THE GEOLOGICAL SURVEY OF WYOMING

Horace D. Thomas, State Geologist

BIENNIAL REPORT

OF THE STATE GEOLOGIST

1959 - 1961

Laramie, Wyoming

January, 1961

January 10, 1961

The Honorable Jack R. Gage
Acting Governor of the State of Wyoming
Cheyenne, Wyoming

Dear Governor Gage:

Pursuant to the requirements of Article 11, Section 9-252, Wyoming Compiled Statutes, 1957, the Biennial Report of the State Geologist for the years 1959-61 is herewith submitted.

Respectfully yours,

Horace D. Thomas

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State Geologist

HDT:dc

Biennial Report of the State Geologist

of the

State of Wyoming

for

1959 - 1961

by

Horace D. Thomas

INTRODUCTION

This report covers the activities and accomplishments of the Geological Survey of Wyoming during the two-year period 1959-61. The geological projects undertaken are briefly described, the various activities of the Survey are discussed, and the resulting publications are listed.

ORGANIZATION OF THE GEOLOGICAL SURVEY

The Geological Survey of Wyoming was created in 1933 and has been located at the University of Wyoming since that time. Of the 46 state geological surveys, over two-thirds are located at state universities or colleges, which suggests that most states recognize the advantages in affiliating the state geological survey with the department of geology at a state institution of higher learning.

Because of its university affiliation, it is possible for the Geological Survey of Wyoming to obtain the advice and part-time assistance of the seven geological specialists on the staff of the University Geology Department. The office of the Northern Rocky Mountains Branch of the U. S. Geological Survey is also located in Geology Hall and provides valuable assistance. Close collaboration is maintained with the University of Wyoming Natural Resources Research Institute, whose research is largely on the utilization of Wyoming mineral resources. The U. S. Bureau of Mines Laramie Petroleum Research Center is located nearby on the campus. The advice, suggestions, and assistance of engineers, chemists, physicists and other scientists on the campus are readily available.

In September, 1955, quarters in the new Geology Building on the campus were occupied. The Survey has three offices, a map and publication

distribution room, and a drafting and filing room. In addition, a large part of the basement is devoted to storage space for oil well samples and cores. Most important, the Survey benefits from the availability of the modern technical equipment installed by the Department of Geology, such as X-ray diffraction equipment, differential thermal analysis equipment, magnetic separators, ultrasonic devices, and other equipment used in rock and mineral identifications.

Dr. S. H. Knight, Professor of Geology, served as State Geologist and Director of the Geological Survey of Wyoming from 1933 to 1940. The incumbent, Dr. H. D. Thomas, has served since March, 1941. By virtue of action by the University Administration, the State Geologist has a reduced teaching load so that a share of his time may be devoted to the direction of the Geological Survey.

In 1951, for the first time, a full-time Assistant State Geologist was employed. Dr. William H. Wilson resigned from the U. S. Geological Survey to accept the appointment. Dr. Wilson is the holder of five university degrees in geology and engineering and is a specialist in economic geology, engineering geology, and ground water geology. The addition of Dr. Wilson to the staff aided immeasurably in broadening the program and services of the State Geological Survey.

A full-time secretary, Mrs. Dorothy Clark, is also employed. Her duties involve the maintenance of office records, the distribution of publications and maps, and administration of non-technical office matters.

Students majoring in geology or taking post-graduate work constitute a valuable store of geological talent and are employed on a part-time basis as summer field geologists, to serve as geological draftsmen, to maintain collections of samples from wells drilled for oil or water, and in many other ways.

COMPARISON WITH OTHER STATES

The Geological Survey of Wyoming does not receive as large an appropriation as those received by most other state geological surveys. At present, 46 states have geological surveys and that of Alaska is being organized. During 1959, the latest year for which figures are available, the 46 surveys had appropriations totaling over $6,300,000 for geological research, services, and administration, or an average of about $138,000 per survey. This contrasts with the $26,865 appropriated to the Geological Survey of Wyoming for that year.

Although Wyoming ranks 12th among the states in valuation of mineral products ($393,925,900 in 1959), the State ranks 41st among those appropri-

