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ACTIVITIES OF GEOLOGICAL SURVEY OF WYOMING

BY

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LONG RANGE PROGRAM

annual--next section

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LONG RANGE PROGRAM OF THE WYOMING GEOLOGICAL SURVEY

Over the years there has been a marked evolution in the search for valuable rocks and minerals. Early prospecting in Wyoming was essentially restricted to seeking deposits of gold and silver and of the base metals. It has become apparent, however, that the mineral wealth of Wyoming, other than the mineral fuels and iron, lies mainly in the nonmetallic substances. The search for and the evaluation of nonmetallic deposits is quite different from that of the early prospector with his gold pan, and must be carried on by technical personnel if the search is to be fruitful. A long-ranged plan for geological work involves the following factors (1) detailed mapping of individual deposits of known commodities (2) detailed areal geological mapping and petrographic studies as a method of discovery of new deposits, (3) basic geological studies (4) subsurface water investigations (5) paleontological investigations.

Detailed mapping of individual deposits of known minerals. In order to obtain an accurate inventory of the known mineral resources of Wyoming, the State Geological Survey has carried on a program of detailed mapping of individual deposits. The work has been essentially completed for certain rocks and minerals, such as vermiculite; others have been fairly well covered, such as saline lake deposits, chromite, and asbestos. During 1945 and 1946 detailed mapping was done on deposits of bentonite, talc, anorthosite, titaniferous magnetite, cordierite, tungsten and copper. To complete the detailed mapping of bentonite deposits alone in the State will involve many man-hours of field work. To cover all the other commodities in detail will take many years.

Exploration for new deposits through areal geological mapping. There remain in Wyoming tens of thousands of square miles which have never been subjected to detailed geological mapping. These regions comprise the Tertiary basins, which are potential oil and gas producing areas, and the cores of the major mountain ranges, which may contain valuable deposits of metallic and nonmetallic minerals. The oil companies, as individual enterprises, are now concerned with the mapping of the Tertiary basins in the search for new oil fields. The State Geological Survey has started a program of regional mapping of the mountain areas which will take many years to complete. As a result of this recently innaugurated program one mineral deposit, the largest of its sort known in the world, which was previously not known to exist and which may have important economic possibilities, was discovered in 1946. Such programs of detailed mapping of igneous and metamorphic rocks in the field must be followed up with petrographic studies in the laboratory and the work must be carried on by skilled personnel.

Basic geological studies. Basic studies in regional geology and in areas of sedimentary rocks and in stratigraphy serve as a foundation for the understanding of the occurrence of mineral fuels, nonmetallic deposits, underground water and construction materials. Such studies have constituted and important part of the State Geological Survey program since 1933. Approximately 30 studies of this sort have been made by graduate students at the University in the past 10 years. The resulting maps have been made available to the public and have proved useful in many ways, but large areas remain which have not been mapped adequately on the present mapping standards.

Subsurface water investigations. Water is precious in Wyoming and investigations on its development and conservation are important. Soon after

the establishment of the Geological Survey at the University it entered into the program of drought relief and during the drought years of 1933 and 1934 did yeoman service in locating water wells, studying dam sites and in other ways during the crisis. Since that time studies have been made of sub-surface water supplies of specific areas, and geological guidance has been given during the drilling of many water wells, but no coordinated program of ground water studies have ever been possible.

Paleontological investigations. Wyoming has a world-wide reputation for its wealth of fossils and all the larger museums in this and other countries have representative collections of Wyoming fossils. After many years, the University has set aside funds to be used in the collecting and preparation of Wyoming fossils and Dr. Paul O. McGrew has been appointed to carry on the work. The State Geological Survey will cooperate in this program to the extent of assisting with the collection of fossil remains in the field and in making these collections a part of the University geological museum.

TECHNICAL ACTIVITIES OF THE GEOLOGICAL SURVEY OF WYOMING, 1945 - 1946

PETROLEUM GEOLOGY

Druing 1945 and 1946 the State Geological Survey continued to offer services in petroleum exploration by making available to individuals and companies maps and charts valuable in petroleum exploration, by consultation with petroleum geologists on technical problems pertinent to exploration, by actively collaborating with the Wyoming Geological Society, an affiliate of the American Association of Petroleum Geologists Geologists, and in other general ways. Specific projects are described in the following paragraphs.

