.

Uinta County Planning Office -- The Geologic Hazards Division continued to work with the Uinta County Planning

Office in integrating concerns for geologic hazards into the County's Master Plan. A presentation on development concerns in the Meeks Cabin area was given to County officials.

University of Wyoming -- (1) The State Geologist and several of the Survey's Division geologists continued to provide quarterly minerals outlook articles for publication in the Institute for Policy Research's *Wyoming quarterly update*, (2) the State Geologist and Deputy Director were members of the American Heritage Center's Advisory Board for the Anaconda Collection, which was opened for use in FY 88, (3) the State Geologist served on the College of Agriculture's Advisory Council, (4) the Metallic Minerals 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) a geologist with the Stratigraphy Division taught a series of workshops on the geology of the Fremont County Youth Camp for the College of Agriculture's State 4-H Conservation Camp, (6) The Geologic Hazards Division assisted the Cooperative Extension Service by helping to prepare a brochure for a selenium information tour, and (7) ongoing assistance and information was provided to faculty and students from several different departments of the University.

Water Development Commission -- The Geologic Hazards Division reviewed and commented on geologic, hydrologic, geochemical, and seismic reports on the proposed Sandstone Reservoir project site in the Baggs-Savery area.

In addition, spot requests for assistance were received in FY 88 from 45

other State and local entities. The following is a list of these entities in FY 88:

Afton School District
Albany County Extension Office
State Archaeologist's Office
Attorney General's Office
State Auditor's Office
Burns School District
Campbell County
Carbon County Economic Development Board
Carbon County Sheriff's Office
Casper School District
Crock County Extension Office
Department of Education
Encampment School District
State Engineer's Office
Fremont County Associated Governments
City of Guernsey
City of Hartville
Highway Department
Hot Springs County Coordinator's Office
State Inspector of Mines
Lander School District
City of Laramie
Laramie Police Department
Laramie School District
State Library
Midvale Irrigation District
Natrona County Extension Office
Natrona County Family Practice
Residency Clinic
Natrona County Health Department
Park County
Recreation Commission
Department of Revenue and Taxation,
Ad Valorem Tax Division
Riverton Museum
State Chemical and Biological
Laboratories
State Crime Laboratory
Sweetwater County Planning Department
City of Thermopolls
Office of the State Treasurer
University of Wyoming
Water Research Center
Western Research Institute
Western Wyoming Community College
White Mountain Library
Wyoming Air National Guard
Wyoming Army National Guard
Wyoming Association of Municipalities

Requests for information and assistance were also received and answered for 91 Federal, foreign, or other state entities as listed below:

Federal

Department of Agriculture
 Denver Wildlife Research Center
 Forest Service
Attorney General's Office
Army Corps of Engineers
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Mines
Bureau of Reclamation
Department of Energy
Energy Information Agency
Environmental Protection Agency
Federal Emergency Management Agency
Fish and Wildlife Service
Geological Survey
 Board of Geographic Names
 Geologic Division
 National Earthquake Information Service
 National Mapping Division
 Water Resources Division
Department of Housing and Urban Development
Interstate Commerce Commission
Minerals Management Service
National Academy of Sciences
National Museum of Natural History
National Park Service
Office of Surface Mining
Postal Inspection Service
Securities and Exchange Commission
Soil Conservation Service
Wyoming Congressional Delegation

Foreign

Canadian Consulate
Geological Museum of China
India Department of Atomic Energy
London Imperial College of Science
New Brunswick Department of
 Natural Resources
University of Cape Town-South Africa
University College of Wales

Other States

Arizona Board of Technical Registration
Arizona Geological Survey
University of Arizona

Arkansas Geological Survey
Augustana College
Brigham Young University
California Department of Food &
 Agriculture
California State University
California Water Quality Board
University of California-Santa Barbara
Central Michigan University
Colorado Geological Survey
Colorado School of Mines
Colorado State University
University of Colorado
Georgia Institute of Technology
University of Hawaii
Idaho Department of Agriculture
Idaho State University
University of Idaho
Illinois Geological Survey
Indiana Geological Survey
Iowa State University
Kentucky Geological Survey
Louisiana Geological Survey
University of Southwestern Louisiana
MacKay School of Mines
Macon County Conservation District
 (Illinois)
Mesa College
Missouri Central State University
University of Missouri-Rolla
Monroe Community College
Montana Bureau of Mines & Geology
Montana State University
Nebraska Geological Survey
Nevada Bureau of Mines & Geology
University of Nevada-Reno
New Jersey Geological Survey
North Carolina State University
Oklahoma Geological Survey
Oklahoma State University
Pennsylvania Geological Survey
South Dakota Agricultural Experiment Station
South Dakota Energy Office
Tennessee Valley Authority
Texas Bureau of Economic Geology
Texas Securities & Exchange (Austin)
Texas Securities & Exchange (Ft. Worth)
Texas Water Commission
University of Utah
Utah Geological & Mineral Survey
Virginia Polytechnic Institute
Washington Department of Natural Resources
West Virginia Department of Energy
University of Wisconsin-River Falls

As an extension of this service-related function, the State Geologist, Division geologists, and the Editor collectively presented 37 talks or briefings on mineral resources, geology, or geologic hazards to the following groups:

Association of Oilwell Servicing Contractors, Rocky Mountain Chapter, Casper

Audubon Society, Casper

College of Agriculture's LEAD Program Conference, Gillette

Dedication Ceremony for Wyoming Bicentennial of the U.S. Constitution stone, Guernsey

