NEW MEXICO
BUREAU OF MINES AND
MINERAL RESOURCES

ANNUAL REPORT for the Year
July 1, 1968 to June 30, 1969
THE NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES

Frank E. Kottlowski, Acting Director

Full-Time Staff

Joyce M. Aguilar, Stenographer
William E. Arnold, Scientific Illustrator
William E. Bertholf, Resource Economist
Roshan B. Bhappu, Senior Metallurgist
Robert A. Bieberman, Petroleum Geologist
Lynn A. Brandvold, Assistant Chemist
Elise Brower, Assistant Chemist
Richard R. Chavez, Lab Assistant
Lois M. Devlin, Office Manager
Jo Drake, Director's Secretary
Lucien A. File, Staff Researcher
Rousseau H. Flower, Senior Paleontologist
Roy W. Foster, Assoc. Petroleum Geologist
Paul H. Johnson, Metallurgist
Linda L. Lake, Secretary
Cheryl A. LePlatt, Secretary
F. Leo Misaq, Mining Engineer
Donna Peckenpaugh, Secretary
Robert L. Price, Draftsman
Teri Ray, Editor
Jacques R. Renault, Assoc. Geologist
Dexter H. Reynolds, Res. Chemist
Jackie H. Smith, Lab Assistant
W. Kelly Summers, Hydrologist
Frank B. Titus, Hydrologist
Heidi Warlies, Draftswoman
Robert H. Weber, Senior Geologist
Sue Wilks, Secretary
Max E. Willard, Econ. Geologist
Juarine W. Wooldridge, Clerk-Typist

Part-Time Staff

David G. Jackson, Dir. Info. Service
Ching H. Ma, Assoc. Prof. Metallurgy
Robert Montoya, Warehouseman
Rufie Montoya, Dup. Mach. Oper.
John Reiche, Instrument Manager
Ronald J. Roman, Res. Metallurgist

Graduate Students

Richard D. Clark, Geologist
Saul Escalera, Metallurgist
Walter W. Fisher, Metallurgist
Lorna M. Goebel, Chemist
Rudolph H. Jacobson, Metallurgist
Fajesh K. Mishra, Metallurgist
Gee Bie Oey, Chemist
Ronald W. Riese, Geologist
Eugene F. Toby, Geologist
William P. Zelinski, Geochemistry

Plus more than 35 undergraduate student assistants

Front cover photograph was made available by the New Mexico Petroleum Industries Committee
ANNUAL REPORT

NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES

For the Fiscal Year
July 1, 1968 to June 30, 1969

Prepared by the
Acting Director

SOCORRO, NEW MEXICO

Geoscience Research is the Key to Industrial Development

JUNE 1969
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY

Stirling A. Colgate, President

STATE BUREAU OF MINES AND MINERAL RESOURCES

Frank E. Kottlowski, Acting Director

THE REGENTS

MEMBERS EX OFFICIO

The Honorable David F. Cargo .......... Governor of New Mexico
Leonard DeLayo .................. Superintendent of Public Instruction

APPOINTED MEMBERS

William G. Abbott .................. Hobbs
Henry S. Birdseye .................. Albuquerque
Thomas M. Cramer .................. Carlsbad
Steve S. Torres, Jr. ............... Socorro
Richard M. Zimmerly ............... Socorro

Copies may be obtained from the New Mexico Bureau of Mines and Mineral Resources
Campus Station, Socorro, New Mexico - Free
TO: Board of Regents  
Honorable Stirling A. Colgate, President  
Members of the New Mexico Legislature  
Board of Educational Finance  
Taxpayers of New Mexico

I have the honor of transmitting to you the annual report of the New Mexico Bureau of Mines and Mineral Resources for the year July 1, 1968 to June 30, 1969 as required by Section 3, Chapter 115, of the Eighth State Legislature session laws, approved March 4, 1927.

During the year, 39 projects were completed, 24 technical reports published including revisions of those in popular demand, 16 projects were initiated, modernization of our field vehicle fleet was begun and additional laboratory equipment was procured, 11 technical talks were presented at scientific meetings, and 10 technical papers were published in outside scientific journals. Information concerning exploration and development of New Mexico's mineral resources was given during 3235 visits by outside technical personnel, in 4740 letters, and by 2790 phone calls. Sales of our technical publications, priced at only publication costs, totaled about $16,500. More than 7700 copies were also sent to state officials, libraries, and other scientific agencies.

A search by the President for a new director from outside New Mexico, that lasted from the last half of FY 1967-68 through the first 10 months of FY 1968-69, culminated with the appointment, effective July 1, 1969, of Prof. Don H. Baker, Jr., an eminent metallurgist from Waterloo University and the U.S. Bureau of Mines. Much staff time was spent on Tech Research Foundation projects, teaching courses for the College and Graduate divisions, in supervising student theses, and serving on New Mexico Tech committees. Bureau staff members also served as officers and on numerous committees for many outside scientific and professional organizations.

The Board of Educational Finance recommended a 3.5% increase in appropriation for the Bureau for FY 1969-70; the Legislature approved a 2.3% increase. This contrasts with the national 4.7% increase in costs. Along with the rising cost of employing students, this decrease in available funds precluded filling of 3 professional staff vacancies for a mining engineer, economic geologist, and a ceramist.

Despite some difficulties, we have accomplished much during the past year. It is my great pleasure to present this annual report to you.

Respectfully submitted,

[Signature]

Frank E. Kottlowski  
Acting Director
Diesel electric truck at the Santa Rita Copper Mine.

The Santa Rita Copper Mine - one of New Mexico's outstanding scenic attractions.
BUREAU ACTIVITIES

New Mexico’s mineral industry constitutes a vitally important part of the State’s economy. In 1968 the industry employed about 16,000 people, its total production was about $902 million, and the industry paid to the State and its subdivisions about $85 million in taxes, rentals, royalties, and bonuses. No other industry even approaches these figures in the direct fiscal support it provides to the State’s government.

There is much demand for applied research, basic information, and the solution of economic and technical problems in all the areas that make up the mineral industry. Scientific evaluation is increasingly needed to assess the State’s mineral potential, and requires geologic, mining, and metallurgical studies to assure a stable mineral economy. We must look ahead to the time when the presently mined and produced deposits are depleted and others, as yet not discovered must take their place.

Many of the talents and funds for the exploration and development of New Mexico’s mineral resources can come from private industry. The State, however, must actively contribute to the exploration and development of its mineral resources, and must take the lead in applied research aiding the industry’s proper and prudent growth. Appropriations provided by the State Legislature for such purposes should be considered a necessary outlay, which will provide a return far out of proportion to the funds invested.

The New Mexico Bureau of Mines and Mineral Resources is the only State organization charged with the duty of investigation, studying, and reporting on the geology of the entire State, as well as on all types of mineral resources, such as uranium, oil and gas, coal, metallic and nonmetallic minerals, and ground water. We are responsible for conducting applied research on all types of mineral deposits for the purpose of finding, increasing production, and using New Mexico’s deposits.

Having no regulatory functions, the Bureau is free to cooperate impartially with all companies, individuals, agencies, and institutions in supplying the best possible scientific information for their use, and in turn receiving from them nonconfidential information which is shared by all, with the Bureau acting as a clearinghouse. A prime example of this is the oil-well sample library and the records of drilling secured by companies and individuals at a cost of several billion dollars, which are freely available in the Bureau. The value of these records increases with the passing of time.

The activities of the New Mexico Bureau of Mines and Mineral Resources in general cover applied research in three major scientific fields, Geology and Mineral Resources, Metallurgy and Chemistry, and Mining and Economics. In addition, the administrative staff provides direction and services to these three applied-research sections and information to the general public.
Geology is an important tool in the exploration and development of mineral resources. Direct investigations of mineral deposits, regional geologic reports, structure contour maps, detailed and reconnaissance geologic maps, and stratigraphic studies aid in finding and in the eventual extraction of New Mexico’s minerals. For immediate use of geologic information, many geologists, mining engineers, prospectors, and landowners visit with the Bureau’s staff and confer informally on geologic facts and projections.