Cooperation with Fuels Section of U. S. Geological Survey. During 1945 and 1946 the U. S. Geological Survey maintained an office in the quarters of the State Geological Survey. This office, under the supervision of Dr. J. D. Love, is in charge of petroleum investigations carried on in Wyoming by Fuels Section of the U. S. Geological Survey. The State Geological Survey has made its facilities available to the Federal Geological Survey and when called upon has assisted in the general program in every way possible. As a result of this series of investigations, the U. S. Geological Survey has issued maps and charts carrying a notation to the effect that they were prepared with the cooperation of the Geological Survey of Wyoming. These maps and charts are of great value in petroleum exploration in Wyoming.

Oil well core and sample repository. Cores and cuttings from deep wells are frequently the only tangible return for the expenditure of hundreds of thousands of dollars spent as drilling costs. These cores and samples, however, are of great value in future exploration and the State Geological Survey has established a repository where they may be kept in orderly arrangement and be available for study by petroleum geologists. Various oil companies in the State have contributed cuttings and cores and at present there are over 100 sets of samples from representative deep wells scattered over the State and the Rocky mountain area. These represent a total drilled interval of over 387,000 feet, or about 77 miles. The collection is housed in a room especially fitted with storage shelves. Tables, microscopes and other equipment are available for those wishing to make sample studies.

Vanadium in Wyoming crude oils. In order to determine something of the history of migration of Wyoming Paleozoic crude oils, a study was undertaken of the vanadium content of representative crudes. The University Natural

Resources Research Institute has completed analyses of 33 Wyoming crudes and the vanadium pentoxide content was found to range from a trace to as much as 23 parts per million. These results will be subjected to geological interpretation and published for general distribution.

NONMETALLIC MINERALS

Anorthosite. Anorthosite was first brought to the attention of industry as a potential source of alumina by Dr. Hagner, Assistant State Geologist, and as a result a commercial plant is in the process of erection. The anorthosite area of the Laramie Mountains was mapped during the summer of 1945 by Dr. Hagner and Dr. Walter Newhouse, Professor of Economic Geology at Chicago University, as cooperative work between the State and Federal Geological Surveys. The anorthosite occurs over an area 30 miles long in a north-south direction and is 10 to 18 miles wide. Mapping was done on aerial photographs. Anorthosite is an igneous rock composed mainly of the mineral labradorite, a soda-lime feldspar. The highest grade rock carries over 30% alumina. On the basis of petrographic features the anorthosite was divided into mappable units whose regional extent will be depicted on the resulting map. In addition to the economic aspects of the anorthosite body, valuable fundamental information was obtained on the nature of anorthosite segregations.

Phosphate rock. During 1945 and 1946 a cooperative project was undertaken with the U. S. Geological Survey to obtain data on the thickness, grade, extent and economic aspects of the phosphate rock deposits in the Lander area, Fremont County. During 1945 the study was restricted to the area between Baldwin Creek, on the northwest, and Little Popo Agie River, on the southwest, along the northeast flank of the Wind River Mountains, over a distance of about

15 miles. At each end of the area a trench was dug completely across the Phosphoria formation, about 285 feet thick, to establish the number and position of the phosphate zones. Two zones warranted further exploration.

Trenches were then dug across the two zones at points well distributed along the outcrop to obtain samples and to determine thicknesses. Samples were analyzed by the University of Wyoming Natural Resources Research Institute and by the Tennessee Valley Authority. Nine trenches were dug in the upper phosphate zone showing a range in thickness of from 3 to 8 feet. The rock is low-grade and carries from 30 per cent to 50 per cent bone phosphate of lime. Twelve trenches were dug in the lower phosphate zone showing the thickness to range from 11 inches at the northwest to almost 4 feet at the southeast. This bed is medium-grade and contains from 50 per cent to 70 per cent bone phosphate of lime.