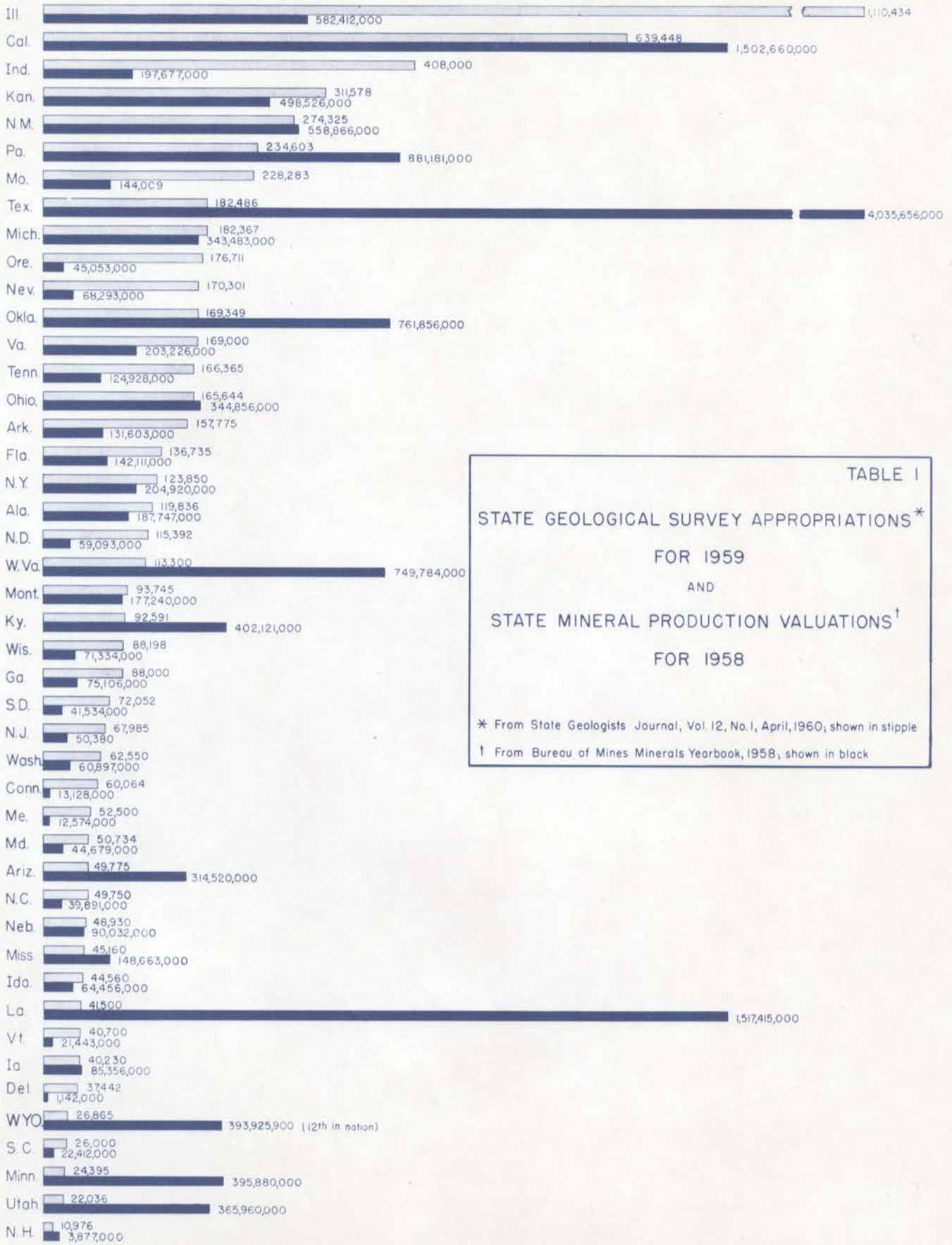

TABLE I

STATE GEOLOGICAL SURVEY APPROPRIATIONS* FOR 1959 AND STATE MINERAL PRODUCTION VALUATIONS† FOR 1958

* From State Geologists Journal, Vol. 12, No. 1, April, 1960; shown in stipple

† From Bureau of Mines Minerals Yearbook, 1958, shown in black

ating funds for state geological surveys. Table 1 shows the appropriations for the various state geological surveys in 1959 and the valuation of mineral production for each state in 1958. The Illinois Geological Survey receives over $1,000,000 per year; 20 other surveys receive between $600,000 and $100,000 per year, and 10 receive between $100,000 and $50,000 per year. Only South Carolina, Minnesota, Utah and New Hampshire appropriate less money than Wyoming does.

Many states having much smaller mineral production valuations appropriate a great deal more money for geological research than does Wyoming. Our neighbor, South Dakota, for instance, had a 1959 mineral production valuation of only $48,500,000 compared to Wyoming's $393,925,900, but the South Dakota Geological Survey's appropriation for 1959 was $104,250 compared to the Wyoming Geological Survey's appropriation of $26,865.

The average number of full-time permanent geologists employed by each of the 46 geological surveys during 1959 was 8.5. This compares with the 1.5 on the staff of the Geological Survey of Wyoming. Some of the geological staffs are surprisingly large: Illinois, 47; Michigan, 33; California, 32; Indiana, 26; Missouri and Pennsylvania, 15 each. Some of the geological surveys of other western states have fair-sized staffs: North Dakota and New Mexico, 8 each; Nebraska and Oregon, 6 each; South Dakota, Montana, and Washington, 5 each.