Emphasis in recent years has been on laboratory studies to aid in the development of mineral resources. The Bureau has not lost sight, however, of the fact that mineral resources occur in the field, in the rocks, and that laboratory work properly should be related to the field occurrence of that particular mineral resource. Thus most geologic studies, as with all types of investigations of mineral resources, are joint field and laboratory projects. In addition, the geologic personnel of the Bureau have more experience in these types of New Mexico’s mineral resources studies than any other group.

Although primarily a service organization, the Bureau of Mines and Mineral Resources does both pure and applied geologic research. Prior to 1960, Schillings’s study of low-grade molybdenum deposits near Questa was in the realm of pure research; today, a mill is extracting this ore. Studies of Late Paleozoic reefs in the San Andres, Sacramento, and Guadalupe mountains before 1962 were chiefly stratigraphic; today, new oil pools yield their black gold from similar Abo reefs in southeastern New Mexico. Investigation of oil shales may be pure research today; within decades, these shales may be important sources of the nation’s petroleum. Outcrop and subsurface stratigraphic studies of the 24 counties not now producing oil or gas may seem to be pure geologic research but could lead to the discovery of petroleum in these areas.

Many New Mexicans and many of the tourists that visit the State are not concerned directly with technical geologic investigations but do have a lively interest in the enchanting landscapes. They want to know how the canyons and mountains, arroyos and mesas, and volcanoes and desert playas were formed. The popular guidebooks entitled *Scenic Trips to the Geologic Past* are written to explain the geology of local areas and point out their scenic and geologic wonders. They also are designed to keep tourists in the State “that extra day” which is so important to New Mexico’s economy. Tens of thousands of these books have been distributed already, and the demand is constant.

The first seven Scenic Trips featured regions near Santa Fe, Taos, Roswell, Ruidoso, Grants, Gallup, Silver City, Santa Rita, Pecos, Raton, and Capulin. Number 8 departed from the previous format and gave an overall view of the
State, a mosaic of the Scenery, Rocks, and History. Scenic Trips No. 9, issued this year, and authored by Dr. Vincent C. Kelley of the University of New Mexico, describes the geologic setting of our major population center, Albuquerque. In addition, most of the other Scenic Trips guidebooks have been revised and brought up to date. The rocks do not change, but the highways do.

Many of the geologic maps and geologic reports published by the Bureau are directed toward helping the petroleum industry. The technical geologic reports to aid in exploration for oil and gas have ranged from reconnaissance geologic maps of the Geologic Map series to detailed studies reported in the bulletins, memoirs, and circulars. Several examples from our list of completed projects in the following pages are Bieberman and Weber’s Energy Resources Map of New Mexico, Bieberman’s petroleum development reports, and several papers on the petroleum potential of southwest New Mexico by Foster, Kottlowski, and Wengerd. Flower’s paleontologic studies also can aid the search for oil.

Geologic investigations that may help exploration for metallic minerals and for industrial rocks and minerals ranged from tabulation of the counties’ mineral production by Stotelmeyer, to detailed work on the Luis Lopez manganese mineralization by Willard and Bulletin 91, the geology and mineral resources for Rio Arriba County by Bingler. Diverse guides to possible ore include Misaqi’s geochemical studies of the Eagle Nest quadrangle and the radiometric dating of igneous rocks and associated mineralization by Weber, Willard, and Kottlowski.

Determinations of ground-water resources are aided by geologic maps showing the location and structure of favorable water-bearing beds, and by specific ground-water investigations such as Havenor’s on the Roswell artesian basin and Summers’ on the Pecos River basin.

Areal geologic mapping and geologic reports, fundamental studies for any geologic and mineral resources investigations, were completed for such quadrangle areas as El Rito, Valle Grande, Brazos Peak, Cebolla, and Tucumcari. Up-to-date ideas on exploration for mineral resources, ranging from geophysical methods to basic geologic studies are summarized in Cir. 101 from talks given at New Mexico Tech’s Fourth Idea Conference. Similar fundamental studies are recorded in Cir. 104, the Border Stratigraphy symposium, in Sanford’s description of New Mexico’s earthquakes for a three-year period, and the several sedimentation projects.

Identification of minerals and rocks, brought to the Bureau’s offices or sent by mail, is an important service rendered chiefly by Weber and Misaqi. Direct services to the petroleum industry include making available, by Bieberman and Chavez, the records on at least 40,000 test wells drilled in New Mexico, as well as cuttings from selected wells, and electric, radioactive, sonic, and other types of logs. Up-to-date petroleum exploration maps are also available for most of New Mexico’s counties.
Is this technical information useful to the mineral exploration industry? This is a pertinent question asked of any service and applied research agency. Sales of Bureau publications did total about $16,500 this year, and in addition about 7700 copies of the new publications were issued free to state officials, libraries, and other scientific organizations. The popularity of a particular publication may not reflect its ultimate worth to New Mexico. A single copy of a bulletin or circular may contain the clue that will lead to discovery of a huge ore body or a million-dollar oil pool.

METALLURGY AND CHEMISTRY

Research by the New Mexico Bureau of Mines in metallurgy was begun in 1957, when the first metallurgist was added to the Bureau staff. Since then work in this field has been accelerated as laboratory space and personnel were made available until it now comprises, with its associated chemical analytic laboratory, almost half of the Bureau’s effort.

The metallurgical section, composed of Bhappu, Johnson, and Smith with numerous students, conducts studies in various aspects of extractive metallurgy and provides technical assistance to those who request it.

A great many prospectors, small mine operators, and most of the major mining companies have availed themselves of this service. The primary objectives are to conduct research in various aspects of extractive metallurgy; to provide technical assistance to operators and mining companies requesting it; and to supply a training ground for future metallurgists and engineers in this field.

Much emphasis during the year was on basic research of leaching agents that might be useful in chemical mining, analyses using x-ray florescence and x-ray diffraction, extraction of rhenium, separation of strontium and barium, extraction of nickel, leaching of uranium ores, testing of alcohol frothers, oxide copper leaching, oxidation of ferrous sulfate solutions, and the leaching of copper-ore dumps. Many of the projects were partly supported by contracts with individual companies or through the New Mexico Tech Research Foundation. These include use of potassium permanganate in flotation of sulfide minerals, recovery of by-product value from Questa tailings, Hanna Mining Co. copper leach studies, Occidental Minerals leach tests, Kennecott tailings leach studies, Dotson Minerals Corp. slag tests, U.S. Smelting & Refining thiosulfate dump leach tests, Winston gold-silver tests, Kerr-McGee Corp. uranium dump leach tests, and leaching of oxide copper ores for Copper Range Co.

The analytic chemists, Reynolds, Brandvold, and Brower, work closely with the metallurgists, advising on chemical features of extractive metallurgy,
and overseeing the students that run about 11,000 determinations of metallic elements from about 5000 samples.

As Vice-President for Research of the New Mexico Tech Research Foundation, Dr. Bhappu spent much time obtaining contracts for the Foundation. Most of the work desired is basic scientific studies or applied metallurgical problems, to be done in the Bureau’s laboratory, utilizing Bureau and College personnel, with a 25% to 100% overhead charge to the Foundation.

A large number of preliminary metallurgical tests are run for prospectors, mining companies, and individuals to aid development of ore deposits. These tests, run mainly by Smith and Bhappu, last from a few hours to several days, and a brief report is prepared. Numerous metallurgical theses studies are also supported.

