

THE GEOLOGICAL SURVEY OF WYOMING

Horace D. Thomas, State Geologist

BIENNIAL REPORT OF THE STATE GEOLOGIST

for the years

1947-1948

Laramie, Wyoming
January, 1949

January 10, 1949

To His Excellency
The Honorable A. G. Crane
Acting Governor of the State of Wyoming
Cheyenne, Wyoming

Dear Sir:

Pursuant to the requirements of Article 12, Section 18-1204, Wyoming Compiled Statutes, 1945, the Biennial Report of the State Geologist for the years 1947-1948 is herewith submitted.

Respectfully yours,

Horace D. Thomas
State Geologist

HDT:mm

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STATE OF WYOMING

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by

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State Geologist

INTRODUCTION

This report covers the activities and accomplishments of the Geological Survey of Wyoming during the two-year period, 1947 and 1948. The Geological projects undertaken by the Survey are briefly described, the various activities of the Survey are discussed, and the resulting publications are listed. In addition, suggestions are made toward the establishment of a more effective program of geological investigations dealing with Wyoming mineral resources.

ORGANIZATION OF THE GEOLOGICAL SURVEY

All but three States have Geological Surveys. Many are located at state universities or colleges and are generally affiliated in some fashion with the department of geology. During 1947, the last year for which complete figures are available, the 45 State Geological Surveys employed 321 full-time geologists and had a sum of \$2,855,692 available for geological work during the year (Fig. 1).

The Geological Survey of Wyoming has been located at the University of Wyoming since 1933. Dr. S.H. Knight, Professor of Geology, served as State Geologist from 1933 to 1940. The incumbent, Dr. H.D. Thomas, Professor of Geology, has served since April, 1941. During the war years, the State Geologist and the Assistant State Geologist, Dr. A.F. Hagner, Associate

Professor of Geology, were allowed by the University administration to devote essentially full-time to the activities of the State Geological Survey. With the return of students after the war, it was necessary for them to devote their required time to teaching.

The State Geologist, by virtue of action of the University administration, carries a half-time teaching load and devotes the other half of his time to the Geological Survey. Since September, 1947, when Dr. Hagner left the University, the State Geologist has been forced to carry on the work of the Survey alone, except for part-time student help and during summers when part-time field geologists were employed.

The general organization of the Geological Survey, its location at the University and its affiliation with the Department of Geology are sound. Because of its location at the University, it is possible to obtain the advice and part-time assistance of the 7 geologists on the staff of the University Geology Department. In addition, close cooperation may be maintained with the University of Wyoming Natural Resources Research Institute, whose work is devoted to research on the utilization of Wyoming mineral resources. The Wyoming office of the Geological Branch of the U.S. Geological Survey is located in Geology Hall, and close cooperation may be had with that agency. The U.S. Bureau of Mines Petroleum Experiment Station and Oil Shale Laboratory is located nearby on the Campus. The advice, suggestions and assistance of chemists, physicists, engineers, and other scientists on the Campus are readily obtainable. The laboratories and library facilities on the Campus are valuable aids in carrying on the work of the Geological Survey.

The belief that the placing of the State Geological Survey at the University was a wise move is reiterated. The situation is mutually beneficial to the Geological Survey and the University. The Geological Survey benefits from the arrangement in that it is able to utilize the

services or the facilities of the Geology Department, the other science departments, the Natural Resources Research Institute, the U.S. Geological Survey and the Bureau of Mines, all of which are located on the Campus. In turn, the University gains the use of the physical equipment of the Geological Survey, staff members of the Geology Department are given the opportunity to do research, and many students are employed on part-time technical jobs. It appears that a Geological Survey administered by a faculty member of the Geology Department of the University, but adequately staffed by non-teaching geologists, is a most effective manner of organization. To improve the service to the State, it is only necessary to enlarge the staff of the Geological Survey to the point where the numerous geological problems needing attention can be efficiently and effectively handled.