An example of an expanded, intensive program of geological investigations is that presently being undertaken in Kentucky. This project, according to a U.S.G.S. press release of November 21, 1960, will involve the geological mapping of the entire state within a 10-year period at a cost of $12,000,000. Half the funds will be supplied by the State of Kentucky; the other half will be matched by the U. S. Geological Survey. During the present fiscal year, $600,000 will be expended on the program; during the succeeding one, $1,200,000 will be spent. The Kentucky State Legislature has already appropriated funds sufficient to support the project through June 30, 1962.

Fortunately, Wyoming already has a fairly adequate geological map, prepared by the U. S. Geological Survey in cooperation with the Geological Survey of Wyoming and the University of Wyoming, which was issued in 1955. Vast areas remain to be mapped in greater detail, however.

NEED FOR AN EXPANDED PROGRAM BY THE GEOLOGICAL SURVEY OF WYOMING

It is obvious, then, that Wyoming is not as aggressive in obtaining geological data as are other states and probably suffers to some extent

thereby. Four fundamental reasons for an expanded program of geological studies are given below; there are numerous others.

First, Wyoming is not competing on an equal basis with other states in geological research on mineral resources. A more comprehensive understanding of the economic geology of Wyoming is needed for the possible attraction of industry to the State and the development of these resources. The value of geological studies in attracting industry to Wyoming is exemplified by the present developments of the Geneva Steel Company in the South Pass area. Although numerous state agencies have lent their aid to this development, the fact cannot be denied that the South Pass iron deposit first came to the attention of the Geneva Steel Company through a geological report issued jointly by the Geological Survey of Wyoming and the University of Wyoming Natural Resources Research Institute in 1949. Numerous other developments could be cited as having originated through previous geological studies.

Secondly, geological data are basic to the solution of Wyoming's water needs and usage. For instance, the development of ground water supplies cannot be attained without a proper understanding of the geology of the rocks in which the ground water occurs. Nor is it wise to construct a dam, large or small, unless geological studies indicate that the rocks at the damsite afford an adequate foundation for the structure and that geological conditions do not allow for subterranean leakage of water from the reservoir area. Geological studies provide knowledge regarding sources of construction materials: sand, gravel, and riprap for dams, bentonite for canal linings, and similar materials.

Thirdly, other State and municipal agencies are finding needs for more geological information and are seeking more and more data from us to help in the solution of problems in mineral availability, land classification, mineral leasing, foundation adequacy, road and highway construction and location, availability of water supplies, radioactive waste disposal, and even in game and fish culture.

Lastly, there is an increasing demand for geological information by rockhounds, tourists, and grade and high school pupils. Semi-technical guides to the geology of the State parks and the major mountain ranges should be prepared. Pamphlets dealing with localities where rocks, minerals, and fossils can be collected are needed. Requests from schools and individuals all over the country for Wyoming rock and mineral specimens are increasing daily.

There is only one way in which the needed geological information can be obtained, and that is through technical investigations made in the field

by competent geologists, and the only way geologists can operate effectively is under the supervision of experienced geologists -- not under the aegis of nontechnical agencies -- and with available laboratory and library facilities so necessary in modern geological studies.

If it appeared necessary for Wyoming to immediately acquire a vast amount of geological information, then a "crash program" like that of Kentucky could be initiated at a cost of millions of dollars. It seems most sensible, however, for us to proceed with our geological investigations in a program which involves only a modest appropriation, which lets us see where we are going, and which progresses at a moderate enough rate so that unnecessary effort is not expended in undesirable ways.

In summary, an expanded program of geological investigations by the Geological Survey of Wyoming seems necessary and desirable. To achieve this would involve an increased appropriation which would permit the employment of an additional full-time geologist and 10 more part-time summer field geologists.

ACTIVITIES OF THE GEOLOGICAL SURVEY

TECHNICAL INVESTIGATIONS

Absaroka Mountains

The study of the old Kirwin mining district in the southern Absaroka Mountains, Park County, which was begun in 1951 by Dr. W. H. Wilson, has been completed. The mapping project, as originally conceived, has been extended beyond the Kirwin district proper, however, and of a proposed total of approximately 600 square miles, more than 400 have already been mapped. The geology of the 300 square miles mapped prior to 1960 is described in a formal 122-page report, accompanied by a map, as follows:

Wilson, W. H., "Petrology of the Wood River area, southern Absaroka Mountains, Park County, Wyoming," Jan., 1960.

Approximately 100 square miles of additional mapping was completed by Dr. Wilson during the summer of 1960.

