

# THE GEOLOGICAL SURVEY OF WYOMING

D. N. Miller, Jr., State Geologist

---

## Thirty-Seventh Biennial Report of the State Geologist for 1973-1974



Geology Building, University of Wyoming

Laramie

September, 1974

DANIEL N. MILLER, JR.  
DIRECTOR AND  
STATE GEOLOGIST

STAFF GEOLOGISTS  
ROY M. BRECKENRIDGE  
GARY B. GLASS  
FORREST K. ROOT  
WILLIAM G. WENDELL



THE GEOLOGICAL SURVEY OF WYOMING  
UNIVERSITY OF WYOMING  
BOX 3008, UNIVERSITY STATION  
LARAMIE, WYOMING 82071

*Serving Wyoming Since 1933*

TELEPHONES:  
(307) 742-2054  
(307) 766-2286

SURVEY ADVISORY BOARD  
D. L. BLACKSTONE, JR., LARAMIE  
WILLIAM H. CURRY, CASPER  
RICHARD K. LISCO, CASPER  
JOHN S. RUNGE, CASPER  
ROBERT J. STEELE, GREEN RIVER

September 26, 1974

The Honorable Stanley K. Hathaway  
Governor of the State of Wyoming  
State Capitol Building  
Cheyenne, Wyoming 82002

Sir:

Submitted herewith is the Thirty-seventh Biennial Report of the State Geologist covering the period from July 1, 1973 to June 30, 1975, as required by Article 11, Section 9-252, Wyoming Compiled Statutes, 1957.

