New Mexico EARTH MATTERS

Summer 2005

THE NEW MEXICO BUREAU OF GEOLOGY THROUGH THE YEARS

The New Mexico Bureau of Geology and Mineral Resources has served as the state geological survey for nearly eighty years. We are a non-regulatory, research-oriented state agency and a division of the New Mexico Institute of Mining and Technology. Our focus is on fundamental geologic mapping and research in support of responsible resource development for the benefit of New Mexico's citizens. Our employees support other land- and resource-based agencies, run sophisticated analytical facilities, do collaborative research with university faculty and students, teach, and conduct geoscience outreach education for K-12 students, teachers, and the general public. We are a data repository for much of the state's geoscience information, maintaining libraries of geologic publications, petroleum and mineral well cores, cuttings, logs, and other records, and mining- and energy-related paper documents. Our publishing program serves both the professional geologic community and the general public.

Although these efforts are ongoing, our directions have shifted somewhat since our beginnings in response to the changing needs of the state and its citizens. In our formative years we concentrated primarily on hard-rock mining. The scope of our studies rapidly expanded to cover much broader areas, including applied studies on the location and quality of industrial minerals, uranium, coal, oil, and natural gas. More recently water-supply and water-quality issues have moved to the forefront in New Mexico, and we've expanded our hydrologic and geochemical efforts in those areas, as well as in areas of geologic hazards, climate change, and related topics.

A Short History of the Bureau

The New Mexico Bureau of Mines and Mineral Resources (as we were first known) was established by legislative act on March 14, 1927, as a department of the New Mexico School of Mines (as New Mexico Tech was then known). The idea of state geological surveys was not a new one. The first one was created in 1823, in North Carolina; by 1840 there were already fifteen state surveys in the U.S. Our first home was the basement of Brown Hall. Our first director, E. H. Wells, served concurrently as president of the university, a tradition that continued until John Kelly became director in 1942. For many years our director also served as state geologist, although this was not mandated by law until 1989.

Bureau geologist Shari Kelley working in exposures of Bandelier Tuff along Polvadera Creek, in the northern Jemez Mountains. Field studies continue to be an important part of our mission. Photo by Kirt Kempter.

The 1927 enabling act stated the bureau's mission very clearly and set the direction for many of our current efforts. It provided for the creation of a library and archives of information, photographs, and mineral specimens. The law charged the bureau with studying the geological formations, topography, and physical features of the state, particularly with reference to "their practical bearing upon the occupation of the people." It mandated a publishing program that would "embrace both general and detailed descriptions" of the state's geology and natural resources. Our responsibilities included the compilation and dissemination of statistics related to geology, mining, metallurgy, and the oil and gas industry. Finally, the broadly cooperative nature of our work was clearly outlined. We were instructed to work with other departments of state government, the state's universities, the U.S. Geological Survey, and the U.S. Bureau of Mines.

The initial staff consisted of the director (who was half time, given that he was also president of the university) and four part-time staff members: two geologists, a librarian, and a stenographer. Early efforts included the compilation of a bibliography of New Mexico geology, as well as field studies in Taos, Rio Arriba, and Santa Fe Counties. The years leading up to World War II saw little growth in our staff, but a number of basic geologic studies were completed and published, including bulletins on the ore deposits of Socorro and Sierra Counties, and E. H. Wells's circular on gold deposits in New Mexico.

The World War II years were difficult years for both the university and the bureau. Enrollment at the university sank to fifteen students in 1944. The bureau went through five different directors in the seven years between 1939 and 1945. By 1946 a resurgent bureau had eleven full-time employees, whose efforts were

focused mainly on mining, minerals, and oil and gas.

Over the next several years, our archives and collections continued to grow. The school's Mineral Museum already had an excellent reputation and an impressive collection. By 1927, when the bureau was created, the museum boasted a collection of over 5,000 specimens. Unfortunately both the museum and the Old Main building in which it was housed were lost in a catastrophic fire in 1928. The rebuilding of the Mineral Museum began with the help of the bureau's first director, E. H. Wells, although the museum did not formally became a part of the bureau until 1962.

In October 1949 the bureau moved out of its home in the basement of Brown Hall into new quarters in the first Workman Center (later torn down to make room for the new Workman Center). In 1955 the bureau proudly hosted the annual meeting of the Association of American State Geologists at its new building in Socorro. Fifty-one years later, we're hosting it again, in June 2006 in Santa Fe.