Earthquake Planning Workshop, Cody

First Conference on Oil and Gas Information and Data-base Management, Oklahoma City, Oklahoma

Governor's Crisis Management Task Force, Cheyenne

Governor's Selenium Work Group (one talk and one field trip), Cheyenne, and Casper

Lander Leader Group, Lander

Lions Club, Pine Bluffs

North American Conference on the Control of Ore Deposits (2 talks), Rolla, Missouri

Northwest Mining Association's Annual Conference and Trade Show, Spokane Washington

State 4-H Conservation Camp (4 workshops), Lander

Thermopolls Trowel & Pick Club, Thermopolls

Uinta County Planning and Zoning Commission, Mountain View

U.S. Forest Service and Yellowstone Coalition meeting (one talk and one field trip), Dubois

Wyoming Emergency Management Agency's Hazard Mitigation Course for Local Officials (3 talks), Casper and Cheyenne

Wyoming Geological Association Annual Field Conference (2 talks), Jackson Lake Lodge

Wyoming Geological Association luncheons (4 talks), Casper

Wyoming Mining Association's Annual Meeting, Jackson Lake Lodge

Wyoming Mining Association's Teacher Workshop, Rock Springs

Wyoming Science Teachers Association's Interdisciplinary Conference, (2 talks), Cheyenne

Wyoming State Retired Employees Association, Cheyenne

Yellowstone Association's Annual Physical Science Symposium, Yellowstone National Park

2. CONDUCT AND REPORT ON FIELD AND LABORATORY INVESTIGATIONS THAT CONTRIBUTE NEW GEOLOGICAL KNOWLEDGE TO THE STATE CONCERNING MINERAL RESOURCES AND OTHER MATTERS THAT HAVE A PRACTICAL BEARING ON WYOMING'S COMMUNITIES AND PEOPLE.

The following five investigations were completed in FY 88:

(1) At the request of the Land Quality Division of the Department of Environmental Quality (DEQ), the State Geologist and the Coal and Oil and Gas Divisions planned, supervised, and interpreted a subsurface study of venting natural gases at the Rawhide Village subdivision near Gillette. The drilling project was completed in five days. Based on the drilling and field investigation, the Survey prepared two unpublished reports for the DEQ: *Investigation of venting methane and hydrogen sulfide gas at Rawhide Village, Campbell County, Wyoming* and *Investigation of the potential for near-surface explosive concentrations of methane to occur in the Rawhide Village subdivision, Campbell County, Wyoming.*

(2) The Industrial Minerals and Uranium Division completed a cooperative project with Albany County to evaluate the Plumbago Creek silica sand deposit northeast of Laramie in the Sybille Canyon area. Subsurface drilling, geologic mapping,

and laboratory testing were used to estimate the quantity and quality of the silica resources at that site. A report was prepared and published by the Survey.

(3) The Industrial Minerals and Uranium Division completed a cooperative project with Platte County to evaluate a silica rock deposit near Glendo, Wyoming. Sub-surface drilling, geologic mapping, and laboratory testing were used to estimate the quantity and quality of silica resources at the Cassa site. A report was published by the Survey.

(4) The Industrial Minerals and Uranium Division provided information and technical assistance that helped Mountain Cement Company in Laramie find a needed gypsum deposit. In addition, the Division helped locate deposits of ornamental rock, mineral pigment, construction aggregate and clay, and magnetite for various companies. In these cases, the companies are now using or evaluating the deposits.

(5) At the request of the U.S. Forest Service, the Geologic Hazards Division conducted a hazards analysis of a proposed dam site on the Jack Creek drainage near Bondurant. An unpublished report was prepared and given to the Forest Service.

Ongoing investigations include:

(1) The Metallic Minerals Division's field sampling and laboratory processing of diamond-bearing kimberlite from the Laramie Range and other areas of the State continued under a cooperative agreement with the University of Wyoming's Mining and Mineral Resource Research Institute.

(2) Reconnaissance surveys of mineral occurrences throughout the State continued as in-house projects in the Metallic Minerals and Industrial Minerals and Uranium Divisions.

(3) The Head of the Geologic Hazards

Division, as the Chairman of the Governor's Selenium Work Group, continued a cooperative multidisciplinary study of selenium in Wyoming.

(4) The Geologic Hazards and the Industrial Minerals and Uranium Divisions continued a cooperative study of radon occurrences in the State with the Wyoming Department of Health and Social Services and the U.S. Environmental Protection Agency.

(5) Compilation and collection of surface and subsurface coal data for entry into the U.S. Geological Survey's National Coal Resources Data System was continued by the Coal Division.

(6) The Industrial Minerals and Uranium Division continued to compile maps of background gamma-radiation levels across Wyoming.

(7) The Metallic Minerals Division continued geologic mapping of the South Pass greenstone belt in the southern Wind River Range of Fremont County.

(8) The Geologic Hazards Division continued statewide research and mapping of geologic hazards. Primary emphasis is currently on landslides and active faults.

(9) The Stratigraphy Division continued geologic mapping of the southeastern Bighorn Mountains in Johnson, Natrona, and Washakie Counties.

(10) The Metallic Minerals Division and the Laboratory Section continued to provide mineral and rock identifications for the general public, other Survey Divisions, industry, other State agencies, and the University of Wyoming. Collectively, 453 samples were identified in FY 88, which is more than 70 percent more identifications than the previous fiscal year. The Laboratory Section completed 1,060 in-house analyses and tests on 353 of those samples in FY 88.