Respectfully submitted,

*Daniel N. Miller, Jr.*

Daniel N. Miller, Jr.  
State Geologist

DNM:sa

ANNUAL REPORT OF THE STATE GEOLOGIST  
FOR THE  
GEOLOGICAL SURVEY OF WYOMING  
1973-1975

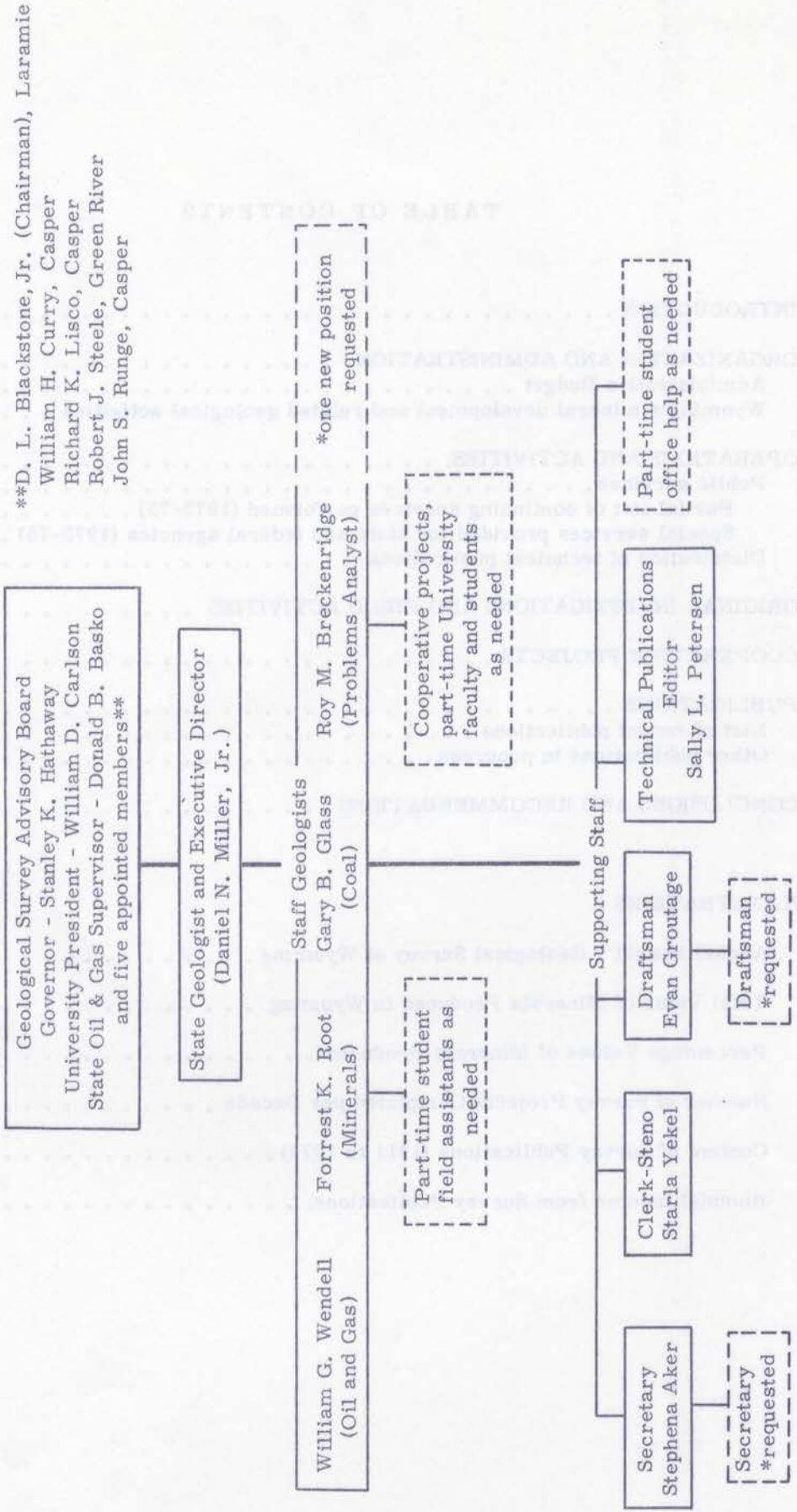
TABLE OF CONTENTS

	Page
INTRODUCTION . . . . .	1
ORGANIZATION AND ADMINISTRATION . . . . .	1
Administrative Budget . . . . .	2
Wyoming's mineral development and related geological activities . . . . .	2
OPERATIONS AND ACTIVITIES . . . . .	4
Public services . . . . .	4
Partial list of continuing services performed (1973-75) . . . . .	4
Special services provided for state and federal agencies (1973-75) . . . . .	4
Distribution of technical publications . . . . .	5
ORIGINAL INVESTIGATIONS AND FIELD ACTIVITIES . . . . .	5
COOPERATIVE PROJECTS . . . . .	5
PUBLICATIONS . . . . .	6
List of recent publications . . . . .	6
Other publications in progress . . . . .	6
CONCLUSIONS AND RECOMMENDATIONS . . . . .	7
ILLUSTRATIONS	
Annual Budget - Geological Survey of Wyoming . . . . .	2
Total Value of Minerals Produced in Wyoming . . . . .	2
Percentage Values of Minerals Produced . . . . .	3
Number of Survey Projects Completed per Decade . . . . .	7
Content of Survey Publications (1911 to 1974) . . . . .	7
Biennial Income from Survey Publications . . . . .	7

The goal of the Geological Survey is to provide a maximum of information and service to the people of the State, industry, and to other State and Federal agencies. All activities are planned administratively for budgetary purposes; they include both basic and cooperative work. The primary objective of the Survey is to provide a continuing program of research and investigation that will result in the production of reports, maps, and other publications that will be of benefit to the State. All printing and distribution expenses are paid through a separate account independent of the administrative budget.

New administrative positions were filled during the past year. The positions of technical writer-editor, Dr. Roy M. Brown, and administrative assistant, Miss G. Woodell, were filled. Dr. Woodell replaced Dr. U.S. Brown, and Miss Woodell replaced Miss Barbara Jones, and Mrs. Gladys M. Tabor, who replaced Mrs. Grace Eckersley at Clark Street. Three new positions have been requested for the 1973-75 biennium as shown on the Organizational Chart.