COOPERATION WITH THE U.S. GEOLOGICAL SURVEY

Formal cooperative agreements with the U.S. Geological Survey for the undertaking of geological investigations in Wyoming have been carried on since 1941. State and Federal funds are matched in equal amounts on specific projects. These agreements have enabled the State to obtain Geological work for half the cost, and to take advantage of the highly skilled personnel of the U.S. Geological Survey. Projects have been carried on dealing with phosphate rock, titaniferous magnetite, anorthosite, cordierite, regional geology, ground water supply, and the examination of individual mineral deposits. The results of completed projects have been published either by the State Geological Survey or by the U.S. Geological Survey.

Formal cooperation is maintained with the Fuels Section of the U.S. Geological Survey, which office is located in the same building with the State Geological Survey. The Fuels Section is concerned solely with the petroleum geology and resources of Wyoming. As a result of this program,

9 maps or charts have been published by the U.S. Geological Survey and 2 bulletins by the State Geological Survey.

Cooperative projects on the geology of underground water have been established with the Ground Water Branch of the U.S. Geological Survey. Reports on two completed projects have been issued. As a result of cooperation with the U.S. Geological Survey Engineering Geology Section, the Federal government has issued two maps and the State has issued one map on natural construction materials in Wyoming.

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.

COOPERATION WITH OTHER FEDERAL AGENCIES

U.S. Bureau of Mines.- Close, but informal, cooperation is carried on with the U.S. Bureau of Mines. Deposits of certain minerals which need core-drilling, or other subsurface development in order to accurately determine potentialities, 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 inter-change of information between the State Geological Survey and the Bureau of Mines.

U.S. Coast and Geodetic Survey.- The State Geologist supplies the Seismological Field Survey of the Coast and Geodetic Survey with data on the occurrence of earthquakes in Wyoming. Earthquake report cards are distributed to forest rangers, postmasters, and others over the State. These report cards are returned to the State Geologist with information

regarding earthquake occurrences. The assembled data are then sent to the Seismological Field Survey

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 other Federal groups or committees.

COOPERATION WITH STATE AGENCIES

University of Wyoming Natural Resources Research Institute.- The Natural Resources Research Institute was established to carry on scientific research on the utilization of the mineral resources of the State. The State 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 brings to the attention of the Institute any mineral deposits whose quality or uses may 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.

Other State agencies.- The State Geological Survey has supplied geological information to various State agencies, or has undertaken geological investigations for them. For instance, at the request of the State Game and Fish Commission, geological studies were made which lead to the development of an adequate water supply for the Como Bluffs Hatchery. Geological studies for the State Board of Charities and Reform led to the concentration of hot waters at the Saratoga hot springs.

ACTIVITIES OF THE GEOLOGICAL SURVEY

GEOLOGICAL INVESTIGATIONS

Wind River Mountain phosphate deposits.- The State and Federal cooperative project on phosphate rock near Lander continued through the summers of 1945 and 1946. Ralph King, of the U.S. Geological Survey completed the final report and maps in June, 1947. The project has now been completed and the final results published as Geological Survey of Wyoming Bulletin 39.

Laramie Range.- The State and Federal Geological Surveys have carried on a cooperative study of the geology of the Laramie Mountains since 1944. During the summers of 1947 and 1948, Dr. W.H. Newhouse, representing the U.S. Geological Survey, supervised the continuation of the project. The study has involved the titaniferous magnetite deposits and the anorthosite deposits (alumina rock), as well as regional geology. The results will be published by the State Geological Survey. A part of the work, that involving the largest known deposit of a mineral called cordierite, which has possible ceramic value, has been completed and the results are in manuscript form for publication by the State Geological Survey. As a result of this work, the Laramie Range bids fair to become one of the classical geological localities in the world, for new fundamental concepts dealing with the origin of igneous and metamorphic rocks are being formulated on the basis of the exceptionally fine rock exposures of the area.