(11) Work on a revised *Stratigraphic*

nomenclature chart for the State of Wyoming continued as a joint effort of the Stratigraphy Division, the U.S. Geological Survey, and the Wyoming Geological Association. The Stratigraphy Division prepared a near-final draft of the chart in FY 88.

(12) The Industrial Minerals and Uranium Division continued its investigation of mineral occurrences in Platte County and their potential economic value.

(13) A project to assemble and publish the U.S. Bureau of Land Management's (BLM's) heretofore unpublished coal drilling and analytical data was begun. The first report to be assembled and published will be a geologic report on the coal resources underlying the Rawhide Village subdivision. The project is funded by a grant from the BLM and is being done by the Coal Division.

(14) The Industrial Minerals and Uranium, Coal, Metallic Minerals, and Oil and Gas Divisions are preparing maps of the mineral and energy resources of the Powder River Basin. This project is partially funded by the Evolution of Sedimentary Basins Program of the U.S. Geological Survey.

3. PREPARES AND PUBLISHES TIMELY AND SIGNIFICANT REPORTS AND MAPS THAT LEAD TO A BETTER UNDERSTANDING OF THE LOCAL AND REGIONAL GEOLOGY OF THE STATE AND ITS MINERAL RESOURCES.

The State Geologist, Heads of the Geologic Divisions, and the Editor and Editorial Assistant compile, edit, and(or) write many reports and maps for publication by the Geological Survey each fiscal year. In addition, manuscripts are sometimes accepted from authors outside the Survey.

The 41 publications prepared by the Survey in FY 88, while slightly below the record years of FY 86 and FY 87, is still 3.5 times greater than 1982 (Figure 5). This dramatic increase since 1982 is the result of a concerted effort

to increase the number of new publications each year.

The Editor, after consultation with the State Geologist, establishes printing priorities. The two graphs in Figure 6 summarize the general subject matter of Survey publications and the number of new publications completed each decade. While the number of new reports and maps has steadily increased, there is an increasingly larger backlog of material that cannot be published in any given year due to budgetary constraints.

The Editorial Section prepared bid specifications for 26 printing jobs in FY 88, and the Editor attended 11 press runs to assure the printed quality of these publications met Survey standards.

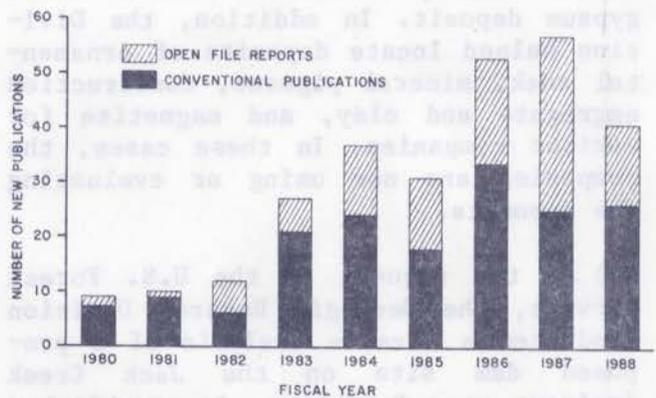


Figure 5. Number of new publications completed each fiscal year (1980 through 1987).

TECHNICAL AND POPULAR GEOLOGY	202 REPORTS AND MAPS	54%
MINERAL RESOURCES	175 REPORTS AND MAPS	46%

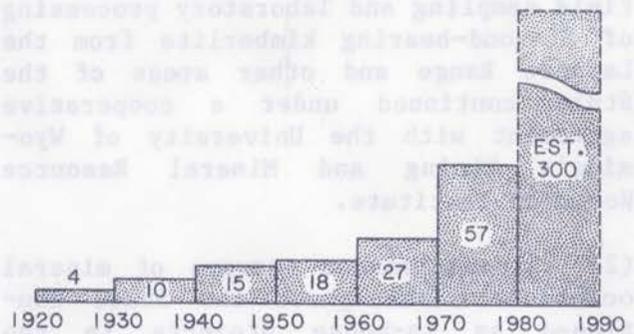


Figure 6. General content of publications (FY 1911 through FY 1988) (above) and number of new publications per decade (below).

The following 41 reports, maps, and other materials were published in FY 88:

ANNUAL REPORT

Fifty-fourth annual report of the Geological Survey of Wyoming, July 1, 1986, to June 30, 1987, by G.B. Glass (1987).

BULLETIN

Traveler's guide to the geology of Wyoming (2nd edition): Bulletin 67, D.L. Blackstone, Jr. (1988).

INFORMATION CIRCULARS

Geology of Wyoming, by G.B. Glass and D.L. Blackstone, Jr. (1987).

Guide to some rocks and minerals of Wyoming, by W.D. Hausel, F.K. Root, and K.G. Albert (1987).

Hints for rock hunting and prospecting in Wyoming, by W.D. Hausel (1987).

Geology of Wyoming, by G.B. Glass and D.L. Blackstone, Jr. (1988).

Guide to some rocks and minerals of Wyoming, by W.D. Hausel, F.K. Root, and K.G. Albert (1988).

Hints for rock hunting and prospecting in Wyoming, by W.D. Hausel (1988).