ORGANIZATIONAL CHART - THE GEOLOGICAL SURVEY OF WYOMING (1974)



BIENNIAL REPORT OF THE STATE GEOLOGIST  
FOR THE  
GEOLOGICAL SURVEY OF WYOMING

1973 - 1975

INTRODUCTION

The Geological Survey of Wyoming was established by the State Legislature in 1933, modified by legislative enactment in 1957 (Wyoming Compiled Statutes, Art. 11), and further modified in 1969 (Art. 11, Geological Survey Div. II, Secs. 9-264.1 to 9-264.10).

The Survey is charged with eleven specific objectives which have been summarized as follows:

- (a) To compile and maintain libraries and files of all published material, records, maps, and data, relating to the surface and subsurface geology of Wyoming, and to make such information available upon request to other State agencies, the mineral industries, and the public at large.
- (b) To conduct field investigations that contribute new geological information to the State especially as it relates to mineral resources but also as it relates to other practical matters that have a bearing on Wyoming's communities and people.
- (c) To publish timely and significant reports and maps that lead to a comprehensive understanding of the overall geology of the State and its resources.
- (d) To offer geological advice, consulting services, and cooperative working arrangements to all State agencies and departments and to enter into practical agreements for the purpose of conducting investigations of mutual concern.
- (e) The State Geologist serves on the Wyoming Oil and Gas Conservation Commission, as a member of the Interdepartmental Water Planning Conference, on the Interstate Oil and Gas Compact Commission, and on other committees where geological information is needed.

The State Geologist and Geological Survey are especially concerned with the distribution and potential of Wyoming's mineral resources and evaluation of State lands. They assist the State Board of Land Commissioners, the Department of Economic Planning and Development, and advise other State agencies on the geology of such matters.

Offices and other facilities of the Survey are located on the University of Wyoming campus in Laramie, and are staffed as illustrated on the Organizational Chart.

ORGANIZATION AND ADMINISTRATION

The staff of the Geological Survey is organized to provide a maximum of information and service to the people of the State, industry, and to other State and Federal agencies. All activities are considered administrative for budgetary purposes; they include both in-house and cooperative interagency programs that consist of field and laboratory investigations and the preparation of reports, maps, and other publications describing the geology of the State. All printing and publication expenses are paid through a separate account independent of the administrative budget.

New additions to the staff this biennium are Sally L. Petersen - technical writer-editor, Dr. Roy M. Breckenridge - environmental problems analyst, William G. Wendell - oil and gas-stratigraphy, who replaced Dr. Donald Lane, Evan Groutage - draftsman, who replaced Miss Barbara Tomes, and Mrs. Starla M. Yekel, who replaced Mrs. Diane Beshara as a Clerk Steno. Three new positions have been requested for the 1975-77 biennium as shown on the Organizational Chart.

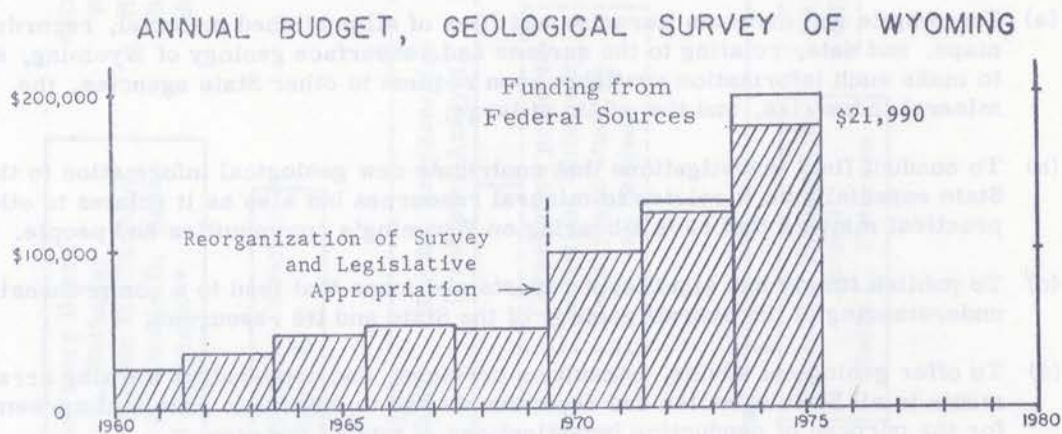
The location of the Survey on the University campus affords numerous advantages because of the close proximity of the Department of Geology, the U.S. Geological Survey, the U.S. Bureau of Mines, the Natural Resources Research Institute and ready access to other university facilities. Cooperative working arrangements with these organizations help to keep project costs and overhead expenses minimal.