Largely as a result of this study, exploration for mineral deposits within the mapped area was initiated during the summer of 1960 by a major mining concern. The mapping which has been done serves as an excellent guide to intelligent exploration and will save time, effort, and money for the interested company. As a consequence, it is planned to include the molybdenum deposits on the South Fork of the Shoshone River in the State Geological Survey's mapping program for the forthcoming biennium.

A graduate student, Richard Dunrud, was given a $300 subsidy to assist him in the geological mapping of 50 square miles in the Jack Creek area in the Absaroka Mountains during the 1960 field season. A formal report and map will result and will be made available to the public when completed in early 1961.

Precambrian Project

The Precambrian project, involving the mapping of the crystalline cores of the major mountain ranges, was initiated in July, 1957. Because the Medicine Bow Mountains lend themselves exceptionally well to the beginning of a long-range project of this sort, most mapping has been done in that area. Some has been done in the Sierra Madre Mountains, west of Encampment, however.

To date, approximately 700 square miles have been mapped in detail by 12 graduate students at the University of Wyoming, under the direction of Dr. R. S. Houston, Associate Professor of Geology, on a scale of 600 feet to the inch, and it is anticipated that the Medicine Bow Mountains will have been completely mapped by 1962. A number of areas of economic interest have been studied during the regional mapping program, including pegmatite districts in the southern part of the mountains, vermiculite deposits along the western slope, copper-gold deposits in the Keystone area, copper-platinum deposits in the Centennial area, magnetite occurrences in the Lake Owens area, and copper deposits in the Ferris-Haggerty area of the Sierra Madre Mountains. A list of reports and accompanying maps which have recently been completed and are on open file is given below. Copies of the maps are available for public distribution.

Childers, M. O., "Geology of the French Creek area, Albany and Carbon counties, Wyoming", 1957. (Covers 49 sq. mi.)

Currey, D. R., "Geology of the Keystone area, Albany County, Wyoming", 1959. (Covers 43 sq. mi.)

Matus, Irwin, "Geology of the lower French Creek area, Carbon County, Wyoming", 1958. (Covers 28 sq. mi.)

Myers, W. G., "Geology of the Sixmile Gap area, Albany and Carbon counties, Wyoming", 1958. (Covers 18 sq. mi.)

Orback, C. J., "Geology of the Fox Creek area, Albany County, Wyoming", 1960. (Covers 19 sq. mi.)

Short, B. L., "Geologic and petrographic study of the Ferris-Haggerty mining area, Carbon County, Wyoming", 1958. (Covers 10 sq. mi.)

Wied, O. J., "Geology of the Encampment area, Carbon County, Wyoming", 1960. (Covers 36 sq. mi.)

All field work was completed on the following projects during the 1960 field season and formal reports and maps are presently being prepared:

McCallum, Malcolm, "Geology of the Centennial Ridge-Rambler area, Albany County, Wyoming". (Covers 110 sq. mi.)

Ruehr, Ben, "Geology of the Devils Gap area, Albany and Carbon counties, Wyoming". (Covers 26 sq. mi.)

King, James, "Geology of the Boswell Creek area, Albany County, Wyoming". (Covers 30 sq. mi.)

Stensrud, H., "Geologic and magnetic study of the Lake Owens mafic complex, Albany County, Wyoming". (Covers 20 sq. mi.)

Swetnam, Monte, "Geology of the Pelton Creek area, Carbon and Albany counties, Wyoming". (Covers 23 sq. mi.)

The following maps have been completed and are on open file for public consultation:

Houston, R. S., "Geologic map of the Medicine Bow Mountains, Wyoming", scale 2 in. = 1 mi.

Houston, R. S., "Geologic map of the Bennett Peak area, Carbon County, Wyoming", scale 1 in. = 600 ft.

Houston, R. S., "Miscellaneous mine maps of deposits in the Medicine Bow Mountains".

Some of the mineralized areas found during the course of mapping are believed to be of immediate economic interest. In order to make the information quickly available to the public, a new publication series, to be entitled "Preliminary Reports", will be started. These reports will contain summaries of the geology and economic possibilities and results of assays. They will include geologic maps. The first preliminary report is in press; others are being prepared, as follows:

Houston, R. S., "Geology of the Big Creek pegmatite area, Carbon County, Wyoming". (In press)

Currey, D. R., "The Keystone mining district, Albany County, Wyoming". (In preparation)

Stensrud, H., "Magnetite occurrences in the Lake Owens mafic complex, Albany County, Wyoming". (In preparation)

McCallum, Malcolm, "Mineral deposits of the Centennial Ridge district, Albany County, Wyoming". (In preparation)

The following papers are being prepared for publication in technical periodicals:

Houston, R. S., and McCallum, M., "The Mullen Creek - Nash Fork shear zone, Medicine Bow Mountains, Wyoming".

Houston, R. S., and Parker, R. B., "Refolding of lineation".