MAP SERIES

Tectonic map of the Overthrust Belt, western Wyoming, northwestern Utah, and southeastern Idaho, showing oil and gas fields and exploratory wells in the Overthrust Belt and adjacent Green River Basin: MS-23, D.L. Blackstone, Jr. and R.H. DeBruin (1987).

Land inventory map of Wyoming 1987: MS-24, Wyoming Department of Agriculture and the Geological Survey of Wyoming (1987).

Geologic map of the Newcastle 1° x 2° Quadrangle, northeastern Wyoming and

western South Dakota: MS-25, J.D. Love and A.C. Christiansen (1987).

MEMOIR

Late Pleistocene periglacial wedge sites in Wyoming: an illustrated compendium: Memoir 3, Brainerd Mears, Jr. (1987).

MISCELLANEOUS

First draft of proposed stratigraphic nomenclature chart for the State of Wyoming: Miscellaneous publications, J.D. Love, A.C. Christiansen, and A.J. VerPloeg (1987).

OPEN FILE REPORTS

The geology and occurrence of critical strategic metals (chromium, cobalt, manganese, and platinum) in Wyoming: OFR 87-7, W.D. Hausel (1987).

Rare earth elements and yttrium in Wyoming: OFR 87-8, J.K. King and R.E. Harris (1987).

Preliminary map of windblown sand areas in Wyoming: OFR 87-9, J.C. Case and Cynthia Boyd (1987).

Revised geologic map of the Miners Delight Quadrangle, Fremont County, Wyoming: OFR 87-10, W.D. Hausel (1987).

Guide to potentially seleniferous areas in Wyoming: OFR 88-1, J.C. Case and J.C. Cannia (1988).

Revised geologic map of the South Pass City Quadrangle, Fremont County, Wyoming: OFR 88-2, W.D. Hausel (1988).

Geologic map of the Lewiston Lakes Quadrangle, Fremont County, Wyoming: OFR 88-3, W.D. Hausel (1988).

Preliminary geologic map of the Fraker Mountain Quadrangle, Johnson County, Wyoming: OFR 88-4, A.J. VerPloeg, R.H. DeBruin, and P.L. Greer (1988).

Preliminary geologic map of the Barnum Quadrangle, Johnson County, Wyoming: OFR

88-5, A.J. VerPloeg, R.H. DeBruin, and P.L. Greer (1988).

Preliminary geologic map of the Tabletop Quadrangle, Washakie and Johnson Counties, Wyoming: OFR 88-6, A.J. VerPloeg, R.H. DeBruin, and P.L. Greer (1988).

Revised geologic map of the Atlantic City Quadrangle, Fremont County, Wyoming: OFR 88-7, W.D. Hausel (1988).

Reconnaissance geologic map of the Halls Meadow Springs Quadrangle, Fremont and Sublette Counties, Wyoming: OFR 88-8, W.D. Hausel (1988).

Ongoing studies on the geology of Wyoming: OFR 88-9, P.L. Greer and A.J. VerPloeg (1988).

Fluorite in Wyoming: OFR 88-10, R.E. Harris and J.K. King (1988).

Stream-sediment sample results in search of kimberlite intrusives in southeastern Wyoming: OFR 88-11, W.D. Hausel, W.M. Sutherland, and E.B. Gregory (1988).

POSTCARD

Tyrannosaurus rex.

REPORTS OF INVESTIGATIONS

Geothermal resources of the Wind River Basin, Wyoming: RI 38, B.S. Hinckley and H.P. Heasler (1987).

Geology and economic potential of a high-calcium limestone and dolomitic limestone deposit near Manville, Niobrara County, Wyoming: RI 39, R.E. Harris (1987).

The Plumbago Creek silica sand deposit, Albany County, Wyoming: RI 40, R.E. Harris (1988).

Analyses and measured sections of seven coal samples from the Rock Springs district, Green River Basin coal field, southwestern Wyoming: RI 41, G.B. Glass and J.T. Roberts (1988).

The Cassa silica rock deposit, Platte County, Wyoming: RI 42, R.E. Harris (1988).

REPRINT

Geologic road log of part of the Gros Ventre River valley including the Lower Gros Ventre Slide: Reprint 46, J.D. Love and J.M. Love (1988).

WYOMING GEO-NOTES

No. 15: by G.B. Glass, R.H. DeBruin, R.W. Jones, W.D. Hausel, R.E. Harris, J.C. Case, and A.J. VerPloeg, (June, 1987).

No. 16: by G.B. Glass, R.H. DeBruin, R.W. Jones, W.D. Hausel, R.E. Harris, and A.J. VerPloeg, (October, 1987).

No. 17: by G.B. Glass, R.H. DeBruin, R.W. Jones, W.D. Hausel, R.E. Harris, A.J. VerPloeg, and J.C. Case, (January, 1988).

No. 18: by G.B. Glass, R.H. DeBruin, R.W. Jones, R.E. Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (April, 1988).

ADVERTISING MATERIALS

Publications available from the Geological Survey of Wyoming, September, 1987, compiled by Sheila Roberts (1987).

Publications available from the Geological Survey of Wyoming, March, 1988, compiled by Sheila Roberts (1988).

In addition, the State Geologist, Division geologists, or the Editor wrote the following 19 papers and reports for outside publishers:

American Association of Petroleum Geologists Bulletin: *Developments in coal in 1986*, by S.A. Friedman, R.W. Jones, C.G. Treworgy, and C.J. Smith (1987).

American Institute of Mining and Metallurgical Engineers, *Mining Engi-*

neering: *Wyoming [Exploration in 1987]*, by W.D. Hausel, R.E. Harris, and R.W. Jones, (1988).