MINING AND ECONOMICS

The chief activities in this field have been Misaqi’s revision of the Socorro County mineral deposits report, his geochemical and biogeochemical study of the Eagle Nest quadrangle, and Clark and Bertholf’s investigation of the socioeconomics of southeast New Mexico. Misaqi has advised individuals on mining engineering problems.

File is overseeing a comprehensive study, in cooperation with various companies and state and federal agencies, on surface mining practices. In addition he records and provides information on mining history, mining laws, and maintains liaison with government and mining groups.

The Bureau supported one-half to one-third of the salaries for Prof. Ching H. Ma and Prof. David A. Rowland of the College Division, and David G. Jackson, Tech’s Director of Information. Mr. Jackson helps set up Research Foundation contracts, oversees publicity, and has directed several TV programs describing the Bureau’s activities, services, and publications.

ADMINISTRATION SERVICES

These include supervision of personnel, project planning and guidance, overseeing purchasing, maintaining proper budget procedures, and providing technical and nontechnical information. Preparation of manuscript for publication, editing, proofreading, and scheduling of printing was done mostly by Ray. This was a busy year for publications, as more than an average number of reports were issued.
Preparation of geologic maps, general drafting, illustrative copy, and other reproductions were directed by Arnold, aided by Price and Warlies. The Business Office, directed by Devlin, handled requisitions, checked on the accounting, did manuscript typing, staff correspondence, and took care of the large sales and distribution of publications. Sales for FY 1968-69 were about $16,500 and more than 7700 free copies of new reports were distributed to state officials, libraries, and other scientific organizations. Secretarial staff includes Aguilar, Drake, Lake, LePlatt, and Wooldridge.

PERSONNEL CHANGES

On the recommendation of the president, the Board of Regents on May 5, 1969, appointed Prof. Don H. Baker, Jr., as Director of the Bureau effective July 1, 1969. For the past two years, he has been director of extractive metallurgy in the chemical engineering department of the University of Waterloo, in Waterloo, Ontario, Canada. Prof. Baker received his B.S. and M.S. degrees in Metallurgical Engineering, as well as a Professional Engineering degree, from the University of Arizona, was a research metallurgist for American Smelting & Refining Company at their Hayden operations, and a research metallurgist and physical scientist for the U.S. Bureau of Mines in Boulder City and Reno, Nevada, and Washington, D.C.

Our Editor, Miss Teri Ray, resigned in April 1969, moving to Phoenix, Arizona. During her six years with the Bureau, she edited and guided through the press more than 100 publications. Mrs. Cheryl A. LePlatt, our Business Office secretary in charge of publication sales, and Mrs. Linda L. Lake, secretary for the Petroleum Geology Section, both resigned in May 1969. They were replaced by Mrs. Linda Sue Wilks and Mrs. Donna Mae Peckenpaugh, respectively.

Dr. Roshan B. Bhappu, Senior Metallurgist, began a year's sabbatical leave in June 1969. He will serve UNESCO at Middle East Technical University in Ankara, Turkey, helping to set up programs for their metallurgical department. Dr. Ronald J. Roman, Research Metallurgist, shared with the Bureau by the Tech Research Foundation and the College Division since May 1969, has taken over Roshan's duties.

At the beginning of the year, Mrs. Myrtie M. Edgar, Director's Secretary and valued employee for 15 years, resigned owing to disability. Her experience and knowledge of the Bureau's activities and personnel, and her cheerful attitude were greatly appreciated by the entire Bureau staff. Her competent replacement, Mrs. Jo Drake, began her duties in September 1968.
COMPLETED PROJECTS

During the period July 1, 1968 to June 30, 1969, the following projects were completed. Results are available as Bureau publications, in other scientific journals, are on open file, were submitted to a contracting company, or are in press.

Energy Resources Map of New Mexico, by Bieberman and Weber; in press.
Petroleum Developments in New Mexico during 1962, by Bieberman and staff; in press.
Geology and mineral resources of Rio Arriba County, by Bingler; Bull. 91.
Southern Zuni Mountains, by Foster; revised Scenic Trips No. 4.
Geologic map of El Rito quadrangle, by Bingler; Geol. Map. 20.
Santa Fe, by Kottlowski; revised Scenic Trips No. 1 (Baldwin and Kottlowski).
Structure, stratigraphy, and hydrogeology of the northern Roswell artesian basin, by Havenor; Cir. 93.
Geologic map of Valle Grande quadrangle, by Bingler; Geol. Map 21.
Botryceras, Mohawkian endoceroid, Canadian endoceroids, and Chazayan cephalopod fauna, by Flower; Mem. 21.
Petroleum developments in New Mexico during 1961, by Bierberman; Cir. 96.
Mathematical and experimental model of the electrical properties of silicate minerals, by Deju and Bhappu; Cir. 97.
Geothermics - New Mexico's untapped resources, by Summers; Cir. 98.
Geochemical and biogeochemical studies in the Eagle Nest quadrangle, by Misaqi; Cir. 94.
Petroleum potential of southwest New Mexico and south Arizona, by Kottlowski; in press, AAPG.
New Mexico's 1967 mineral production by counties, by Stotelmeyer (U.S. Bureau of Mines); MRR 1.
Note 37 - Records of the American Commission on Stratigraphic Nomenclature for 1966-1968, Kottlowski; in press, AAPG.
Tantalum Project, Rociada, New Mexico, by Sheffer and Goldsmith (U.S. Bureau of Mines); MRR 2.
Geology of Brazos Peak quadrangle, by Muehlberger (Univ. Texas); Geol. Map 22.
Early Ordovician highlands of Precambrian rocks and their associated facies, Kottlowski, LeMone, and Foster; in El Paso Geol. Soc. 3d Guidebook.
Geology of the Cebolla quadrangle, by Doney (NE Louisiana St. Coll.); Bull. 92.
San Andres Limestone west of the Sacramento Mountains, by Kottlowski; in N. M. Geol. Soc. Special Pub. 3.
Albuquerque, by Kelley (Univ. N. Mex.); Scenic Trips No. 9.
Removal of copper from Pima molybdenite concentrates, by Bhappu and others; company report.
Chemical mining - a study of leaching agents, by Johnson and Bhappu; Cir. 99.
Tierra Amarilla coal field, by Landis and Dane (U.S. Geol. Surv.); Cir. 100.
An instrumental study of New Mexico earthquakes 1964-1967, by Sanford; Cir. 102.
Some El Paso guide fossils, by Flower; Mem. 22.
Exploration for mineral resources, edited by Kottlowski and Foster from papers given at 4th Idea Conference; Cir. 101.
Border stratigraphy symposium, edited by Kottlowski and LeMone; Cir. 104.
Geology of west half of Tucumcari 1:250,000 quadrangle, by Bejnar (Highlands Univ.); in press, Texas Bur. Econ. Geology.
Rapid analysis of Questa mill samples using x-ray fluorescence and x-ray diffraction; by Renault; company report.
Use of permanganate in flotation systems, by Escalera and Bhappu, Carus Chem. Co. report.
Analysis and extraction of rhenium from Questa and Pima molybdenite concentrates, by Goebel, Reynolds, and Bhappu; company reports.
Key oil tests and stratigraphic sections in southwest New Mexico, by Foster, Kottlowski, and Wengerd; N. Mex. Geol. Soc. guidebook, in press.
Separation of strontium from barium in Mountain Pass (Calif.) tailings; by Brower and Bhappu; Moly. Corp. company report.
Extraction of nickel from Guatemalan laterites, by Johnson and Bhappu; company report.
Continuing projects during fiscal 1968-1969 include the following:

Geology of the Pelona quadrangle, by Willard
Annual petroleum development reports, by Bieberman.
Leaching of low-grade uranium ore, by Johnson and Bhappu
Optimum alcohol frothers for copper flotation, by Escalera and Bhappu
for Cont. Oil Co., Tech Research Foundation contract.
Laboratory handbooks on rock and water analyses, by Reynolds and Brandvold.
Studies of Early Paleozoic faunas, by Flower
Studies of European and North American cephalopods, by Flower (travel funded by NSF).
Diatomite deposits of New Mexico, by Foster
Standard D.T.A. curves for selected minerals, by Foster
X-ray diffraction patterns of selected minerals, by Foster
Semi-quantitative spectrographic analysis of selected trace elements, by Foster
Tin deposits of the Black Range, by Jahns
Absolute ages of Precambrian rocks in central New Mexico, by Foster
San Andres Limestone in east-central New Mexico, by Kelley (Univ. N. Mex.).
Leaching of Chino's copper-ore dumps, by Johnson and Bhappu
Oxide copper leaching, by Johnson and Bhappu
Recovery of silver from Questa tailings, by Smith and Bhappu
Oxidation of ferrous sulfate solutions, by Johnson
Geology and geochemistry of New Mexico basalts, by Renault
Crystal perfection studies, by Renault
Compact optical spectrograph, by Reynolds
Chemical analysis by x-ray fluorescence, by Reynolds
Determination of rhenium in molybdenite, by Reynolds.
Datil-Mogollon volcanic field study, by Weber.
Zeolites of New Mexico, by Weber
Geology and archeology of Mockingbird Gap Early Man site, by Weber
Radiometric dating of igneous rocks and associated mineralization in southwest New Mexico, by Weber, Willard, and Kottlowski
Geology and geochemistry of Luis Lopez manganese deposits, by Willard
Sedimentology of western San Juan Basin, by Willard
Pennsylvanian and lower Permian of Joyita Hills, by Kottlowski and Stewart (Texaco).
Comprehensive water resources analysis of Pecos River Basin, by Summers (Water Res. Inst. grant)

Role of hydrological cycle in formation of White Sands, Summers and DeBrine (Water Res. Inst. grant)

Hydrogeology of the Socorro-Magdalena area, Summers

Geothermal resources of New Mexico, by Summers

An annotated-indexed bibliography of geothermal phenomenon, by Summers (NSF grant).

Procedure for estimating recoverable heat content of Hawaiian basalts, by Bertholf

Methods of curing capital obsolescence induced by potash oversupply, by Clark and Bertholf
NEW PROJECTS

During the period July 1, 1968 to June 30, 1969, the following projects were initiated. Some were completed this fiscal year.

Geologic map of west half of Tucumcari quadrangle, by Bejnar (Highlands Univ.)
Surface mining practices in New Mexico, by File and others.
Geologic map of Glorieta quadrangle, by Budding.
Mineral resources of Socorro County, updating by Misaqi.
Geology of the San Diego Mountain fluorspar area, by Seager (N. Mex. State Univ.).
Permeability of uranium leach dumps, by Griswold
Key oil tests and stratigraphic sections in southwest New Mexico, by Foster, Kottlowski, and Wengerd.
Ground-water resources in Sandia, Manzanita, and Manzano Mountains, by Titus (coop project with U.S. Geol. Surv.).
Mineral Resources and geology of the Silver City 7½-minute quadrangle, by Cunningham (N. Mex. Western Univ.).
Trace elements of Fierro-Hanover stock, by Babu (Univ. Missouri at Rolla).
Geochemistry of uranium movement, by Schwab
Geologic map of west half of Brownfield quadrangle, by Reeves (Tex. Tech).
Mica separation and evaluation, by Horst (Univ. Arizona).
Wolfcampian carbonate facies in southern New Mexico, by Jordan and Wilson (Rice Univ.).
Black Range tin genesis, by Lufkin (Stanford Univ.).
Stratigraphy and fuel resources of the San Juan Basin, by Foster.
REPORTS AND ABSTRACTS BY BUREAU PERSONNEL
PUBLISHED IN OUTSIDE JOURNALS


Renault, J. (1968) *Variation in some Quaternary basalts in New Mexico* (abs.): Geol. Soc. Am. Program, Mexico City meeting, p. 247.


TECHNICAL PAPERS AND TALKS
given by Bureau Staff


Johnson, P. H. and Bhappu, R. B. “Chemical mining, a study of leaching agents” at AIME February 1969 meeting in Washington.


Kottlowski, F. E. “Oil and Gas Exploration in New Mexico” at Highlands University Institute of Scientific Research May 1969 seminar in Las Vegas.

Renault, J. “Variation in some Quaternary basalts in New Mexico” at Geol. Soc. Am. November 1968 meeting in Mexico City.


Summers, W. K. “Geologic survey of thermal ground waters in New Mexico” at Geol. Soc. Am. Rocky Mountain Section May 1969 meeting in Salt Lake City.


Weber, R. H. “Perlite and related volcanic glass” at Highlands University Institute of Scientific Research April 1969 seminar in Las Vegas.
SCIENTIFIC ORGANIZATIONS

In addition to cooperative projects with other state and federal agencies, Bureau personnel served on committees and as officers of many New Mexico and national scientific and professional organizations, broadened their scientific knowledge by attending technical meetings, and helped the other divisions of New Mexico Tech by teaching, directing theses studies, and serving on committees as follows:

American Association of Petroleum Geologists
District Representative, Bieberman.
Geological Highway Map Committee, Foster.
Stratigraphic Correlations Committee, Foster.
Associate Editor, Kotlowski.
Stratigraphic Computer Coding Advisory Committee, Kotlowski.
Program Chairman, Rocky Mountain Section meeting, Kotlowski.
Attend Rocky Mountain Section meeting, Albuquerque, Feb. 1969; Bieberman, Kotlowski, Summers*, and Ray.
Attend national meeting, Dallas, April 1969; Bieberman and Kotlowski.

American Chemical Society
Chairman, Central New Mexico Section, Reynolds.
Attend national meeting, Minneapolis, April 1969; Brandvold and Brower.

American Commission on Stratigraphic Nomenclature
Vice-Chairman and Secretary (1967-1968), Kotlowski.
Chairman (1968-1969), Kotlowski.

American Institute of Mining, Metallurgical and Petroleum Engineers
Chairman, Council of Section Delegates, Bhappu.
Chairman, Waste Disposal Committee, Bhappu.
Program Chairman, Solution Mining Committee, Bhappu.
Vice-Chairman, Hydrometallurgy Committee, Bhappu.
Attend meeting, Minneapolis, Sept. 1969; Bhappu* and Johnson.
Attend national meeting, Washington, Feb., 1969; Bhappu** and Johnson*.

Association of American State Geologists
Attend annual meeting, Tucson, May 1969; Kotlowski
Elected Honorary Member, May 1969; Director Emeritus, Alvin J. Thompson.
Association of Earth Science Editors
Attend annual meeting, Norman, Okla., Oct. 1968; Ray

American Institute of Professional Geologists
President, New Mexico Section, Kottlowski.
Professional and Scientific Standards Committee, Kottlowski.

American Mining Congress

Federation of Rocky Mountain States, Natural Resources Council
New Mexico's Energy Resources representative, Kottlowski
Attend annual meeting, Las Vegas, Feb. 1969.

Four Corners Regional Commission
Advisory Research Committee on Minerals and Fuels, Kottlowski.

Friends of the Pleistocene

Geological Society of America
Attend national meeting, Mexico City, Nov. 1968; Renault* and Kottlowski**.
Attend Rocky Mountain Section meeting, Salt Lake City, May 1969; Summers* and Willard.
CoChairman, Symposium on Coal Resources of the Americas, Mexico City meeting, Kottlowski**.
Program Committee, Mexico City meeting, Kottlowski.
Associate Editor, Kottlowski.
Chairman, Coal Geology Division, Kottlowski.

Governor's Committee on Reorganization of State Government
Advisor, Bertholf.

International Geological Congress
Attend meeting, Prague, August 1968; Flower**.

International Geologic Correlations Committee
Attend informal meetings, Zurich and Geneva, after main Prague meeting cancelled; Kottlowski**.