Because of the southward thickening of the lower phosphate bed, during 1946 additional trenches were dug at scattered points over the area 4 miles south of Little Popo Agie River but the southernmost trench showed but 3 feet of phosphate rock. On the basis of bone phosphate of lime content and thickness of the bed, an area of about 1,000 acres was selected for detailed mapping. About 600 acres is underlain by phosphate rock of the lower bed and probably contains a reserve of over 6,000,000 tons of phosphate rock. The results of this study will be published in 1947.

Bentonite. During 1945 detailed geological and topographic mapping was carried on in Natrona County on bentonite deposits in the vicinity of Casper. Detailed maps were made of deposits in five different areas. Tonnage reserves were estimated. Three other areas were studied in reconnaissance. Microscopic and x-ray diffraction studies were made of the bentonite to determine the

mineralogical and compositional features. Physical tests of the bentonite were made by the University of Wyoming Natural Resources Research Institute which demonstrated that the bentonites studied are generally low in colloidal content if contrasted with Black Hills bentonite but that the bonding properties are comparable. The results of this investigation are given in Geological Survey of Wyoming Bulletin 37.

Talc. During 1945 and 1946 geological studies of talc deposits in Platte County were carried on. Preliminary studies of the talc deposits in the vicinity of the Big Chief mica mine were undertaken by A. F. Hagner in 1945. In 1946 detailed mapping was undertaken by Frank W. Osterwald, a graduate student at the University. The Big Chief talc body was mapped in detail with plane table and alidade and a surrounding area of about 9 square miles was mapped on aerial photographs. During the regional mapping several more talc bodies of varying size and quality were discovered. The largest of these is about 1⅓ miles long and one-third of a mile wide. Laboratory work is now in progress to determine the physical nature of the talc and the possibilities of commercial utilization.

Jade. During 1945 and 1946, preliminary studies were made on the jade occurrences in the Sweetwater River area. Additional field work is necessary to determine the nature of the known deposits in situ and such information may prove useful in the location of new deposits. A mimeographed circular describing the types of jade and their occurrence has been issued.

METALLIC MINERALS

Titaniferous magnetite. The State Geological Survey, in cooperation with the U. S. Geological Survey, has completed a detailed study of the titaniferous magnetites of the Laramie Mountains. Geological guidance was given the Bureau of Mines in their core drilling program to block out the reserves. A report on the geology of the deposits will be published as a State Geological Survey Bulletin. Two Bureau of Mines reports appeared during 1946: "Exploration of the Shanton iron-ore property ", U. S. Bureau of Mines Report of Investigations 3918, August, 1946, and "Exploration of Iron Mountain Titaniferous magnetite deposits", U. S. Bureau of Mines Report of Investigations 3968, November, 1946.

Iron Mountain has for many years been thought of as an almost inexhaustible deposit of titaniferous magnetite but as a result of the geological and exploratory work the estimate of the available tonnage was greatly reduced and the deposit appears to consist of only one-tenth as much ore as had previously been calculated, yet the reserve is sufficient to warrant mining if processing methods are worked out.

Tungsten and copper. Detailed geological mapping of a tungsten-copper deposit in the Laramie Range was undertaken during the summer of 1946 by M. L. Troyer, a graduate student at the University. About one-half a square mile was mapped in detail with plane table and alidade and the surrounding area of about 3 square miles was mapped on aerial photographs.

REGIONAL GEOLOGY

Laramie Range. A study of the pre-Cambrian geology of the Laramie Range was undertaken during the field seasons of 1945 and 1946 by A. F. Hagner, representing the State Geological Survey, and W. H. Newhouse, representing the U. S. Geological Survey. The study was started in the Laramie Mountains, since the key to the complete understanding of the pre-Cambrian history of Wyoming can be determined there more advantageously than elsewhere in the State. New fundamental concepts have been discovered concerning the nature of igneous and metamorphic rocks which are applicable to all other areas of pre-Cambrian rocks in the State. During the course of the mapping, deposits of minerals with probable economic value which were previously unknown were brought to light, ~~notably the cordierite deposits.~~ With the background of understanding derived from this study, similar work can be undertaken elsewhere in the State.