Board of Mines Projects

The Board of Mines supplied funds for field work by graduate students during the summers of 1958 and 1959 in areas in which mineral deposits are being developed or produced, or in areas in which there are chances for the commercial utilization of mineral resources.

During the summer of 1958, seven graduate geologists undertook field work, and the final reports were completed in 1959. These pertain to the potash-bearing rocks of the Leucite Hills, regional geology of the Shirley Basin, regional geology of the Crooks Gap-Muddy Gap area, and oil shale in the Green River area.

Formal reports placed on open file for public inspection are:

Deardorff, D. L., "Stratigraphy and oil shales of the Green River formation southwest of the Rock Springs Uplift, Wyoming". (Gives stratigraphic sections and data on oil shales over a 234 sq. mi. area)

Johnston, R. H., "Geology of the northern Leucite Hills, Sweetwater County, Wyoming". (Covers 45 sq. mi.)

Riedl, Gary, "Geology of eastern portion of Shirley Basin, Albany and Carbon counties, Wyoming". (Covers 84 sq. mi.)

Riva, Joseph, "Geology of the Sheep Creek - Middle Cottonwood Creek area, Fremont County, Wyoming". (Covers 53 sq. mi.)

Shipp, B. G., "Geology of an area east of Bates Hole, Carbon and Albany counties, Wyoming". (Covers 85 sq. mi.)

Smithson, Scott B., "Geology of the southeastern Leucite Hills, Sweetwater County, Wyoming". (Covers 63 sq. mi.)

During the 1959 field season, investigations were made by three graduate geologists in three areas having economic potentialities: uranium and natural gas in the Baggs area, petroleum in the Lost Soldier area, and oil shale in the valley of the Green River. Formal reports which have been placed on open file for public inspection were completed during 1960, as follows:

Good, Loren, "Geology of the Baggs area, Carbon County, Wyoming". (Covers 150 sq. mi.)

Guyton, J. W., "Geology of the Lost Soldier area, Carbon County, Wyoming". (Covers 80 sq. mi.)

Millice, Roy, "Stratigraphy of the Green River formation in the southeastern Bridger Basin, Wyoming". (Nine stratigraphic sections were measured and sampled for oil shales within a 216-sq. mi. area.)

Engineering Geology

During the past few years 25 individual examinations of damsites have been made for the Natural Resource Board. The sites investigated are located in 14 counties. Such studies are made to determine whether or not the foundation is adequate for the dam and whether or not there might be water leakage around or under the dam.

Engineering geological studies were also made of highway tunnels and of public building sites in several municipalities.

Mineral Inventory

As a long-range program, the Geological Survey has been compiling factual and reliable information on the known mineral deposits of the State. As a result, Bulletin No. 50, "Mineral Resources of Wyoming", was published in 1959. In addition, Report of Investigations No. 7, "Radioactive Mineral Deposits of Wyoming", was printed in 1960.

In addition to those mineral deposits studied under the Precambrian project, field examinations were made during the biennium of a clay deposit in Sweetwater County, pumicite in Big Horn and Sweetwater counties, marble in Platte County, sandstone in Goshen County, iron in Fremont County, and uranium in Big Horn County.

Ground Water

Helpful advice was given to many individuals, principally ranchmen, on the possibilities of obtaining water on their lands and on the drilling depths to possible aquifers. In addition, the Geological Survey participated in a conference with city officials of Sundance in regard to the establishment of a program of exploration designed to augment the municipal water supply.

Mineral Identification Service

The Geological Survey maintains a free mineral identification service designed to be of value to prospectors, amateur rock collectors, and the general public. If the submitted specimens appear to have possible economic importance, they are turned over to the Natural Resources Research Institute for assay or analysis. Several potentially important mineral deposits in the State have been brought to light through this service in the past.

Since the University of Wyoming Natural Resources Research Institute no longer has a mineralogist on its staff, all mineral specimens received by that agency are turned over to the Geological Survey. This has greatly increased the amount of time spent in mineral identification.

COOPERATION WITH THE U. S. GEOLOGICAL SURVEY

Informal cooperation is carried on with all branches of the U. S. Geological Survey. The State Geologist has brought to the attention of the U. S. Geological Survey certain geological problems needing attention, and the Federal Survey has taken action on them. Conversely, the Federal Survey keeps us informed on the independent projects it is carrying on in Wyoming. This complete cooperation lends effectiveness and efficiency to the geological work carried on by both agencies in the State and prevents overlap or duplication of effort.

In 1960, the U. S. Geological Survey was independently carrying on 35 specific geological projects in Wyoming, according to the Chief Geologist. These include regional geology (11 projects), mineral deposits (7 projects), stratigraphy and paleontology (11 projects), geochemistry (5 projects), and petroleum geology (1 project).