Mine Safety Advisory Board
Chairman, Kottlowski.
Mineralogical Society of America
Attend national meeting, Montreal, June 1969; Renault.

New Mexico Academy of Science
Secretary, File.
Editor of Bulletin, File.
Attend fall meeting, Santa Fe, Nov. 1968; File.
Attend spring meeting, Socorro, April 1969; File.

New Mexico Geological Society
Treasurer (1968), Bieberman.
Secretary (1969), Bieberman.
Chairman, Field Conference Road Log Committee, Foster.
CoChairman, San Andres Limestone Symposium, Summers and Kottlowski.
Attend Field Conference, Farmington region, Sept. 1968; Bieberman,
Foster, and Kottlowski.
Attend annual meeting, Santa Fe, April 1969; Summers* and Kottlowski.

New Mexico Institute of Mining and Technology
Graduate Council, Bhappu and Kottlowski
Regent’s Chancellor, Bertholf.
Insurance Committee, Foster.
Ombudsman Committee, Foster.
Bureau Program and Director Recommendation Committee, Foster.
Library Committee, Renault.
Faculty and Graduate Seminar Committee, Renault.
Vice-President for Finance, Bertholf.
Student Loan Committee, Renault.
Chairman, Bureau Editorial Committee, Willard.
Student Coops Committee, Foster.
Sabbatical Leave Committee, Kottlowski.
Courses taught; Geology 343 Sedimentation, Willard.
   Geology 582 Directed Study, Willard and Bertholf.
   Geology 303 Economic Geography, Summers.
   Geology 571 Mineral Equilibria, Renault.
Ground-Water 551 Legal Aspects of Water Resources, Bertholf.
Met 423 Chemical Metallurgy I, Bhappu.
Met 581 Directed Study, Bhappu and Johnson.
Met 590 Independent Study, Johnson.
Met 591, 592 M.S. Thesis, Bhappu.
Mining 447 Directed Study, Misagi.

New Mexico Land Commissioner’s Advisory Board
Minerals Member, Kottlowski.

New Mexico Mapping Advisory Committee
Bureau’s Representative, Weber.

New Mexico Mining Association
Education and Information Committee, File.
Attend annual meeting, Carlsbad, Nov. 1968; Bhappu, File, Johnson, Misagi, and Brower.

New Mexico Press Association
Attend annual spring and fall meetings, Albuquerque, File.

New Mexico Public Relations Association
Attend annual meeting, Albuquerque, File.

New Mexico Tech Research Foundation
Vice-President for Research, Bhappu
Secretary, Bertholf

Paleo-Indian Institute, Eastern New Mexico University
Consulting Associate, Weber.
Attend Summer Field Research Symposium, near Albuquerque, Aug. 1968; Weber.

Society of Economic Paleontologists and Mineralogists
Receive award for best technical paper presented at Oklahoma City national meeting; Kottlowski.

University Council on Water Resources
New Mexico Tech delegate, Bertholf.

Weather Control and Cloud Modification Commission
Chairman, Bertholf.

Western Governors’ Mining Advisory Council
Member, Kottlowski.

* presented technical talk
** travel paid for by AIME, NSF, or IUGS.
During the period July 1, 1968 to June 30, 1969, the following publications were printed and are being distributed by the Bureau:

SOUTHERN ZUNI MOUNTAINS: Scenic Trips No. 4 by Roy W. Foster, revised edition, 55 pages, 61 illus; 50 cents.
This booklet outlines five trips that point out geologic features along NMex. 53 in the area of the southern Zuni Mountains. The route includes "side" trips to the Ice Caves and Zuni Pueblo and devotes one section to the El Morro National Monument area. Editorial revisions have updated the materials.

GEOLOGY AND MINERAL RESOURCES OF RIO ARIBA COUNTY, NEW MEXICO: Bulletin 91 by Edward C. Bingler, 158 pages, 4 tables, 22 figures, 7 plates, index; $3.00.
Report discusses geologic stratigraphy and structure of the county, gives a brief history of its mining activity and mineral deposits, and describes both metallic and nonmetallic commodities by mining districts and individual mines therein. Included is a geologic map of the county.

GEOLOGIC MAP OF EL RITO QUADRANGLE, RIO ARIBA COUNTY, NEW MEXICO: Geologic Map No. 20 by Edward C. Bingler; $1.00

GEOLOGIC MAP OF THE VALLE GRANDE PEAK QUADRANGLE, RIO ARIBA COUNTY, NEW MEXICO: Geologic Map No. 21 by Edward C. Bingler; $1.00.
These maps, scale 1:24,000, show the geology and structure of the areas of this mid-northern county of the state and the areal relationships of the Santa Fe Formation, Abiquiu Tuff, Los Pinos Formation, Ritito Conglomerate, El Rito Formation, Cutler Formation, and Ortega Quartzite. Cross sections illustrate the structure and the intertwining relationships of the Santa Fe, Los Pinos, Abiquiu, and Ritito units.

SANTA FE: Scenic Trips No. 1 by Brewster Baldwin and Frank E. Kottlowski, revised edition, 52 pages, 40 illus., 5 color plus cover; 50 cents.
This first revision of the original booklet of this series brings the material up to date, adding a bit of information about the city itself and including several additional black-and-white pictures. A new feature of the booklet, its six color photographs give it a bright, modern look. Each of the four trips logged leads to a different landscape in the vicinity of New Mexico's capital city, from towering, forested slopes of the Sangre de Cristo Mountains, to the area of the deep gorge of White Rock Canyon, to juniper-dotted plains, to "badlands".

BOTRYCERAS, A REMARKABLE NAUTILOID from the Second Value of New Mexico; An ENDOCEROID FROM THE MOHAWKIAN of Quebec; ENDOCEREOIDS FROM THE CANADIAN of Alaska; A CHAYAN CEPHALOPOD Fauna from Alaska: Memoir 21 by Rousseau H. Flower, 36 pages, 5 plates, index; $2.00.
The first of these four short papers discusses an apparent endoceroid cephalopod, known from a remarkable endosiphuncle, the structure of which indicates tentative assignment to the Endoceratida. The second describes a large endoceroid of Black River age, while the third describes endoceroids yielding four new genera comprising four new species, all of Late Canadian age. The fourth paper discusses one new species of Franklinoceras and two new species of Proteoceras, all from the Seward Peninsula.
STRUCTURE, STRATIGRAPHY, AND HYDROGEOLOGY OF THE NORTHERN ROSWELL ARTESIAN BASIN CHAVES COUNTY, NEW MEXICO: Circular 93 by Kay C. Havenor, 30 pages, 6 tables, 2 appendices, bibliography, $2.00.

Study delineates structural and stratigraphic controls of the quantity and quality of waters within the basin, recognizing three structural zones, the Border Hill, Six Mile, and YO, suggesting a fourth near the town of Dexter, and considering a fifth. It discusses three structural blocks, over-appropriation, intensive pumping, leakage factors, and saline encroachment, based upon studies of outcrops, cores, samples, and electric logs, and offers recommendations for additional study to increase understanding of the geology and hydrology of this part of the Roswell artesian basin and the basin system as a whole.

PETROLEUM DEVELOPMENTS IN NEW MEXICO DURING 1961: Circular 96 by Robert A. Bieberman, 68 pages, 4 tables, 1 figure; 50 cents.

The most important industry in New Mexico, petroleum comprised almost 65% per cent of the total value of all minerals produced in the state in 1961. Statistics for crude oil, potash, natural gas, uranium, copper, natural gas liquids, sand and gravel, and all remaining minerals summarize production and drilling during the report period. A list by county of individual wells completed in the state during 1961 gives the location, completion date, initial production, elevation, top of pay, and producing formation for each well.