Reshaw Hills, Platte County. The Reshaw Hills area, Platte County, was mapped during the 1946 field season by John Lynn, a graduate student at the University. Mapping was done on aerial photographs and covered approximately 20 square miles, principally in T. 22 N., R. 69 W. New information was obtained on the geological structure of the area and on stratigraphy. The data are pertinent to petroleum exploration in Platte County and information was obtained on the occurrence of construction materials, limestone, and subsurface water supplies.

Horse Creek area, Laramie County. The geology of the east flank of the Laramie Mountains was mapped during the field season of 1946 by Loren Gray, graduate student at the University. Mapping was done on aerial photographs

and covered the area from Horse Creek south to Federal. Besides the new information on the geological structure of the area, data were obtained on the occurrence of construction materials, limestone, and subsurface water supplies.

WATER SUPPLY

Ranchester municipal water supply. At the request of the town of Ranchester, an investigation of subsurface water supplies was made during the field season of 1946. The work was on a cooperative basis with the U. S. Geological Survey and a report has been issued on the possibilities of the development of subsurface water for municipal use.

Glendo municipal water supply. A cooperative study of the subsurface water supply in the Glendo area was undertaken by the State and Federal geological surveys during the summer of 1946, the study having been requested by town officials. At the year's end the report had been completed and had been submitted to Washington for approval of release

MINERAL IDENTIFICATION SERVICE

The free service of mineral identification started during the war has been continued. The composition and possible commercial value of mineral samples submitted are determined and if further qualitative or quantitative data seem warranted, specimens are turned over to the University Natural Resources Research Institute for assay or analysis.

BIBLIOGRAPHY OF GEOLOGICAL LITERATURE

Because of the apparent need for a bibliography of the geological literature bearing on Wyoming, and at the further request of the Wyoming Geological Association, representing various oil companies, a project has been underway for two years involving the compilation of a bibliography of geological literature on Wyoming covering the period from 1918 to 1945. The work has been done by M. L. Troyer, a graduate student in geology at the University, and the first draft of the manuscript has been completed. The report will be published in 1947.

COOPERATION WITH OTHER AGENCIES

University of Wyoming Natural Resources Research Institute. The work of the State Geological Survey is tied in closely with that of the University of Wyoming Natural Resources Research Institute. The Institute furnishes the State Geological Survey with qualitative and quantitative data to supplement the geological data obtained in the field mapping program of the Survey. Deposits which have been mapped by the survey are brought to the attention of the Institute so that tests may be made on the possibilities of commercial exploitation. In the general program of development of Wyoming mineral resources, it is the role of the State Geological Survey to locate deposits, to determine their size and estimate reserves, and to obtain data on their origin and mode of occurrence and on possible mining operations. The N.R.R.I. may then determine the grade of the rocks, minerals or ores, the uses to which they may be put, and investigates means of treating or beneficiating. The need for close cooperation is apparent.

U. S. Geological Survey. The State Geological Survey assists the U. S. Geological Survey in both general and specific ways. Close cooperation exists between the two agencies. The opinion of the State Geologist is solicited as to the areas which seem most deserving of early attention and the field programs are so arranged as to not overlap and bring about duplication of effort. Specific projects involving matching of funds on a dollar-for-dollar basis have been established. These have dealt with phosphate rock, anorthosite, titaniferous magnetite and ground water studies. Consultation and exchange of information goes on constantly in connection with the work being carried on in Wyoming by the Federal Geological Survey on petroleum investigations and on the mineral resources of the Missouri River Basin. Numerous publications of the U. S. Geological Survey were prepared in cooperation with the State Geological Survey and a forthcoming publication of the State Geological Survey will be based on data obtained on the stratigraphy of central Wyoming by the U. S. Geological Survey. These publications are listed later in this report.

U. S. Bureau of Mines. Close cooperation has been maintained with the U. S. Bureau of Mines. The State Geological Survey has at times served as field consultants on projects undertaken in the State by the Bureau of Mines. The advice of the State Geological Survey is sought by the Bureau of Mines on rocks, minerals and ores which are worthy of the attention of the Bureau in making metallurgical tests, beneficiation tests, and others. The State Survey is cooperating with the Bureau of Mines in its studies leading to the utilization of power developed in the Missouri River Basin in Wyoming in the possible commercial treatment of rocks, ores and minerals.