Association of American State Geologists, *The State Geologists Journal: Wyoming [Geological Survey activities]*, by G.B. Glass, (in press); *Geological Survey of Wyoming*, by Sheila Roberts in *History of State Geological Surveys* (in press).

California Mining Journal: *Metals and precious stones in Wyoming*, by W.D. Hausel (1987).

28th International Geological Congress, *Guide to Field Trip T-322: Precambrian rocks and mineralization, Wyoming Province*, by G.L. Snyder, W.D. Hausel, T.L. Klein, R.S. Houston, and P.J. Graff (in press).

McGraw Hill, Inc., *Keystone Coal Industry Manual: Description of Wyoming coal fields and seam analyses*, by G.B. Glass (in press).

Oklahoma Geological Survey Special Publication 88-3: *Oil and gas information systems in Wyoming*, by R.H. DeBruin (1988).

Theophrastus Publications, Inc., Athens, Greece: *Structural control of Archean gold mineralization within the South Pass greenstone terrain, Wyoming (USA)*, by W.D. Hausel in *The practical applications of trace elements and isotopes to environmental biogeochemistry and mineral resources evaluation* (1987).

U.S. Bureau of Mines Preprint from the 1986 Bureau of Mines Minerals Yearbook: *The mineral industry of Wyoming*, by W.L. Rice and G.B. Glass (1988).

University of Kentucky, *Proceedings 1987 National Symposium of Mining, Hydrology, Sedimentology, and Reclamation: Subsidence problems in Wyoming and their social impact*, by M.G. Karfakis, J.C. Case, and Gary Beach (1987).

University of Wyoming, College of Agriculture's Cooperative Extension Service: *Selenium information tour [Kendrick/Casper-Alcova Irrigation District]*, by Mike Carnevale, J.C. Case, S. Williams, Larry Munn, T. Jackson, D. Peterson, N. Frissell, and Don Brosz (1988).

University of Wyoming, Institute for Policy Research's *Wyoming Quarterly Update: Minerals update*, by G.B. Glass, W.D. Hausel, R.W. Jones, R.H. DeBruin, and R.E. Harris [volume 6, no. 4; volume 7, no. 1; volume 7, no. 2; volume 7, no. 3] (1987 and 1988).

Wyoming Geological Association, *The Contact: Wyoming coal developments, markets, and future opportunities [abstract]*, by R.W. Jones (1988); *39th Annual Field Conference Guidebook: Geology and mineral resources of the Black Hills uplift, Wyoming*, by W.D. Hausel and W.M. Sutherland (1988).

Wyoming Mining Association, *The Mining Claim: Wyoming -- a frontier for gold exploration*, by W.D. Hausel (1988).

4. 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 FY 88, the Agency (1) enlarged its geologic hazards files, particularly in regard to landslides and selenium-related documents, (2) expanded its geologic and mineral and energy resource files by the addition of at least 4,500 records, and (3) added at least 3,000 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 and paper

copies of many oil and gas well logs, aerial photographs, unpublished geologic and mineral reports, U.S. Geological Survey and U.S. Bureau of Mines Open File Reports, 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 library.

OUTSIDE FUNDING SOURCES (GRANTS)

Grants and cooperative agreements do provide a source of special revenue. But unlike the revenue from the sale of publications, which goes directly into the General Fund, grant funds are used by the Geological Survey to support special projects or investigations. These grants come from outside sources with the Survey often providing service in kind. Since the Division Heads conduct these projects, the in-kind match is generally met by a portion of their salary (prorated to reflect the time that they spend on the project).

Investigations and projects of this sort provide data that the Agency otherwise could not assemble or collect in as timely a manner. In all cases, the Geological Survey only undertakes these projects when they support its mission or goals and are clearly of mutual benefit to the State of Wyoming. Each of these projects generally results in a salable publication. Revenue from the sale of these reports eventually repays a part of the in-kind expenses. With the tightening of its budget in the last few years, however, the Survey's investigative work has become very dependent on these outside funding sources. Unfortunately there is no guarantee that these outside sources will be available in subsequent years.

In FY 88, the Survey had nine outside grants totaling \$101,320. Of these funds, the Survey's grant-related expenditures in FY 88 were \$56,881. A summary of ongoing or completed grants in FY 88 (to include the expenditures from each

grant) are summarized below: 03.60 (\$3,323.86 carryover from FY 86) for mapping of landslides in Wyoming, funded by the U.S. Geological Survey (Revenue Code 78001); 03.70 (\$3,037.29 carryover from FY 86) for entry of coal data into the U.S. Geological Survey's National Coal Resources Data System (NCRDS) (Revenue Code 78008); 03.13 (\$11,628.95 carryover from FY 87 for geologic mapping in the South Pass-Atlantic City area, funded by the U.S. Geological Survey's COGEMAP Program (Revenue Code 78008); 03.23 (\$10,447.09 carryover from FY 87) for geologic mapping in the southern Bighorn Mountains, funded by the U.S. Geological Survey's COGEMAP Program (Revenue Code 78008); 03.51 (\$10,508.67 carryover from FY 87) for the compilation and publication of coal drill hole and coal analytical data derived from Federal drilling projects over the last several years, funded by the U.S. Bureau of Land Management (Revenue Code 78105); 03.74 (\$14,172.26 carryover from FY 87) for continuation of the NCRDS coal data entry project (see 03.70 grant above), funded by the U.S. Geological Survey (Revenue Code 78008); 03.24 (\$2,672.59) for another year's mapping in the southern Bighorn Mountains (an extension of the 03.23 grant above), funded by the U.S. Geological Survey (Revenue Code 78008); and 03.32 (\$1,090.41) for compilation of mineral and energy resource maps of the Powder River Basin, funded by the U.S. Geological Survey (Revenue Code 78008). In addition, funds for a ninth grant (03.75) were not received from the U.S.