Formal cooperation on a fund-matching basis with the U. S. Geological Survey has been carried on in Wyoming since 1941. In the past, projects have been undertaken on phosphate rock, titaniferous magnetite, anorthosite, cordierite, and regional geology.

A project on the titanium-bearing Cretaceous black sands which was begun in 1954 is nearing completion by publication. The manuscript has

been reviewed and is now being revised by the authors. It is hoped that this comprehensive bulletin will be issued before the end of the biennium.

A project on Upper Cretaceous facies relationships, started in September, 1957, has not yet been completed, and a project on the general geology of the Wind River Basin, begun during the biennium, is still continuing.

Cooperation without fund matching is maintained with the Office of the Northern Rocky Mountains Branch located in the Geology Building at the University. Dr. W. R. Keefer is supervising geologist, Dr. J. D. Love is research geologist, and Laura McGrew, J. A. Van Lieu, and Toni Dana are geologists. A secretary completes the staff. Since the establishment of this office on the campus in November, 1943, 36 maps, charts and bulletins have been issued as federal documents prepared in cooperation with the Geological Survey of Wyoming and the Department of Geology, University of Wyoming. Seven State publications have originated through this cooperative program.

COOPERATION WITH OTHER FEDERAL AGENCIES

U. S. Bureau of Mines. In 1953, the State Geological Survey entered into a formal agreement with the U. S. Bureau of Mines for the annual collection of basic data on Wyoming mineral production. Each year a pamphlet is issued, titled "The Mineral Industry of Wyoming", which contains data on mineral production and valuation as well as discussions of new developments. Close, but informal, cooperation is carried on in other ways. Deposits of certain minerals which need core drilling, or other subsurface development, have been brought to the attention of the Bureau of Mines and, if warranted, that agency has carried on subsurface exploratory work. There has been a free interchange of information between the State Geological Survey and the Bureau of Mines. The Petroleum Research Center, located on the campus, has been especially helpful to the State Geological Survey.

U. S. Coast and Geodetic Survey. Since 1941 the State Geologist has served as Collaborator in Seismology and has collected reports on earthquakes felt in Wyoming. A fine seismograph has now been installed in the Geology Building by the Geology Department, and reports on the earthquakes registered are forwarded daily to the Coast and Geodetic Survey. Average frequency of quakes recorded is two per day. Few of these have their epicenters in Wyoming; other parts of the world are much more active seismically. The station here has also participated in the study and detection of waves created by atomic blasts.

Other Agencies. The State Geological Survey is called upon to supply geological information to many other Federal agencies, such as the Soil

Conservation Service, the Grazing Service, the Reclamation Bureau, the Department of Commerce, and others. Data have been supplied to Congressional Committees and to other Federal groups or committees.

COOPERATION WITH UNIVERSITY AGENCIES

Department of Geology. The intimate interrelationship of the Geological Survey and the Department of Geology has been pointed out earlier in this report. It should be pointed out further, however, that the field research undertaken by graduate students is of great value to the Geological Survey. These results are made available to us early. Many of the resulting theses have been published by the Geological Survey. In turn, the Geological Survey has assisted students in defraying field expenses on projects in which the Survey is interested, or by supplying thin sections or polished surfaces.

The graduate students constitute a valuable store of part-time assistance for the Survey. They have been employed to catalog oil well samples, plot oil well logs, draft geological maps and illustrations, and to undertake other assignments. The students, in turn, receive useful experience in applied geology. If it were not for the high-quality part-time help available through the employment of graduate students, the full-time staff would have to be considerably larger.

Although the State Geological Survey underwrote the thesis work of a few graduate students during the biennium, dozens of other graduate students undertook research on the geology of Wyoming at their own expense, the investigations serving as part of the requirements for advanced degrees. The results of all these investigations are immediately available to the Survey.

Natural Resources Research Institute. The Natural Resources Research Institute was established to carry on scientific research on the utilization of the natural resources of the State. The Geological Survey and the Natural Resources Research Institute work in close cooperation, and the State Geologist is a member of the executive committee of the Institute. The Geological Survey may bring to the attention of the Institute any mineral deposits whose quality or uses might be determined through laboratory investigations. In turn, the Institute supplies the State Geological Survey with needed analytical information on mineral specimens submitted as an aid in determining the potentialities of certain deposits.

COOPERATION WITH STATE DEPARTMENTS

Natural Resource Board. The State Geological Survey stands ready to cooperate with the Natural Resource Board in any possible manner on the mineral resources of the State or in engineering or ground water problems

on which geology has a bearing. The Geological Survey has supplied data on mineral deposits, made examinations of potential damsites, conferred on ground water problems, and participated in public conferences held over the State on natural resources. In turn, the Natural Resource Board paid most of the cost of compiling and printing Geological Survey of Wyoming Bulletin 50, "Mineral Resources of Wyoming".