Administrative Budget

During the biennium the Survey operated on an overall budget of \$450,747 which included \$29,000 in the publications account, and \$50,000 for architectural planning of the new Survey Building. Federally funded cooperative programs with the U.S. Geological Survey and U.S. Bureau of Mines amounting to \$43,980 are included in the total.

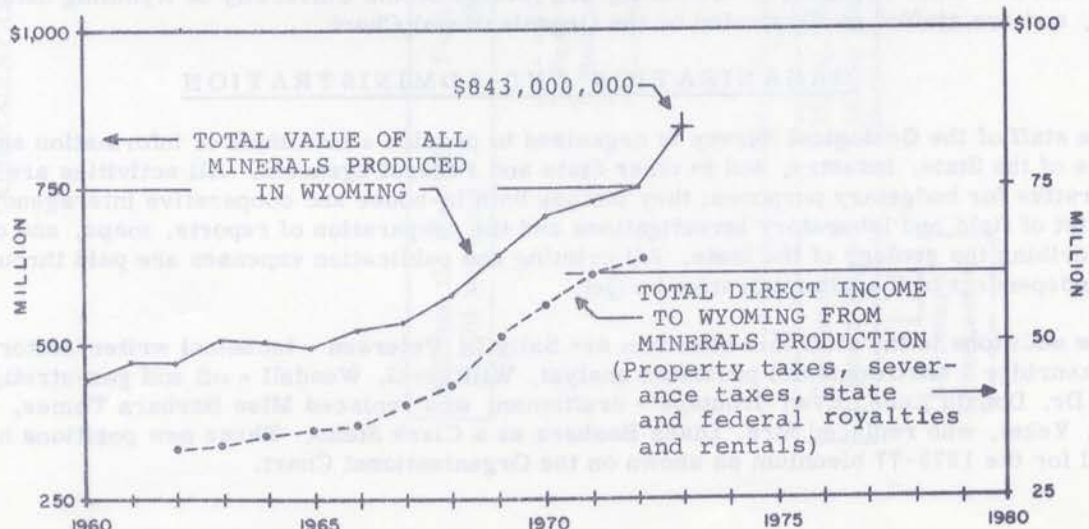
Of the total funds appropriated 60% was used for salaries and other related personal services, 16% went to contractual services, 9% for supplies, 2% for the purchase of new equipment, 11% for architectural planning, and 2% for non-operative expenses.

The following graph shows the budget on an annual basis compared to previous years.