Allanite in the southern Big Horn Mountains.- A mineral specimen submitted to the State Geological Survey for identification in the spring of 1948 proved to be allanite, a thorium-bearing mineral which is of interest as a radioactive material. During the summer, the deposit was mapped for the State Geological Survey by Professor Robert Russell and Mr. George DeVore, and a radioactivity survey was made with a Geiger counter. On the basis of the preliminary survey, it was estimated that

the deposit contains 4,700,000 tons of ore ranging between 0.1% and 0.5% allanite. It was inferred that another 5,000,000 tons of ore may be present as lateral extensions, or of extensions at depth, of the exposed ore bodies.

The completed report was sent to the U.S. Geological Survey and considered by the Trace Elements Office of that agency, which coordinates the geological work on radioactive deposits with the Atomic Energy Commission. As a result, further collaboration is planned whereby additional studies will be made of the deposit, with the U.S. Geological Survey supplying a specialist in the quantitative appraisal of radioactive raw materials by radiometric measurements. Detailed analyses of the ore will be made.

Tertiary stratigraphy and paleontology of the Platte Valley.- During the summers of 1947 and 1948, the State Geological Survey carried on a study of the stratigraphy and paleontology of the North Park formation of the Platte Valley. The project was under the direction of Dr. P.O. McGrew, Assistant Professor of Geology. The age of the North Park formation, its areal distribution, and its structure had never been adequately determined. A reconnaissance map covering approximately 500 square miles was made, and shows the regional occurrence and structure of rocks of Miocene and Pliocene age. Dr. McGrew was successful in locating fossil camels, rhinocerases, three-toes horses, antelopes, mastodons and other fossils which definitely date the time of deposition of the formation. The results of the work will be published by the State Geological Survey and will be valuable to oil companies and others interested in the regional geology of the area.

Vermiculite.- During the summer of 1948, Professor Robert Russell and Mr. George DeVore undertook an examination of the vermiculite properties in the Encampment area (1) to determine if workings made since earlier

studies had opened up to observation any facts bearing on the origin of the vermiculite, and (2) to give mine owners the benefit of any geological advice derived therefrom.

Geology of the Esterbrook area.- During part of the summer of 1947, Dr. D.L. Blackstone, Associate Professor of Geology, undertook geological mapping for the State Geological Survey in the Esterbrook area, in southern Converse County. The results of this work will be incorporated in the revised geological map of Wyoming now being prepared.

Individual mineral deposits.- Mr. Frank Osterwald, Instructor in Geology, carried on an investigation of miscellaneous mineral deposits for the State Geological Survey during the summer of 1947. Mr. Osterwald studied and made reports on lead-zinc deposits in the Encampment area, pumice in the Leucite Hills, and a titaniferous magnetite deposit in the Laramie Range.

Regional geological mapping.- Great areas in Wyoming remain unmapped geologically, or inadequately mapped according to present mapping standards. For 15 years, the State Geological Survey and the Department of Geology at the University have collaborated in the geological mapping of strategic areas. This work has been done by graduate students in geology preparing theses for the Master's degree. In the past, all or part of the field expenses of such investigations were borne by the Geological Survey. At present, because of the large numbers undertaking such work, the Geological Survey has assisted mainly by supplying field and laboratory equipment or transportation facilities.

The resulting maps find many uses. Although the maps have not been printed, hundreds of blueprint copies have been distributed upon request to exploring oil companies. The maps have also proved useful in ground water studies, in engineering geological studies, or in other problems demanding regional geological control. These maps, too, will be

incorporated in the revised geological map of Wyoming now being prepared.

During the summer of 1948, 13 graduate students in geology mapped approximately 970 square miles in geologically complicated area widely scattered over the State. The completed maps will be made available to the Geological Survey for distribution to interested agencies and persons.

Newcastle water supply.- A cooperative study of the Newcastle water supply was undertaken at the request of town officials. The field survey was conducted by Mr. Charles Williams, of the U.S. Geological Survey.

Gillette water supply.- At the request of town officials, a preliminary survey of the subsurface water possibilities near Gillette was inaugurated. Acting in cooperation, the preliminary survey was conducted by Mr. Robert Littleton, of the U.S. Geological Survey.