Commissioner of Public Lands. Prior to the issuance of permits for the collection of fossils in Wyoming, which are obtained from the State Commissioner of Public Lands, the endorsement of the State Geologist is necessary. The Geological Survey also has been called upon to offer opinions on mineral associations in respect to State mineral leases. These are strictly geological matters, and each one appears to constitute an individual problem. In addition, the Geological Survey advised on and materially contributed to the revision of State mineral leases.

During the biennium three field examinations were made of mineral deposits on State lands; a rare earth deposit in Crook County, uranium deposits in Goshen County, and a bentonite deposit in Weston County.

State Highway Department. From time to time the Geological Survey is asked to collaborate on problems in engineering geology which confront the Highway Department.

State Game and Fish Commission. Through the years the Geological Survey has assisted the Game and Fish Commission, principally on problems of water supply for hatchery use or in dam site investigations.

Oil and Gas Conservation Commission. The State Geologist, by law, is a member of the Oil and Gas Conservation Commission.

OIL WELL SAMPLE LIBRARY

The Geological Survey has in its oil well sample library the most important collection of Wyoming oil well samples in the Rocky Mountain region. The collection has been accumulated through the collaboration of oil companies operating in Wyoming who have donated samples and cores with the belief that they will be properly cataloged, cared for, and preserved for the future at the University. The library contains sets of samples from over 1,000 wells representing over five million feet, or more than 5,000 miles of drilled hole. Students have worked part time in cataloging and storing the sets of samples and cores.

PUBLIC EDUCATION

Wyoming Industrial Rock and Mineral Sets. Sets of 16 important Wyoming rocks and minerals have been prepared in special compartmented boxes. Composition, properties, uses, and occurrences are given inside the lid. These sets are available to Wyoming secondary schools for instructional purposes. A simplified brochure on Wyoming mineral resources has been prepared for use in conjunction with the sets of specimens. In order to fill the many requests received from out-of-state teachers, school children, and other interested persons for specimens of Wyoming rocks or minerals, special sets of two specimens have been prepared, and 300 or more of these have been distributed during the biennium.

Tourist Information. Many tourists planning to visit Wyoming are amateur mineralogists who, prior to their visits, ask for information on the occurrence of mineral specimens in the State. A pamphlet on rock and mineral localities has been prepared to fill such requests, but a more comprehensive illustrated one is needed. There is need, also, for a similar one pertaining to common Wyoming fossils. Geologic guides to State parks and major mountain ranges should be prepared.

PUBLIC SERVICES

Office Callers. Almost every day representatives of oil and mining companies or other individuals interested in mineral resources call at the Geological Survey offices. One of the most effective points in handling these callers is that here in one building such persons may take advantage of advice and information available from the staffs of the State Geological Survey, the U. S. Geological Survey and the Department of Geology of the University. In addition, it is possible for such persons to confer also with other agencies located on the campus, such as the Bureau of Mines Petroleum Research Center, the Natural Resources Research Institute, the Engineering College, or other departments.

Correspondence. A large volume of inquiries seeking information on Wyoming mineral resources, petroleum geology, and geology in general is received daily by the office. Properly answering this mail constitutes an imposing chore which becomes more burdensome each year.

Topographic Sheets. The Geological Survey carries a supply of the topographic maps covering Wyoming. These are useful to hunters, fishermen, campers, prospectors, ranchmen, tourists, and others, and many hundreds of copies are distributed each year.

Air Photos. The entire State has aerial photographic coverage, but because of the cost of such photos it has been impossible to purchase more

than a fraction of all the available ones. It is hoped that by adding to the air-photo library from time to time, it will eventually be possible to obtain complete coverage. These photographs are very useful to anyone seeking information on surface features, or the geology, of specific areas.

PUBLICATIONS, MAPS AND REPORTS

Geological examinations have little value unless the accumulated information is made available to the public. Every effort has been made, within limited resources, to publish printed reports on the results of projects of major magnitude. About 300 copies of each publication are deposited in libraries in the United States and foreign countries. Other copies are distributed to individuals, corporations, agencies, and others on request.

Unpublished reports are placed on open file for public examination and photocopies are available to interested parties. Copies of more comprehensive unpublished reports are placed in the Geology Library where they may be consulted or borrowed.

Copies of unpublished regional geological maps made by 142 graduate students at the University as part of the requirements for advanced degrees are available to the public through the Geological Survey. Over the years thousands of these maps have been distributed, principally to oil companies.

Along with increased activity in petroleum and uranium exploration in Wyoming, there has been increased demand for our publications. Many of the earlier ones are now out of print and no longer available for distribution.