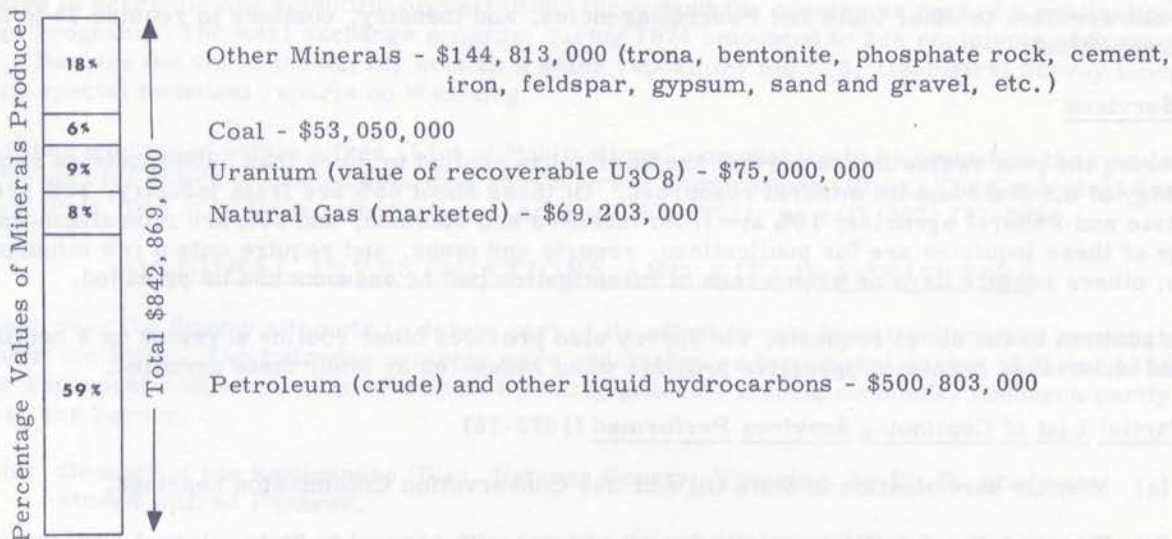


Wyoming's Mineral Development and Related Geological Activities

Wyoming's overall mineral production including oil and gas continues to increase and was conservatively estimated by the U.S. Bureau of Mines to have reached \$843,000,000 in 1973. The total direct income to Wyoming for the past year has not yet been calculated but should approximate \$75,000,000. A recent 1974 Legislative change in the severance tax to 3% will make a substantial difference in this last figure. As illustrated on the graphs below, the total value of minerals produced can be expected to reach one billion dollars somewhat sooner than had been anticipated in the last Biennial Report. It now appears, due to recent inflation in market price values, that the State's mineral production will reach the one billion dollar value mark between 1975 and 1976.



In terms of the value of the individual mineral commodity produced in Wyoming in 1973, the U.S. Bureau of Mines shows the following breakdown:



Of these commodities, oil and gas representing 67% of the total is by far the most significant. During 1973 the State produced 142 million barrels of oil and 384.5 billion cubic feet of gas. The pace of exploration in the Powder River and Green River Basins has increased substantially, directed primarily toward deeper objectives. Well-head prices on new oil have reached \$11.00 per barrel. Prices on natural gas have fluctuated widely but several contracts have offered 50 - 55¢ per thousand cubic feet. For the past few months there have been 100 to 110 active drilling rigs in the State. Substantial new reserves of oil and gas have been proven in and around Brady Field in south central Sweetwater County, and in the southern Powder River Basin.

Coal production continues to increase and the best estimate shows that 14.8 million tons were mined and marketed in 1973 which had a total value of \$57,876,000. Figures are not yet available for 1974, but Gary Glass estimates that 18.6 million tons were mined and that the overall value will be approximately \$74,000,000. By far the greatest amount of coal consumed in the State is in coal-fired, electrical generating plants. Wyoming is presently shipping more than 13 million tons of coal to 18 states in the north-western and mid-western parts of the nation. Although there has been much talk about the establishment of coal gasification plants in Wyoming, none of these has commenced thus far.

Uranium production based on Forrest Root's interpretation of AEC data, advanced to 10,700,000 pounds in 1973, and valued at approximately \$75,000,000. During 1973 approximately 8,308,000 feet of exploratory drilling was conducted in the State. Uranium production increased in 1974 and is expected to increase as much as 40% during the next two years.

Mineral exploration and development companies continue to be optimistic over future markets. During the last two years Reynolds Aluminum sold the bulk of their land, coal and water holdings near Buffalo to Texaco; and Carter announced plans for a large coal mine just north of Gillette. Alcoa has continued exploratory drilling associated with the anorthosite deposit in the Laramie Range and plans for a possible pilot plant. Both Exxon and Kerr McGee are planning development of underground uranium mines near the Highland surface operation in the southern Powder River Basin. In the western part of the State, Texas Gulf Sulphur is completing their new underground trona mine west of Rock Springs, and Kemmerer Coal Company is expanding its production. Amax continues to evaluate the copper prospect at Kirwin, southwest of Meeteetse, and a new bentonite processing mill has been completed near Worland.

During 1973 Wyoming ranked first among the states in the nation in terms of uranium, bentonite and soda ash production, fifth in terms of oil production, and ninth in terms of coal production.