Describes development of a model of a mineral particle and its surrounding electric layers, studies of electric layers surrounding a mineral particle in suspension, and construction of model of potential as a function of distance and presents the results obtained from these experiments.

GEOTHERMICS—NEW MEXICO'S UNTAPPED RESOURCE: Circular 98 by W. Kelly Summers, 9-page reprint from New Mexico Business, published by the Bureau of Business Research, University of New Mexico; 25 cents.

Defines "geothermal" and answers the questions, What are these resources, where are they, what are they worth? Discusses the four major uses of such resources in the light of New Mexico's potential and needs and touches upon legal aspects, interest in the nation's geothermal resources, and the geologic setting of natural-steam reservoirs.

GEOCHEMICAL AND BIOGEOCHEMICAL STUDIES IN THE EAGLE NEST QUADRANGLE, NEW MEXICO: Circular 94 by F. Leo Misaqi, 24 pages, 1 table, 17 figures; $1.00.

This geochemical study of bedrock, soil, and plant samples of the Eagle Nest quadrangle showed a conspicuous anomaly in metal content in the northwestern and north-central parts and indicated an anomaly in the southwestern part of the area. The author recommends a detailed, large-scale study of the latter section.

SERVICES OF THE NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES: Annual report by Frank E. Kotkowsk, 35 pages, 1 table; no charge.

Covering the period July 1, 1967, through June 30, 1968, this report lists the Bureau personnel, reviews Bureau activities, describes various projects of staff members, gives vignettes of publications, and includes a financial statement.
NEW MEXICO'S 1967 MINERAL PRODUCTION BY COUNTIES: Mineral Resources Report 1 by Ronald B. Stotelmeyer, 23 pages, 2 tables; 50 cents.

This county-by-county summary of the state's annual mineral production initiates a new series of Bureau publications, the Mineral Resources Reports. Minerals range from carbon dioxide to zinc, and most producers and uses are given in each county description, as well as the value of production.

TANTALUM PROJECT, ROCIADA, NEW MEXICO: Mineral Resources Report 2 by Herman W. Sheffer and Louis A. Goldsmith, 15 pages, 3 tables, 5 figures; 50 cents.

The authors investigated tantalum-bearing pegmatitic dikes in Mora and San Miguel counties by sampling and evaluation to determine whether the area contained a domestic supply of tantalum worthy of development. Laboratories of the Bureau and of the Salt Lake City Metallurgy Research Center both ran analyses on the collected samples. Besides tantalum, minerals of interest noted included beryllium, rubidium, and marginal lithium.

GEOLOGY OF BRAZOS PEAK QUADRANGLE, NEW MEXICO: Geologic Map 22 by William R. Muehlberger, 7 pages text accompanying geologic map, cross-sections map, and structure contour and tectonic map; $1.00.

Brazos Peak quadrangle lies adjacent to the Chama quadrangle along the New Mexico—Colorado line in the north-central part of the state. In addition to the geologic maps, a short text describes stratigraphic sequences of the Precambrian and Cenozoic rocks of the area and briefly reviews geologic structure, which here has a history intimately related to that of the Chama quadrangle.

GEOLOGY OF THE CEBOLLA QUADRANGLE, RIO ARriba COUNTY, NEW MEXICO: Bulletin 92 by Hugh H. Doney, 114 pages, 1 table, 21 figures, 1 plate, 1 appendix; $3.00.

Studies the geology and structure of the two physiographic provinces contained in the quadrangle, the San Juan Basin and the Turas Mountains. Discussions include the Kiowa Mountain Formation, Dakota Formation, Mancos and Mesaverde Groups, Ritiito Formation, Brazos Basalt, Chama Basin, Brazos uplift, mass-wasting, economic geology for coal, gold, and petroleum, and resumes of the geologic history. The appendix lists measured sections.

ALBUQUERQUE—ITS MOUNTAINS, VALLEY, WATER, AND VOLCANOES: Scenic Trips to the Geologic Past No. 9 by Vincent C. Kelley, 101 pages, 65 illustrations, including 6 color photographs; $1.00.

Most recent of the Scenic Trips series, this guidebook discusses the geologic background of the Albuquerque area and how it has affected present-day topography of mountains and valley. The author thoroughly explains the problems posed by run-off, ground, and river water and its influence on the city. Five trip logs guide the reader on tours of the mountains, arroyos and alluvial fans, the lowlands, the river, and the volcanoes that distinguish Albuquerque's western skyline. Two side trips explore Tijeras Canyon and the Sandia Peak Tramway ride.

CHEMICAL MINING—A STUDY OF LEACHING AGENTS: Circular 99 by Paul H. Johnson and Roshan B. Bhappu, 10 pages, 9 tables; 50 cents.

Testing involved a variety of commercially available chemicals as leaching agents on different types of copper, nickel, lead, zinc, silver, beryllium, uranium, vanadium, and molybdenum ores. Improved chemical mining processes for treating several of these ores were devised. Half a dozen effective leaching agents were also determined.
THE TIERRA AMARILLA COAL FIELD, RIO ARIBA COUNTY, NEW MEXICO: Circular 100 by Edwin R. Landis and Carle H. Dane, 14 pages, 2 tables, 3 figures including geologic map; 50 cents.

Report discusses nine coal beds, most thin and lenticular, on the east flank of the Chama basin. Of subbituminous A rank, the coal has supplied local users. Information presented contributes to the knowledge of fuel resources of the northeastern part of the San Juan Basin and the stratigraphy of the Mesaverde Group.

AN INSTRUMENTAL STUDY OF NEW MEXICO EARTHQUAKES JULY 1, 1964, THROUGH DEC. 31, 1967: Circular 102 by Allan R. Sanford and Daniel J. Cash, 7 pages, 1 figure, 3 tables; 50 cents.

A continuation of the study reported in Circular 78, this report reviews seismic activity within or very close to New Mexico, listing origin times, locations, and magnitudes for all earthquakes greater than or equal to 2.7 magnitude. Of especial significance was the seismic event near Dulce on January 23, 1966, the strongest recorded in New Mexico in 28 years.

SOME EL PASO GUIDE FOSSILS; FOSSILS FROM THE SMITH BASIN LIMESTONE of the Fort Ann Region; FOSSILS FROM THE FORT ANN FORMATION; MERO-STOMES from the Cassinian Portion of the El Paso Group; Memoir 22 by Rousseau H. Flower, 63 pages, 9 plates; $2.00.

The first of these short papers describes fossil species from the El Paso diagnostic of some horizons or of correlative significance. The second discusses and illustrates eleven faunas from the Smith Basin limestone, and the third discusses commoner fossils of the Fort Ann Limestone, exclusive of cephalopods, including five new species. The fourth paper presents four species of merostomes of the new genus Lomeneites and proposes a new family.

MINERAL RESOURCES DISCOVERY TECHNIQUES: Circular 101 edited by Frank E. Kottlowski and Roy W. Foster; $1.00.


BROMINE IN THE SALADO FORMATION, CARLSBAD POTASH DISTRICT: Bulletin 93 by Samuel S. Adams; $3.00.

This study of the potash-producing horizons in the Salado Formation gives details on the relationships of bromine, and illustrates its possible use as a guide for exploration.
GEOLOGY AND BERYLLIUM MINERALIZATION NEAR APACHE WARM SPRINGS, SOCORRO COUNTY, NEW MEXICO: Circular 103 by Patrick D. Hillard; $1.00.

This detailed study of the mineralized volcanic rocks includes the results of test drilling and a geologic map showing the relationships of beryllium to the altered zones and the volcanic units.

BORDER STRATIGRAPHY SYMPOSIUM: Circular 104 edited by Frank E. Kottlowski and David V. LeMone; $1.00.