Other federal agencies. The State Geological Survey has been called upon to furnish data on Wyoming mineral resources to the U. S. Army Engineers, the Reclamation Service and others interested in the development of the Missouri River Basin. Geological cross-sections through the Green River Basin were compiled for the National Park Service.

U. S. Coast and Geodetic Survey. The State Geologist has served since 1941 as collaborator in seismology for the U. S. Coast and Geodetic Survey. Through arrangements with various state and federal agencies in Wyoming, data are received on the occurrence of earthquakes. These records are turned over to the U. S. Coast and Geodetic Survey and are valuable in determining insurance rates which are concerned with earthquake damage, in the construction of large structure, such as dams and tunnels, and in other ways.

State agencies. The State Geological Survey has been called upon to supply geological data to numerous state agencies, such as the Board of Land Commissioners, the Game and Fish Commission, the Department of Commerce and Industry, the Planning and Water Conservation Board, and others. Expert witnesses have been supplied in law suits involving mineral resources in which the State is concerned.

PUBLICATIONS

The following publications were issued by the State Geological Survey during the period 1945-1946:

"Geology of the northwestern Wind River Mountains, Wyoming", Geological Survey of Wyoming Bulletin 35, 1946.

"Some rocks and soils of high selenium content", Geological Survey of Wyoming Bulletin 36, 1946.

"Geology of bentonite deposits near Casper, Natrona County, Wyoming", Geological Survey of Wyoming Bulletin 37, 1946.

"Late Paleozoic and early Mesozoic stratigraphy of the Uinta Mountains", Contribution, Geological Survey of Wyoming, 1946.

"Wyoming jade", Geological Survey of Wyoming Information Circular, (mimeographed).

Manuscripts have been completed and arrangements are being made for the printing of the following papers:

"Stratigraphic sections of Mesozoic rocks in central Wyoming", Geological Survey of Wyoming Bulletin 48 (Published in cooperation with U. S. Geological Survey).

"Bibliography of Wyoming geology, 1918-1945", Geological Survey of Wyoming Bulletin 49.

The following publications, issued by the U. S. Geological during 1945 and 1946, were prepared with the cooperation of the Geological Survey of Wyoming and carry a notation to that effect :

"Map of Wyoming showing test wells for oil and gas, anticlinal axes and oil and gas fields", U. S. Geological Oil and Gas Investigations, Preliminary Map 19, 1945.

"Geologic and structure contour map of the Sage Creek dome, Fremont County, Wyoming", U. S. Geological Survey Oil and Gas Investigations. Preliminary Map 53, 1946.

"Geology of the Bargee area, Fremont County, Wyoming", U. S. Geological Survey Oil and Gas Investigations, Preliminary Map 56, 1946.

"Stratigraphic sections and thickness maps of Lower Cretaceous and nonmarine Jurassic rocks of Central Wyoming", U. S. Geological Survey Oil and Gas Investigations, Preliminary Chart 13, 1945.

"Stratigraphic sections and Thickness maps of Jurassic rocks in Central Wyoming", U. S. Geological Survey Oil and Gas Investigations, Preliminary Chart 14, 1945.

"Stratigraphic sections and thickness maps of Triassic rocks in Central Wyoming", U. S. Geological Survey Oil and Gas Investigations, Preliminary Chart 22, 1946.

"Tertiary stratigraphy in northeastern part of Wind River Basin, Wyoming", U. S. Geological Survey Oil and Gas Investigations, Preliminary Chart 22, 1946.

"Construction materials and nonmetallic mineral resources of Wyoming", U. S. Geological Survey Missouri Basin Studies No. 9, 1946.

Individual papers descriptive of Wyoming mineral resources and industries were published in the 1945 and 1946 Yearbooks of the Colorado mining Association, in the Bulletin of the Association of American State Geologists, and in various Wyoming newspapers.