PUBLICATIONS

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

Geological Survey of Wyoming Bulletins.- The following State Geological Survey publications were issued during the period 1947-1948:

Bulletin 36, "Some rocks and soils of high selenium content", by O.A. Beath, A.F. Hagner and C.S. Gilbert.

Bulletin 37, "Geology of bentonite deposits near Casper, Natrona County, Wyoming", by Gabriel Dengo.

Bulletin 38, "Stratigraphic sections of Mesozoic rocks in central Wyoming", by J.D. Love, et al.

Bulletin 39, "Phosphate deposits near Lander, Wyoming", Ralph H. King.

Bulletin 40, "Stratigraphic sections of Jurassic and Cretaceous rocks in the Jackson Hole area, Northwestern Wyoming", by J.D. Love, et al.

One project has been completed and the results are in manuscript form, to be published in the near future, as follows:

"Cordierite deposits of the Laramie Range, Wyoming", by A.F. Hagner and W.H. Newhouse.

Cooperative publications of U.S.G.S. Fuels Section.- Since the beginning of cooperative work with the Fuels Section of the U.S. Geological Survey, 9 maps and charts have been published. Those issued in 1947-1948 are as follows:

"Tertiary stratigraphy of the Jackson Hole area, Wyoming", U.S.G.S. Oil and Gas Investigations Chart 27, 1947

"Geology of the Boysen area, central Wyoming", U.S.G.S. Oil and Gas Investigations Preliminary Map 91 (2 sheets), 1948

Mineral resources map of Wyoming.- As a result of cooperation with the U.S. Geological Survey on the mineral resources of the Missouri River Basin, four maps have been published. The first, issued in 1946, shows the distribution of sand and gravel deposits in Wyoming. Three were issued in 1947-1948, as follows:

"Map of Goshen County, Wyoming, showing possible commercial deposits of sand and gravel", Geological Survey of Wyoming Map, 1947

"Construction materials and nonmetallic mineral resources of Wyoming", U.S.G.S. Missouri Basin Studies No. 9, 1946 (Issued in 1947)

"Metallic mineral deposits of Wyoming", U.S.G.S. Missouri Basin Studies No. 15, 1948

Cooperative water supply reports.- The following reports on water supply, prepared under State and Federal cooperative agreements, have been placed on open file:

"Geology and ground water resources of the Ranchester area, Sheridan County, Wyoming", by Donald A. Warner.

"Geology and ground water resources of the Glendo area, Platte County, Wyoming", by Donald A. Warner.

"Geology and ground water resources of the Newcastle area, Weston County, Wyoming", by Charles Williams.

Coal Resources map.- The following map, which was not printed but is available in blueprint form, was prepared in cooperation with the

University of Wyoming Natural Resources Research Institute:

"Wyoming Coal Resources", 1948, (Map shows coal basins, types of coal, estimated reserves and stream flows).

Publications in technical or trade journals.- The following papers were published in technical or trade journals during the period 1947-1948:

"Wyoming Mineral Industries", 1947 Mining Yearbook, Colo. Mining Assn., 1947, by H.D. Thomas

"Summary of Paleozoic Stratigraphy of the Wind River Basin, Wyoming", Guidebook, 3d Annual Field Conference Wyoming Geological Assn., 1948, pp. 79-95, by H.D. Thomas

"Geology and Petroleum Resources of Wyoming", The Petroleum Engineer, 1948, pp. 128-138, by H.D. Thomas

"Wyoming Mineral Industries", 1948 Mining Yearbook, Colo. Mining Assn., 1948

REVISED GEOLOGICAL MAP OF WYOMING

The latest geological map of Wyoming was issued by the U.S. Geological Survey in 1925. This map is no longer available and in the 23 years since its publication much new information has been obtained. The compilation of a new revised map is in progress. The actual compilation is being undertaken by the U.S. Geological Survey, but the State Geological Survey is actively participating by furnishing geological data to be included on the map. The printed map will probably not be available before 1950.