Geological Survey in time to use them in FY 88. This \$20,000 grant (Revenue code 78008) will begin in early FY 89 as a continuation of the NCRDS coal data entry project (see 03.74 grant above).

The Survey anticipates that new, similar, cooperative working agreements will be developed during the 1989-1990 Biennium although funding from these

outside sources is likely to be at reduced levels. It is anticipated that the COGEOMAP grants and the grant for resource mapping in the Powder River Basin with the U.S. Geological Survey and the drilling report project with the U.S. Bureau of Land Management will be renewed when they expire in FY 88. The U.S. Geological Survey, however, may not renew their NCRDS project in FY 89.

Major accomplishments by 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, supervised by the Editor, is the sales arm of the Survey and performs an essential role in the sale and distribution of information to the public. This Program also provides the funds for preparing and printing geological information collected and interpreted by Survey personnel or outside authors. The Program has two full-time employees.

The major objectives of this Program are four-fold: (1) to make information about Wyoming's geology and mineral and energy resources available to both the public and private sectors in standard publication format, (2) to sell Survey publications at prices that result in a reasonable return in revenues, (3) to respond to inquiries related to Survey publications, and (4) to provide technical support to the director, geologists, and other staff, and occasionally to members of the public.

ACCOMPLISHMENTS

For each of these major objectives, the activities and accomplishments of the Publications Program in FY 88 are described below:

1. MAKE INFORMATION ABOUT WYOMING'S GEOLOGY AND MINERAL AND ENERGY RESOURCES AVAILABLE TO BOTH PUBLIC AND PRIVATE SECTORS IN STANDARD PUBLICATION FORMAT.

The 41 publications listed on page 15 through 16 represent the combined efforts of the Publications Division and other Survey Divisions toward meeting the primary objective of the Publications Programs.

2. SELL SURVEY PUBLICATIONS AT

PRICES THAT RESULT IN A REASONABLE RETURN IN REVENUES.

Prices charged for individual items and quantities printed are based on actual printing costs and the nature of the item. Some publications are highly scientific or technical and have a limited market, others are specifically written for the general public. Some have an enduring market appeal, whereas others are timely, but sales are shorter term. This variety of publications allows the Survey to meet the needs of a varied public, from industry geoscientists who want timely information about Wyoming's mineral resources, to government agencies that want information for

planning and development decisions, to tourists and Wyoming citizens who can be encouraged to understand and enjoy the State through its geology. It is important that the price of Survey publications be affordable to all these groups.

Part of the Publications Program is budgeted for "purchases for resale". In this way the Survey enhances the availability of special books and maps, which have an appeal to Wyoming citizens or tourists but are published by the U.S. Geological Survey or similar organizations rather than our Agency. It is another type of information service. Topographic maps, the *State geologic map*, and the *Highway geology map* are important items provided by this mechanism. Because nearly all these publications are purchased at 30-50 percent discounts, the rate of return on these items is substantial. For example, the estimated \$24,000 that will be used for the purchase of topographic maps in the FY 89-90 Biennium, will result in approximately \$40,000 in revenue to the General Fund (a net gain of \$16,000).

Revenues generated from the sale of publications are deposited in the General Fund. Weekly tallies are reported to the State Geologist. Quarterly tally reports, which show monthly income totals and the number of each type of report or map sold, are submitted to the Geological Survey Advisory Board. Table 2 summarizes the percentage breakdown of revenue from publication sales by publication type for FY 88.

Expenditures for the publications program in FY 88 were \$123,089. Biennial budget requests for commercial printing funds are geared to revenue collected from the sale of publications during the two previous years. In other words, the funds requested of the Legislature for commercial printing costs are already on deposit in the General Fund.

Table 2. Percentage breakdown of revenue from publication sales by publication type for Fiscal Year 1988.

29%	Topographic maps (all scales)	\$20,419.50
19%	Map Series	\$12,945.00
18%	Bulletins	\$12,485.00
8%	Report of Investigations	\$ 5,432.00
6%	Public Information Circulars	\$ 4,488.00
6%	Open File Reports	\$ 4,176.00
3%	Geologic Map of Wyoming	\$ 2,430.00
3%	Geologic Highway Map	\$ 2,214.00
2%	Preliminary Reports	\$ 1,108.00
0.5%	Reprints	\$ 600.00
0.5%	County Resource Series	\$ 340.00
<hr/>		
95%	Subtotal	\$66,637.50
5%	miscellaneous publications and price difference for mailed publications.	\$ 2,884.36
<hr/>		
	Grand Total	\$69,521.86

As a general rule, sales income had been increasing until the peak year of FY 81 (Figure 7). With the subsequent recession, sales declined substantially, dropping to \$48,878 in FY 84. In an effort to increase annual revenues, prices were raised, and the preparation and publication of reports and maps were accelerated. Slumping sales were successfully turned around in FY 85 and have held around \$70,000 for the last three fiscal years, in spite of the continuing economic recession in Wyoming. In the last three fiscal years, the Publications Program recovered 59, 58, and 56 percent of its overall costs,