This symposium consists of papers given at the American Association for the Advancement of Science meeting in El Paso. They describe Precambrian rocks by Denison and Hetherington, Cambrian-Ordovician strata by LeMone, Siluro-Devonian beds by McGlasson, Late Paleozoic strata by Kottlowski, the Santa Fe Group by Hawley, et al., a Neogene flora by LeMone and Johnson, Quaternary geology by Hawley and Kottlowski, and the Black Mountain basalts by Hoffer.

PUBLICATIONS BEING EDITED

Geology and Ore Deposits of the Eagle Nest Area: Bulletin by Kenneth F. Clark.

Pennsylvanian and Lower Permian of the Joyita Hills: Memoir by Frank E. Kottlowski and Wendell J. Stewart.

Geology and Mineral Deposits of the Gallinas Mountains, Lincoln County, New Mexico: Bulletin by Ralph M. Perhac.
AN ACT ESTABLISHING A BUREAU OF MINES AND MINERAL RESOURCES OF THE STATE OF NEW MEXICO; PROVIDING FOR THE CONTROL AND MANAGEMENT OF SAID BUREAU OF MINES AND MINERAL RESOURCES; PROVIDING FOR THE APPOINTMENT OF A DIRECTOR OF SAID BUREAU AND FIXING HIS QUALIFICATIONS; PROVIDING FOR THE OBJECTS, DUTIES AND PURPOSES OF SAID BUREAU OF MINES AND MINERAL RESOURCES AND PROVIDING FOR THE MAINTENANCE AND SUPPORT OF SAID BUREAU OF MINES AND MINERAL RESOURCES OF THE STATE OF NEW MEXICO.

H. B. No. 226; Approved March 14, 1927.

Be It Enacted by the Legislature of the State of New Mexico:

Section 1. There is hereby established a Bureau of Mines and Mineral Resources of the State of New Mexico which shall be a department of the New Mexico School of Mines and under the direction of its Board of Regents. The said Board shall appoint as a director a suitable person to be known as the Director of the Bureau of Mines and Mineral Resources and upon his nomination such assistants and employees as the said board shall deem necessary. Said Board may also determine the compensation of all persons employed by the Bureau of Mines and Mineral Resources including the director and may remove them at will.

Section 2. The objects and duties of said Bureau of Mines and Mineral Resources shall be as follows:

(1) To collect, to compile and to publish statistics relative to New Mexico geology, mining, milling, metallurgy and oil and natural gas and the refining thereof.

(2) To collect typical geological and mineral specimens and samples of products; to collect photographs, models and drawings of appliances used in the mines, mills, smelters, oil wells, natural gas wells and the refineries of oil and natural gas in New Mexico.

(3) To collect a library and bibliography of literature pertaining to the progress of geology, mining, milling, smelting and the production of oil and natural gas and refining the same in New Mexico.

(4) To study the geological formations of the State with special reference to their economic mineral resources, both metallic and non-metallic.

(5) To examine the topography and physical features of the State with reference to their practical bearing upon the occupation of the people.
(6) To study the mining, milling, smelting operations and oil and natural gas production and the refining of same carried on in the State with special reference to their improvement.

(7) To prepare and publish bulletins and reports with the necessary illustrations and maps, which shall embrace both a general and detailed description of the natural resources and geology, mines, mineral deposits, both metallic and non-metallic, oil wells, natural gas wells, reduction plants, smelters, mills, oil refineries and natural gas refineries.

(8) To make qualitative examinations of rocks and mineral samples and specimens.

(9) To assist in the education of miners and prospectors through lectures and publications.

(10) To consider such other kindred, scientific and economic problems and questions as in the judgment of the Board shall be deemed of value to the people of the State.

(11) To communicate special information on New Mexico geology, mining, both metallic and non-metallic, oil and natural gas and to serve as a Bureau of Exchange and Information on the mineral, oil and natural gas resources of New Mexico.

(12) To cooperate with the University of New Mexico, with the State Mine Inspector and with other departments of State Government as may be mutually beneficial and to cooperate with the United States Geological Survey and with the United States Bureau of Mines in accordance with the regulations of those institutions.

Section 3. The Board shall cause to be prepared an annual report showing the progress and condition of the Bureau, together with such other information as they may deem necessary or useful, or as the board may require.

Section 4. The regular and special reports of the Bureau of Mines and Minerals shall be printed as the Board may direct and the reports may be distributed or sold by the board as the interest of the State or science may demand and the money obtained by the sale of said reports shall be paid into the State's Treasury.

Section 5. All materials collected after having served the purpose of the Bureau shall be distributed by the Board to such educational institutions of the State as the Board may direct.

Section 6. The Board may use of the funds appropriated for the maintenance of the New Mexico School of Mines such sums as may be necessary for the maintenance of the Bureau hereby created, not to exceed, however, such sums as may be appropriated for the New Mexico School of
Mines from the fund provided by Section 35 of Senate Bill No. 2775 United States Congress. (Public -- No. 146 -- 66th Congress.)

Section 7. All Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

In November 1967, several members of the Bureau staff recommended to President Colgate that he appoint a "blue-ribbon" committee of outstanding mineral industry personnel to: (1) suggest guidelines for the operation of the Bureau, (2) advise the Bureau on the types of work it should do, and (3) recommend several candidates for the Bureau's director.

During the early part of 1968, the President and Board of Regents met frequently to consider director candidates. Letters of recommendation were solicited from the mineral industry; almost 200 were received, recommending several members of the Bureau staff. In late April 1968, the President appointed a blue-ribbon committee to suggest operational guidelines for the Bureau and to select candidates for the directorship.

The committee consisted of Prof. Charles E. Jacob, representing Tech's Research and Development Division, as chairman; Prof. George B. Griswold from the College Division; Roy W. Foster of the Bureau staff, Frank G. Woodruff, General Manager of the Chino Mines Division of the Kennecott Copper Corp.; Dr. Donald H. McLaughlin, President of Homestake Mining Co., and James P. Malott, Vice-President of Continental Oil Company. Bureau staff members owe much appreciation to these dedicated persons for their deliberations on our behalf.

In September 1968, the committee made the following recommendations:

1. The principal objectives of the New Mexico Bureau of Mines and Mineral Resources should be the investigation and evaluation of the mineral resources of New Mexico. This includes geological, geophysical, geochemical and mining, petroleum and metallurgical, but the primary emphasis should be on aid to exploration and economic evaluation.

2. Contract work with private industry might be arranged but because of the pressing needs of the State, this should be restricted, at least for the immediate future. The work performed by Bureau staff members is public information; therefore industrial contracts should be for the sake of the knowledge and the benefit of all. Results of any contract work should be publishable and the cost allotted on a realistic basis. Consulting by Bureau staff members should not be allowed within the State. Consulting outside New Mexico should be carefully evaluated in terms of time lost to primary objectives, and particularly in the Southwest, in terms of competitive aspects and effects such consulting might have on the State’s mineral industry.
3. There is need for closer liaison between College staff members receiving part of their salary from the Bureau and the Bureau personnel. This could be handled in two ways. First, all such research could be under the supervision of the Bureau director and the dual appointee could be required to devote full time during the summer to this research. Second, dual appointees could be eliminated, and arrangement made for College staff members in fields related to the needs of the Bureau could be placed on 9-month college contracts and be employed by the Bureau during the summer in specific research projects.

4. Student employment should meet the needs of the Bureau. Students should not be used in jobs in which full time professional employees would prove to be of greater overall benefit. The Bureau staff does receive stimulus from association with students in an academic and research environment, particularly when graduate students are involved.
MINERAL PRODUCTION IN NEW MEXICO IN 1968*

The value of mineral production in New Mexico again reached an all-time high in 1968, totaling almost $902 million. This was a 3 percent increase above the 1967 value. Increases of about $25 million each in mineral fuels and in metal production, chiefly copper, more than offset declines in the value of nonmetals production.