UNPUBLISHED GEOLOGICAL MAPS

Approximately 40 geological maps of areas scattered over Wyoming, with a combined total of several thousand square miles of coverage, have been made available to the public through the dissemination of blueprint copies. In addition, geological maps of 16 counties have been made available by the distribution of blueprint copies. Approximately 600 copies of these maps have been distributed during the past two years, mainly to oil companies and petroleum geologists.

TECHNICAL PAPERS PRESENTED

The following papers were presented by the State Geologist during 1947 and 1948:

"Regional stratigraphy and structure of Wyoming", National meeting of Petroleum Geologists, Denver, April, 1948.

"Wyoming Petroleum Developments", Annual Meeting Wyoming Engineering Society, Casper, February, 1948.

"Problems in Stratigraphy of the Wind River Basin, Wyoming", Third Annual Field Conference Wyoming Geological Society, Lander, August 1948.

NATIONAL COMMITTEES

The State Geologist has served as Rocky Mountain and Great Plains chairman of the Paleozoic Committee of the American Association of Petroleum Geologists for 6 years and as a member of the Geologic Names and Correlations Committee of the same organization for 8 years. He also serves as Rocky Mountain representative on the Permian Stratigraphy Subcommittee of the National Research Council.

SENATE COMMITTEE HEARING

In February, 1948, the State Geologist testified on Wyoming mineral resources before the National Resources Economic Subcommittee of the Committee on Public Lands of the United State Senate at a hearing in Denver.

EARTHQUAKE REPORTS

Reports on earthquakes in Wyoming are made to the Seismological Field Survey of the U.S. Coast and Geodetic Survey by the State Geologist, who serves as Collaborator in Seismology. During the years 1947 and 1948, reports were received on earthquakes as follows:

<u>Date</u>	<u>Area affected</u>
April 14, 1947	Limited area south of Douglas, Wyoming (No damage).
October 31, 1947	Yellowstone Park (No damage).
November 23, 1947	Northwestern Wyoming; felt at Moran, Basin, Greybull, Moose, Lovell, Wilson, Jackson, Pitchfork, Painter, and Yellowstone Park (No damage)
February 3, 1948	Northwestern Wyoming; felt at Kelly, Jackson, Moose, Bondurant, Morgan, Wilson, Elk and Yellowstone Park (No damage)

<u>Date</u>	<u>Area affected</u>
October 2, 1948	Southeastern Wyoming; felt at Holmes, Saratoga, Encampment, Centennial, Laramie (No damage).
November 9, 1948	Old Faithful, Yellowstone Park (No damage).
November 10, 1948	Old Faithful, Yellowstone Park (No damage).

Data on earthquake frequency are of value in the determination of equitable earthquake insurance rates and in connection with the erection of large structures such as dams, and of underground structures such as tunnels. The State is apparently quite stable seismically. Most earthquakes are reported from Yellowstone Park and adjacent areas.

OIL WELL SAMPLE REPOSITORY

The State Geological Survey has in its oil well sample repository the largest representative collection of Wyoming oil well samples in the Rocky Mountain region. The collection has been accumulated through the cooperation of oil companies operating in Wyoming, who have donated the samples with the belief that they will be properly cataloged, cared for and preserved for the future at the University. The collection represents about 200 deep wells scattered over the State and comprises nearly 2,000 storage boxes each containing about 100 samples. The approximate total drilled footage represented is nearly a million feet. The collection is under the supervision of a student in geology who works part-time in placing the samples in envelopes, arranging the envelopes in special storage boxes, and in cataloging the sample sets. Microscopes and work tables are available for geologists wishing to examine samples.

MINERAL IDENTIFICATION SERVICE

The Geological Survey carries on an identification service whereby rocks, minerals and fossils are identified for the public. It is estimated that about 1,000 specimens have been identified during the past two years.

If the material appears to have possible commercial value and further testing is desirable, the specimens are turned over to the Natural Resources Research Institute for assay or analysis.

OFFICE CALLERS AND CORRESPONDENCE

It is estimated that 500 persons interested in Wyoming mineral resources have called at the offices of the Geological Survey during the past two years. These persons comprise prospectors, representatives of oil and mining companies, representatives of concerns seeking raw materials, representatives of Federal agencies, and others interested in obtaining factual technical data on the mineral resources of Wyoming.