## OPERATIONS AND ACTIVITIES

The overall operations of the Survey are divided into four parts: (a) Public Services, (b) Original Investigations and Field Activities, (c) Cooperative Projects, and (d) Publications. Inquiries from the public, and services to other State and Federal agencies, and industry, continue to require 75 to 80% of total Survey effort.

### Public Services

During the past twelve month period, the Survey has replied to more than 5300 inquiries regarding the geology of the State and its mineral resources. Of these about 65% are from industry, 15% are from other State and Federal agencies, 10% are from teachers and students, and 10% are miscellaneous. The majority of these inquiries are for publications, reports and maps, and require only a few minutes to process; others require days or even weeks of investigation before answers can be provided.

In addition to the above requests, the Survey also provides other routine services on a continuing basis and undertakes special cooperative projects when requested by other State agencies.

### Partial List of Continuing Services Performed (1973-75)

- (a) Monthly participation in State Oil and Gas Conservation Commission hearings.
- (b) Weekly tally of drilling activity for oil and gas with respect to State mineral ownership for the State Board of Land Commissioners.
- (c) Participation in Interstate Oil Compact Commission meetings.
- (d) Participation in Department of Interior's Oil Shale Environmental Advisory Committee.
- (e) Participation in the State Interdepartmental Water Conferenc.
- (f) Screening of applications for fossil removal permits for the State Board of Land Commissioners.
- (g) Formal talks, lectures and seminars for Wyoming's professional and civic groups.

### Special Services Provided for State and Federal Agencies (1973-75)

- (a) Investigation of Wyoming's coal and commercial grade ore deposits.
- (b) Guided field trips of the geology and mineral resources of the State.
- (c) Local site inspections.
- (d) Recommendations on the geology of ground water occurrences.
- (e) Preparation of new materials and drafting for the State Geologic Map in cooperation with the U. S. Geological Survey.

Because of the sustained interest in the general aspects of Wyoming's geology, the Survey publishes mimeographed material on minerals, rocks, fossils, etc., for free distribution on request to the schools and general public.

The following special material was also prepared and published during the past two years:

- (a) "Directory of Sources of Wyoming Geological Information".
- (b) "Mineral and Mining Laws of Wyoming" (Second Edition)
- (c) "Directory to Geological Consultants in Wyoming"



### Distribution of Technical Publications

Copies of all technical publications and maps are distributed free to all County libraries and to State agencies requesting them. They are available to the public for a nominal fee. Copies are also distributed to academic and scientific organizations throughout the country as part of a publications exchange program. The total exchange program during 1974 amounted to 246 recipients of Survey publications. Besides the above the Survey acts as a sales repository for U.S. Geological Survey topographic maps and special technical reports on Wyoming.

Anyone wishing to obtain a free "List of Publications", or wishing to be placed on the regular mailing list to receive notice of new publications should write: Publications Office, The Geological Survey of Wyoming, P.O. Box 3008 University Station, Laramie, WY 82071, or call (307) 742-2054.

### ORIGINAL INVESTIGATIONS AND FIELD ACTIVITIES

Each year the Survey attempts to devote part of its effort to new investigations and research that will benefit the State. The following projects were undertaken or terminated during 1973 and 1974 by the staff, or represent cooperative University of Wyoming graduate student or faculty research partly subsidized by the Survey.