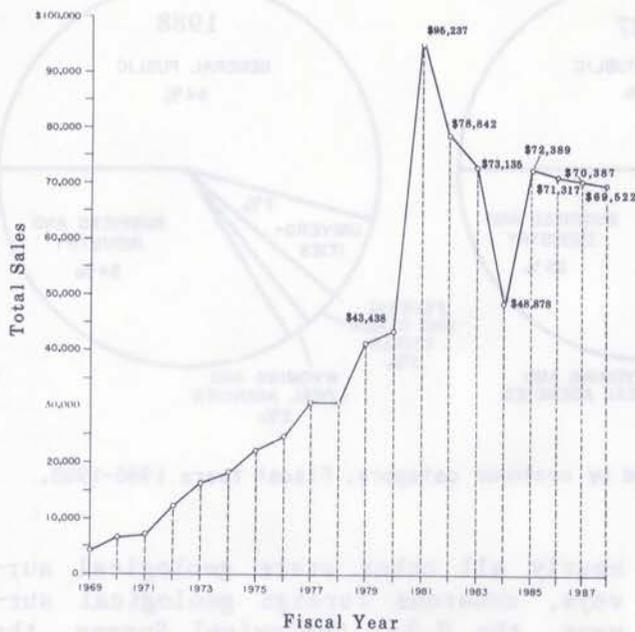


Figure 7. Fiscal year Income to the General Fund from Survey publications.

respectively. This compares to only 40 percent recovered in FY 84.

Level funding and small cuts in the appropriations for the Publications Program over the last four years has necessitated some adjustments. Antiquated photographic and drafting equipment has been kept rather than replaced. Several prepared manuscripts are deferred from publication until each following year and an increasing number of publications are prepared as open file reports rather than sent out for commercial printing. An open file report 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 poor 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.

In FY 88, the Publications Sales Manager and Editorial Assistant responded to 2,855 written inquiries about publications, answered an average of 25 telephone inquiries per day, and received 4,288 publications sales.

Figure 8 shows a percentage breakdown of revenues derived from the sale of publications over the last three fiscal years, arranged by customer category. The revenues from sales to the general public have exceeded 50 percent of the total since FY 86. Most of the increase in revenues from sales to the general public since FY 85 are attributed to increasing sales of topographic maps used for recreation as well as other purposes.

Table 3 points out that the volume of receipted sales in each customer category and the revenues derived from that customer category are not always directly proportional, i.e., although the business and industry category represents fewer purchases than the general public, the sales are for greater dollar amounts.

Responding to a request from the Geological Survey's Advisory 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 the regular mailings of press releases describing new items, Survey publications were displayed and sold at nine meetings of professional geological

Table 3. Percentage breakdown of FY 88 publication sales by customer category and by sales revenue.

Category	Percent of Customers	Percent of Sales Revenue
General Public	76%	54%
Business and Industry	16%	34%
Wyoming and Local Agencies	1%	2%
Federal, Other States and Foreign	2%	3%
Universities	5%	7%

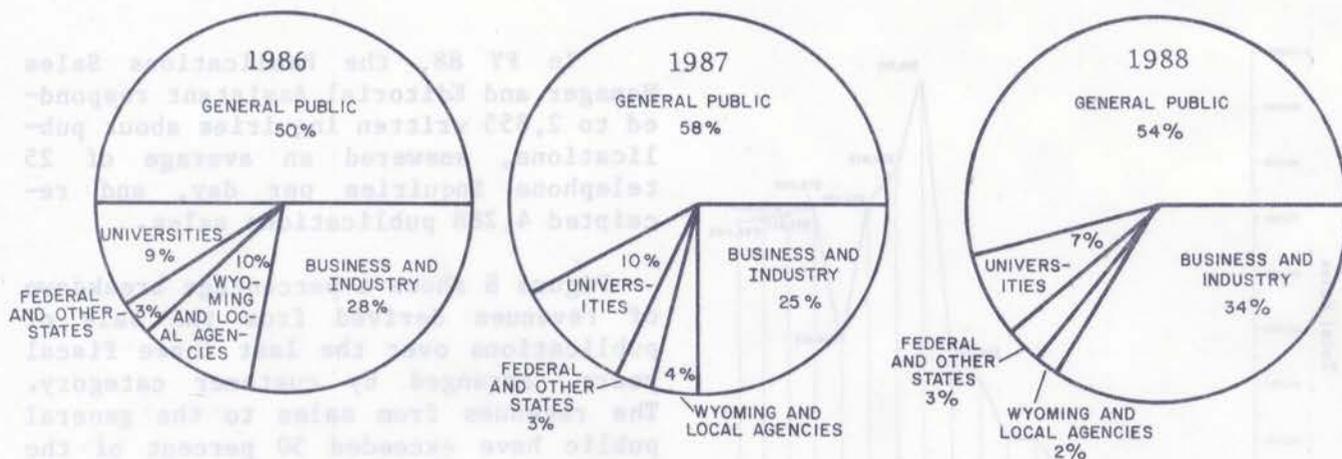


Figure 8. Percentage of publication revenue, arranged by customer category, Fiscal Years 1986-1988.

associations and rock and mineral clubs in the region in FY 88. This effort resulted in additional revenues of \$3,336.20. Of these revenues, \$2,091.80 was derived from sales at out-of-state meetings; \$1,244.40 came from sales at in-state meetings. Copies of *Wyoming Geo-notes* were mailed to government, business, and private concerns in a successful effort to interest them in subscribing to this quarterly publication on Wyoming's mineral resources. Continuing an effort begun in FY 86, posters describing the Survey's topographic map sales and some of the more popularly oriented publications on geology were distributed in the region. Topographic map sales in FY 87 and FY 88 were higher than in FY 86 because of increased public awareness of that service, because the Survey is now selling maps by mail and phone orders as well as over-the-counter, and because the Survey is now the only sales outlet in Wyoming with a complete inventory of Wyoming topographic maps.