Petroleum production increased 1.9 million barrels, from 126.1 million to 128.0 million barrels, establishing a new State high. As usual, petroleum was the single most valuable mineral commodity in the State, valued at $376 million, an increase from 1967's $368 million, and topping the second-ranked mineral, natural gas, which was valued at $149.9 million, a $11.2 million increase from 1967. Natural gas liquids increased from 1967's 29.7 million barrels worth $60.7 million to 1968's 33.1 million barrels valued at $67.6 million.

The Marathon Oil Co. gasoline plant at the Indian Basin field, the Pan American Petroleum Corp. gasoline plant at the Empire Abo field, and the Bloomfield refinery of Plateau, Inc. increased their capacities.

About 146 wildcat tests were drilled in southeast New Mexico along with 585 development wells; in the northwest about 28 exploratory tests and 272 development wells were drilled. Discoveries of oil and gas for the first six months totaled 301. Project Gasbuggy tests were encouraging, as the inflow of gas into the chimney of broken rock was better than expected, but the gas, as anticipated, contained too much radioactive tritium to be commercially salable.

Production of helium declined from 1967's 71 million cubic feet valued at $2.5 million to 41 million cubic feet worth $1.4 million. Carbon dioxide production declined slightly from 771 million cubic feet worth $57,000 to 760 million cubic feet valued at $54,000. The output of coal remained at about 3.4 million tons with a value of about $12.6 million. Both the York Canyon underground mine of Kaiser Steel Corp. west of Raton and the Navajo strip mine of Utah Construction & Mining Co. near Farmington operated at planned capacity. Expansion of the Navajo mine coal-handling facilities began; when full production is reached in 1970 the Four Corners powerplant will use about 8.5 million tons of coal per year.

The value of uranium produced increased $6.9 million from $89.6 million for 11.2 million pounds of recoverable oxide to $96.5 million for 12.2 million pounds of recoverable uranium oxide. Exploration, development of new mines, and expansion of existing facilities were at high levels during 1968.

With the end of the labor strike, copper production increased $19.9 million from the 75 million tons worth $57.3 million in 1967 to the 92 million tons of ore worth $77.2 million in 1968. Kerr-McGee Corp.
discovered copper ore in the Hanover Mountain area northeast of Silver City, in the general region of the newly opened copper-zinc mine of U.S. Smelting, Refining & Mining Co. Production of copper concentrates at the Phelps Dodge Corp. Tyrone open pit mine is scheduled to begin in July 1969.

The value of potassium salts production declined $26.2 million from $91.1 million for 2.9 million tons of potash in 1967 to $64.9 million for 2.3 million tons in 1968. Thus decline is due primarily to competition from Canadian mines.

The value of molybdenum production declined about $1 million mainly as the result of difficult milling characteristics of the ore from the Questa mine. Exploration drilling at the Molycorp mine did delineate an additional 127 million tons of ore with an average grade of 0.185 percent molybdenum disulfide.

Production of zinc, gold, silver, manganese, iron ore, salt, cement, clays, gypsum, perlite, sand and gravel, stone, lime, and sulfur increased, whereas production of lead, pumice, and mica declined. The 376 thousand tons of perlite were valued at $3.7 million, the 15 million tons of sand and gravel were worth $14.8 million, 1.5 million tons of stone were worth $2.6 million, and the 22,300 tons of zinc were valued at $6 million.

FINANCIAL STATEMENT

Receipts and disbursements estimated (in early June) for Fiscal Year 1968-1969 are as follows:

Receipts:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning balance July 1, 1968</td>
<td>$ 32,223</td>
</tr>
<tr>
<td>State appropriation</td>
<td>483,000</td>
</tr>
<tr>
<td>Receipts from sales of publications</td>
<td>16,500</td>
</tr>
<tr>
<td>Basic Geology and Ground-Water appropriations</td>
<td>20,000</td>
</tr>
<tr>
<td>Grants and contracts</td>
<td>13,488</td>
</tr>
<tr>
<td><strong>Total Receipts</strong></td>
<td><strong>$565,211</strong></td>
</tr>
</tbody>
</table>

Disbursements and Commitments:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal services</td>
<td></td>
</tr>
<tr>
<td>Regular salaries</td>
<td>$279,480</td>
</tr>
<tr>
<td>Part-time salaries, mainly students</td>
<td>76,870</td>
</tr>
<tr>
<td><strong>Total Personal services</strong></td>
<td><strong>$356,350</strong></td>
</tr>
<tr>
<td>Travel and automotive</td>
<td></td>
</tr>
<tr>
<td>Travel and per diem</td>
<td>9,685</td>
</tr>
<tr>
<td>Gas, repairs, and insurance</td>
<td>2,530</td>
</tr>
<tr>
<td><strong>Travel and automotive</strong></td>
<td><strong>12,215</strong></td>
</tr>
<tr>
<td>Repairs and maintenance</td>
<td>985</td>
</tr>
<tr>
<td>Supplies and materials</td>
<td></td>
</tr>
<tr>
<td>Postage and resale supplies</td>
<td>5,975</td>
</tr>
<tr>
<td>Office supplies</td>
<td>5,535</td>
</tr>
<tr>
<td>Laboratory and scientific supplies</td>
<td>13,245</td>
</tr>
<tr>
<td><strong>Supplies and materials</strong></td>
<td><strong>24,755</strong></td>
</tr>
<tr>
<td>Printing and publications</td>
<td>38,314</td>
</tr>
<tr>
<td>Other operating expenses</td>
<td></td>
</tr>
<tr>
<td>Building use charge by New Mexico Tech</td>
<td>7,000</td>
</tr>
<tr>
<td>Telephone and telegraph</td>
<td>9,520</td>
</tr>
<tr>
<td>Professional services</td>
<td>13,774</td>
</tr>
<tr>
<td>Retirement</td>
<td>13,265</td>
</tr>
<tr>
<td>Social security</td>
<td>9,240</td>
</tr>
<tr>
<td>Overhead to New Mexico Tech</td>
<td>16,600</td>
</tr>
<tr>
<td>Computer service</td>
<td>5,345</td>
</tr>
<tr>
<td>Freight, insurance, audit, Board of Educational Finance, subscriptions, etc.</td>
<td>4,630</td>
</tr>
<tr>
<td><strong>Other operating expenses</strong></td>
<td><strong>79,374</strong></td>
</tr>
<tr>
<td>Capital outlay</td>
<td>26,700</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>$532,693</strong></td>
</tr>
</tbody>
</table>

Year-end balance, June 30, 1969                          | **$ 32,518** |
Lynn A. Brandvold
Assistant Chemist
Nov. 10, 1965 –

Elise Brower
Assistant Chemist
May 18, 1966 –

Richard R. Chavez
Lab Assistant
Feb. 21, 1957 –

Lois M. Devlin
Office Manager
Jan. 24, 1962 –

Jo Drake
Director's Secretary
Sept. 10, 1968 –

Lucien A. File
Staff Researcher
June 15, 1962 –
Rousseau H. Flower  
Senior Paleontologist  
Sept. 1, 1951 –

Roy W. Foster  
Assoc. Petroleum Geologist  
Nov. 19, 1953 –

Paul H. Johnson  
Metallurgist  
August 1, 1966 –

Linda L. Lake  
Secretary  
June 20, 1967 – May 21, 1969

Cheryl A. LePlatt  
Secretary  
May 24, 1967 – June 10, 1969

F. Leo Misaqi  
Mining Engineer  
Sept. 28, 1962 –
Donna Peckenpaugh
Secretary
May 26, 1969 –

Robert L. Price
Draftsman
May 5, 1958 –

Teri Ray
Editor
Sept. 11, 1961 – May 2, 1969

Jacques R. Renault
Assoc. Geologist
Sept. 1, 1964 –

Dexter H. Reynolds
Res. Chemist
April 2, 1962 –

Jackie H. Smith
Lab Assistant
Dec. 16, 1963 –