Printed Documents. The following documents were published during the years 1959 and 1960:

"Structure and petrology of the northern Bighorn Mountains, Wyoming", Geol. Survey Wyo. Bull. No. 48; 47 pp., 5 figs, 8 pls.

"Mineral Resources of Wyoming", Geol. Survey Wyo. Bull. No. 50, by F. W. Osterwald, D. B. Osterwald, J. S. Long, Jr., and William H. Wilson; 259 pp., 4 figs. (Published in cooperation with the Wyoming Natural Resource Board).

"Radioactive mineral deposits of Wyoming", Geol. Survey Wyo. Rept. Invest. No. 7, by William H. Wilson; 41 pp., 1 fig.

Papers Published in Periodicals. The following papers were published in technical periodicals during 1960:

"Misuse of 'Bioclastic limestone' ", Bull. Amer. Assn. Petrol. Geol., Vol 44, No. 11, Nov., 1960, pp. 1833-34, by Horace D. Thomas.

"Correlation of the Permian formations of North America", Bull. Geol. Soc. America, Vol. 71, No. 12, Dec. 1960, pp. 1763-1806; 2 figs., 1 pl.; prepared by Permian Subcommittee of National Research Council Committee on Stratigraphy; Wyoming part by Horace D. Thomas.

Paper in Press. The following paper has been completed, edited, and is currently being printed:

"The Big Creek pegmatite area, Carbon County, Wyoming", Geol. Survey Wyo. Prelim. Rept. No. 1, text and 2 pls., by R. S. Houston.

Paper in Manuscript Form. The manuscript of the following paper has been revised and approved for publication by the Director, U. S. Geological Survey. Publication has been delayed because of editorial work carried on in Washington. The field and laboratory studies on which this report is based were jointly financed by the Geological Survey of Wyoming and the U.S. Geological Survey.

"Titanium-bearing black sandstone deposits of Wyoming", Geol. Survey Wyo. Bull. No. 49, by R. S. Houston and John Murphy.

U. S. Bureau of Mines Cooperative Publications. The following reports were published by the Bureau of Mines in cooperation with the Geological Survey of Wyoming:

"The mineral industry of Wyoming, 1958", preprint, Bureau of Mines Mineral Yearbook, 1957 (1959).

"The mineral industry of Wyoming, 1959,"Bureau of Mines Area Report D-113 (1959). This will be followed by a more comprehensive report similar to that above in the near future.

TECHNICAL MEETINGS AND LECTURES

In order to keep abreast of new geological or technological developments, the State Geologist or the Assistant State Geologist attended, or will attend, the following regional or national meetings:

Wyoming Mining Association, Riverton, 1959;
Geological Society of America, Rocky Mtn. Section, Missoula, 1959;
National Western Mining Congress, Denver, 1959, 1960;
Geological Society of America, National Meeting, Denver, 1960;

American Association of Petroleum Geologists, National Meeting, Denver, April, 1961;
Geological Society of America, Rocky Mtn. Section, Laramie, May, 1961.

The following technical lectures or addresses were given, or will be given, during the biennium:

H. D. Thomas, "Geological Mapping in Wyoming", Wyoming Mining Assn., Riverton, 1959;
W. H. Wilson, "Radioactive minerals in Wyoming", Wyoming Engineering Society, Laramie, 1959;
H. D. Thomas, "Geological history and structure of Wyoming", Stanford University, San Diego State College, San Jose State College, May, 1960;
J. D. Love, P. O. McGrew, H. D. Thomas, "Relationship of latest Cretaceous and Tertiary deposition to oil and gas occurrences in Wyoming". To be presented at National Meeting of American Association of Petroleum Geologists, Denver, April, 1961;
H. D. Thomas, "Geological history and structure of Wyoming". To be presented at Mines Day, Colorado School of Mines, May, 1961.

EPILOGUE

In conclusion, it might be pointed out that the State Geologist will finish his 20th year of office on March 1, 1961, having served under Governors Smith, Hunt, Crane, Barrett, Rogers, Simpson, Hickey, and Gage. The 20 years of service to the State have been pleasant ones. Although there have been times when it appeared that little progress was being made, it is apparent today that our knowledge of Wyoming geology is infinitely better than it was in 1941. This increased knowledge is the result of the combined efforts of all the geologists who have worked in the State -- State and Federal survey geologists, staff members and students from this and many other universities, and oil and mining geologists. There remains much to be learned, however.

This, then, seems to be an appropriate time to thank my co-workers, my colleagues in the Geology Department, and a multitude of former students, for their great assistance. President Humphrey has served as a member of the Advisory Board of the State Geological Survey for more than 15 years, and his willing aid and support, his wise counsel, and his cheerful encouragement are deeply appreciated.

Respectfully submitted,

Horace D. Thomas

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