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 FY 88, an estimated 1,474 publications were received in exchange for Survey publications.

3. RESPOND TO INQUIRIES RELATED TO SURVEY PUBLICATIONS.

As an offshoot of the Publications Program activities, the Publications Division answers a variety of inquiries in addition to those directed to the Publications Sales Section, as described above. Members of the publishing industry and advertisers regularly request information about Survey publications and many of these contacts result in free publicity for the Survey. Local governmental agencies, especially school districts, libraries, museums, and chambers of commerce, occasionally inquire about publications, and in FY 88 there were several requests for the

posters on topographic maps and popular publications. State agencies request information and posters.

4. PROVIDE TECHNICAL ADVICE AND SUPPORT TO THE DIRECTOR, GEOLOGISTS, AND OTHER STAFF AND OCCASIONALLY TO MEMBERS OF THE PUBLIC.

The Publications Division provides editing and drafting for publications by Survey members, 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. In FY 88 these came from the

University of Wyoming, the Wyoming Geological Association, the Western Research Institute, the Wyoming Water Research Center, the Museum of the Rockies (Bozeman, Montana), the Montana Bureau of Mines and Geology, and five universities in other states.

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. In FY 88, a *Land inventory map of Wyoming* and a geologic map of the Newcastle 1° x 2° sheet were produced as cooperative efforts with the Wyoming Department of Agriculture and U.S. Geological Survey, respectively.

Problem areas and recommendations

1. Wyoming Statute 36-6-102 requires a company that drills an exploration hole on a State lease to submit copies of all subsurface log reports (electrical, gamma-ray, neutron, density, resistivity, etc.) to the State Geologist within three years after completion of drilling. Copies become the property of the State to be retained within the permanent files of the Geological Survey. These subsurface log reports are held "confidential" for a period of seven years after receipt by the State Geologist or until expiration of the lease, whichever is the lesser period of time. If a lease is being held by production, all reports will be held confidential until the lease is terminated.

Although many companies have complied with this law, the small amount of data turned in suggests that there are many companies that have not complied. Because there is currently no requirement for a company to notify the State Geologist that they are drilling or have drilled exploration holes, there is no

efficient way to verify the compliance with this law. Oil and gas companies pose no concern as their logs are routinely turned into the Wyoming Oil and Gas Conservation Commission, thus meeting the provisions of this law since copies of these logs are forwarded to the State Geologist. Exploration logs for other minerals, however, present a problem.

Currently, when the State Geologist learns that subsurface drilling reports are available but not turned in, letters to the delinquent companies, produce the reports. This procedure, however, only works when the State Geologist finds out holes were drilled and when he ascertains who to write to. Although at least a partial listing of exploration holes in Wyoming was acquired from the Land Quality Division of the Department of Environmental Quality in FY 87, the Geological Survey has lacked the funds and manpower to even evaluate these data in regard to company compliance with Statutory requirements.

If this law is to be truly effective for the State in gathering and preserving the valuable mineral resource information provided by subsurface drilling, it needs revised. The revisions should provide some mechanism that will alert the Geological Survey to the drilling of holes on State lands so

that the Agency can monitor compliance with the law. In addition, penalty provisions for noncompliance may be needed. The law would also be more valuable if it required oil and gas companies to at least run gamma-ray logs to the surface in all wells drilled on State lands.

SUMMARY OF PERMANENTLY ASSIGNED VEHICLES

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

License Number	Assigned To	Reason For Assignments
S-799	James C. Case	For light field work on geologic hazards investigations, a backup for trips by others, and for the maintenance of the vehicle. (1981 Eagle with 83,846 miles on it).
S-131	Shella Roberts	For travel to press runs; for pickup and delivery of typeset, illustrations, and photographic materials; and for the maintenance of the vehicle. (1978 Pontiac sedan with 103,161 miles on it).
S-168	Richard W. Jones	For field work on coal-related investigations and for the maintenance of the vehicle. (1972 Blazer with 131,078 miles on it).
S-126	Ray E. Harris	For field work on industrial minerals and uranium investigations and for the maintenance of the vehicle. (1987 Chevrolet pickup with 34,225 miles on it).
S-656	W. Dan Hausel	For field work on metallic minerals; for reconnaissance field work on diamond-bearing kimberlites in the Laramie Range; for a backup vehicle for field investigations by others, and for the maintenance of the vehicle. (1987 Chevrolet pickup with 15,666 miles on it).
S-132	Jay T. Roberts	For pickup and deliveries in town and for other short trips (this is a 1969 Ford pickup with 143,921 miles on it).
S-1026	W. Dan Hausel	Only used during the summer on a field project in the South Pass area. (Rented with Federal grant funds and returned to MVMS in October).
S-1068	Alan J. Verploeg	Only used during the summer on a field project west of Kaycee. (Rented with Federal grant funds and returned to MVMS in October).