- (a) Geology of the Rattlesnake Hills, Natrona County, Wyoming, by Ph.D. graduate student Alfred Pekarek.
- (b) Geologic mapping of the Kennaday Peak - Pennock Mountain areas, Carbon County, Wyoming, by M.S. graduate student Raymond Barton.
- (c) Completion and publication of Geologic Map Atlas and Summary of Mineral Resources: Sweetwater County, Wyoming.
- (d) Completion of laboratory research projects on jade and the mineralogy of uranium ores under the supervision of Professor John Howatson, Department of Chemistry, University of Wyoming.
- (e) Termination of groundwater, geophysical field research investigation with Professor Edward Quincy, Department of Electrical Engineering, University of Wyoming.
- (f) Completion of stratigraphic interpretation of the western Bridger Basin sediments by Ph.D. graduate student Claudia Wolfbauer.
- (g) Termination of radioactive mineral studies of ground and surface waters in the North Platte River drainage by Ph.D. student William R. Miller.
- (h) Termination of a structural and petrologic study of Precambrian rocks in the Laramie Range by M.S. graduate student Robert Blackstone.
- (i) Termination of geologic mapping on the western slope of the Teton Mountains by Professor Roger Hoggan, Department of Geology, Ricks College, Idaho.
- (j) Completion of inventory and mapping of Wyoming's caves by undergraduate students, Department of Geology, University of Wyoming.
- (k) Completion of stratigraphic studies of the Phosphoria and Goose Egg Formations by Donald W. Lane.
- (l) Synthesis of Wyoming's Precambrian rocks and evolution of potential resources by Forrest K. Root.

### COOPERATIVE PROJECTS

From time to time the Survey enters into cooperative working agreements with other State or Federal agencies on programs of mutual concern. The cooperative agreements minimize duplication of effort and maximize productivity. For the past several years the Survey has allocated \$1500 per year to the

U. S. Geological Survey for the technical services of Dr. J. David Love on the compilation of the Wyoming State Geologic Map which is presently nearing completion.

During the past biennium the Survey has been involved in four additional federally funded cooperative projects which amounted to \$43,980.

- (a) The U. S. Geological Survey - Coal drilling and evaluation program, northern Powder River Basin. (\$4,200)
- (b) The U. S. Bureau of Mines - Inventory of uranium mining and County Resource Series investigations. (\$15,000)
- (c) The U. S. Bureau of Mines - Statewide coal sampling and analysis program. (\$24,780)
- (d) The U. S. Bureau of Mines - Statewide inventory of iron, phosphate, chromium and asbestos ores. (final terms not yet determined)

Additional cooperative opportunities continue to become practical as the capability of the Survey's staff increases. When new equipment and laboratory facilities become available, hopefully by 1976 when the new Wyoming Geological Survey Building is completed, the Survey will be in a better position to participate in larger, longer-term programs.

#### PUBLICATIONS

The Survey, as authorized under amended section 9-264, 2, publishes timely technical reports, maps, booklets, tables, graphs, and charts, to whatever extent the budget allows. The publications account is self-sustaining and operates at no cost to the State. The items are sold at a small profit with all proceeds returned to the General Fund. During the 1973-75 biennium the Survey published the following material:

##### List of Recent Publications (1973-75)

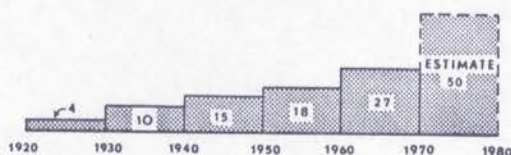
- CRS-2 Sweetwater County, Wyoming: Geologic Map Atlas and Summary of Economic Mineral Resources
- Bull. 54 Fossils of Wyoming (Second Edition)
- P. R. 12 The Phosphoria and Goose Egg Formations in Wyoming
- P. R. 13 Structural Geology of the Eastern Half of the Morgan Quadrangle, the Strouss Hill Quadrangle, and the James Lake Quadrangle, Albany and Carbon Counties, Wyoming
- Sp. Publ. Directory of Sources of Wyoming Geological Information
- Bull. 55 Traveler's Guide to Wyoming (Second Edition)
- Bull. 57 Bibliography of Wyoming Geology 1945-1949
- Bull. 58 Bibliography of Wyoming Coal
- R. I. 9 Analyses of Rock and Stream Sediment Samples, Teton Corridor and Contiguous Areas, Teton County, Northwestern Wyoming
- Sp. Publ. Mineral and Mining Laws of Wyoming (Second Edition, 1973)
- Sp. Publ. University of Wyoming theses list (updated)
- Sp. Publ. Bibliography of Graduate Theses and Dissertations on the Geology of Wyoming (updated)
- Sp. Publ. Publications List (revised and updated)
- R. I. 10 Applied Geology and Archaeology: The Holocene History of Wyoming