The office receives a great volume of mail from all over the nation requesting information on mineral resources. It is estimated that 4,000 inquiries have been answered in the past two years. In order to answer these inquiries effectively, it is necessary to call upon a broad background of knowledge regarding the geology and mineral deposits of the State. In this connection, the specialists on the staff of the Geology Department in the various fields of rocks, minerals, ores, petroleum, ground water, engineering geology, and other phases of the science, have been of inestimable help in supplying precise technical information.

GEOLOGICAL AND MINING MEETINGS

The State Geologist is called upon to participate in all geological field conferences held in the State. Each year the petroleum geologists hold a field conference in some part of Wyoming and during 1947 and 1948 the State Geologist served as one of the leaders on the field excursions and contributed to the guidebook. He has attended meetings of the American Association of Petroleum Geologists, of the Colorado Mining Association, of the Wyoming Engineering Society, and others. He has given talks on the mineral resources of Wyoming before luncheon clubs, scientific societies, and other groups.

Inspections were made of the following mines and processing plants in the State:

1. Westvaco Chlorine Products Company; trona mine and plant at Westvaco, Sweetwater County.
2. San Francisco Chemical Company; phosphate mine near Sage, Lincoln County.
3. Carissa gold mine; South Pass district, Fremont County.
4. Soil Sulphate Distributing Company; gypsum-sulphur mine and plant, Thermopolis, Hot Springs County.
5. Gypsum Products, Inc.; gypsum mine and plant, Cody, Park County.
6. Black Hills Bentonite Company; bentonite processing plant, Moorcroft, Crook County.
7. Baroid Sales Division, National Lead Company; bentonite processing plant, Osage, Weston County.
8. Wyo-Dak Chemical Company; bentonite processing plant, Upton, Weston County.
9. Burlington Railroad; rock quarry, Guernsey, Platte County.
10. Tobin Quarries; rock quarry, Guernsey, Platte County.
11. Colorado Fuel and Iron Company; iron mine, Sunrise, Platte County.
12. Great Western Sugar Company; limestone mine, Horse Creek, Laramie County.
13. Wyoming Feldspar Company; feldspar quarry, Laramie Range, Laramie County.
14. Monolith Portland Midwest Company; cement rock quarry, limestone quarry and cement plant, Laramie, Albany County.
15. Beaver Hill Vermiculite property; vermiculite pit, Encampment district, Carbon County.
16. Mikolite Company; vermiculite pit, Encampment district, Carbon County.
17. Paine Vermiculite property; vermiculite mine, Encampment district, Carbon County.
18. Golden Clover gold mine; Encampment district, Carbon County.

NEEDS FOR IMPROVEMENT OF SERVICES AND ENLARGEMENT OF PROGRAM OF INVESTIGATIONS

In respect to its status as a mineral producing State, Wyoming is not appropriating as much money for geological investigations as other states of less importance in mineral production. The average biennial appropriation for each of the State Geological Surveys is \$152,000 each (Fig. 1). Over \$3,000,000 was available for all the State Geological Surveys last year. Only four states appropriate less money than Wyoming; Maine, New Hampshire, Rhode Island and Vermont, none having mineral resources or mineral production comparable to Wyoming. If Wyoming is to carry on a program of geological investigations on mineral resources similar to those of other states, a larger appropriation is necessary.

The Geological Survey of Wyoming has never had an appropriation large enough to employ a full-time staff member and continue to carry on the already established program. The average number of full-time geologists employed by each of the State Geological Surveys is 9 men. Illinois has 51, California and Missouri each have 20, and 9 other states each have more than 10 full-time geologists.

The organization of the Geological Survey of Wyoming is sound and it operates efficiently and effectively with the resources available. In order to carry on a continuous program of research on the geology of Wyoming's mineral resources it is necessary only to make funds available for the employment of full-time technical help and to supply the money to publish the results and make them available as a stimulus to the development of the mineral wealth of the State.