##### Other Publications in Progress

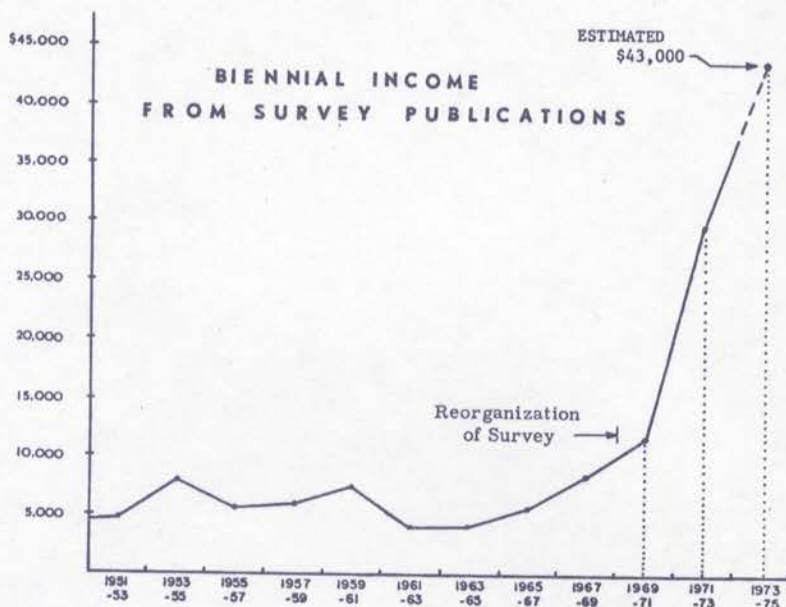
- Bull. 59 Caves of Wyoming
- P. R. 14 Geology of Silver Crown Mining District, Wyoming
- CRS-3 Campbell County, Wyoming: Geologic Map Atlas and Summary of Economic Mineral Resources
- R. I. 11 Structural Geology and Volcanic Petrology of the Rattlesnake Hills, Wyoming
- Sp. Publ. Style Book for the Wyoming Geological Survey Publications
- Sp. Publ. Energy Resources Map of Wyoming (Second Edition, 1974)

During this biennium the publication funds available for the Survey's use amounted to \$29,000. Income from the sale of publications during this same period amounted to approximately \$43,000. Since 1969, income to the State from the sale of geological publications has essentially quadrupled.

NUMBER OF SURVEY PROJECTS COMPLETED AND PUBLISHED PER DECADE



CONTENT OF SURVEY PUBLICATIONS (1911 TO 1974)



### CONCLUSIONS AND RECOMMENDATIONS

The pace of exploration and development by Wyoming's mineral industries continues to accelerate with substantial increases in both uranium and coal production expected during the next two years. The total direct income to Wyoming from mineral production (i. e. from property taxes, severance taxes, state and federal royalties and rentals) during 1974 will amount to approximately \$75,000,000. The total dollar value of Wyoming's mineral production is expected to reach one billion dollars between 1975 and 1976.

The two new staff positions, that of environmental problems analyst and technical writer-editor, have substantially increased the Survey's publication and service capability. Three additional positions have been requested for 1975-77 - a staff geologist to supervise the County Resource Series reports, a cartographic draftsman, and an additional secretary.

All architectural planning for the proposed new Wyoming Geological Survey Building addition has been completed, including working drawings, construction documents, and cost estimates. Final approval by the Legislature of construction appropriations has been recommended and will be considered by the Appropriations Committee in January 1975. The building is designed to provide much needed public service facilities, laboratories, and enlarged work space for the staff, along with space for new equipment and library and record files.

The Survey has also recommended to the Legislature, in the 1975-77 Biennium Budget Request, that the publications account be increased 63% (to \$46,000) to help offset inflationary increases in paper costs, to permit the purchase for resale of a larger sales stock of new USGS topographic maps, and to permit publication of additional maps and reports needed by the State.