The 1950s saw a substantial growth in staff, due in part to an increased interest in the state's ground water resources (a serious drought in Santa Fe in 1951 was partly responsible for this interest). The 1950s also saw a growth in the bureau's paleontological collections and an increased interest in uranium resources throughout the Southwest. The bureau, in cooperation with the Atomic Energy Commission and the Bureau of Land Management, provided assistance to prospectors who descended on this part of the country. (New Mexico has significant uranium resources and reserves, second only to Wyoming in the nation.) In 1954 research contracts with the Bureau of Indian Affairs initiated geologic mapping on 484 square miles of tribal lands.

The bureau's first *Scenic Trip*, to the Santa Fe region, was published in 1955. The first *Memoir* and *Geologic Map* followed in 1956. In 1964–65 the bureau initiated geothermal studies and opened a clay resources laboratory. The Geothermal Resources Act of 1967 guaranteed an ongoing interest in the state's geothermal resources. Dr. Marshall Reiter, who came to the bureau in 1975, has contributed to these efforts for the past thirty years.

In 1971 the bureau published its first hydrologic report and resource map. This was also the year that the bureau published Memoir 25 on the coal resources of the San Juan Basin. That publication came out of a study funded by the U.S. Department of Health and Education, due to a growing concern over air quality issues related to the burning of high-sulfur coal. In 1972 the Coal Surface Mining Act created the New Mexico Coal Surface Mining Commission and determined that the bureau director would occupy a permanent place on this board. At this time there was increased focus on energy reserves. The "Atlas" program was initiated at that time. This seven-year program involved an assessment of the state's energy reserves and other mineral resources. That year the bureau acquired a new building for the New Mexico Library of Subsurface Data.

The bureau staff ca. 1949. Director Callaghan is the fourth from the left.

Frank Kottlowski, who served as director from 1974 until his retirement in 1991.

In 1974 Frank Kottlowski, who'd arrived at the bureau as an economic geologist in 1951, was appointed director. He continued to lead the bureau until his retirement in 1991 and remained an active member of the emeritus staff until his death in 2001. Under his direction the bureau grew enormously, in terms of staff, budget, responsibility, and reputation. Our permanent staff in the years between 1978 and 1990 fluctuated between fifty and sixty full-time employees.

In 1977 the Surface Mining Control and Reclamation Act (SMCRA) was passed, establishing a coordinated effort between the states and the federal government to address the remediation of abandoned mine lands, specifically abandoned coal mines. Since that time the bureau has been involved in a number of statewide cooperative efforts to inventory information on abandoned mine lands throughout the state. The New Mexico Mines Database is one result of those efforts. In the 1980s federal funding became available for coal research and mapping. It was at this time that the bureau established a coal lab. Our coal geologist Gretchen Hoffman was one of four people who came to the bureau to support that program.

The NURE program (National Uranium Resource Evaluation), adminis-

The old Workman Center, the bureau's home from 1949 until the 1990s.

tered by the U.S. Atomic Energy Commission and its successors, provided an influx of money and energy to the bureau's mapping efforts from 1974–84. The program provided funds for geologic mapping at a 1:250,000 scale. It was during this time that Dr. Richard Chamberlin joined our staff.

Dr. Charles Chapin assumed the directorship of the bureau upon Frank Kottlowski's retirement in 1991. Dr. Chapin's efforts on many fronts essentially gave the bureau the shape it has today. It was during his tenure that the bureau's geochronology laboratory was established, in cooperation with Los Alamos National Laboratory and New Mexico Tech. Dr. William McIntosh, who currently holds a joint appointment with the bureau and the Department of Earth and Environmental Science, continues to direct this important facility. Dr. Chapin also increased the focus on volcanology, more than appropriate for a state that boasts a greater diversity of volcanic features than perhaps any other state. Volcanologist Dr. Nelia Dunbar joined the bureau staff during his tenure.

It was during this time that the bureau opened the Albuquerque office (in 1992), and initiated the publication of *Lite Geology*, a popular publication directed toward state teachers. In 1993 the bureau joined the National Cooperative Geologic Mapping program (STATEMAP). Federal matching funds from this program continue to support the bureau's significant geologic mapping efforts throughout New Mexico.

In many ways, the development of the bureau and its staff has paralleled what was going on in New Mexico, and to a large extent this has reflected the changing concerns, needs, and issues of the entire country. Much of the bureau's work in the last few decades has been directed toward cooperative endeavors with the state's energy-related industries—oil and gas—as well as the mining industry, which have played such an important role in the history of New Mexico. We serve as the scientific and technical memory for these industries, and our mission and involvement is less subject to the vagaries of the commercial industry. That scientific memory is more important than ever for the oil and gas industry in the state. Seventy percent of the oil produced in New Mexico today is produced by small, independent companies, many of whom lack the data, technical expertise, and broad regional knowledge we can provide. In mining, our early efforts were focused on metals. Although copper remains an important commodity in New Mexico, our scope has expanded to include industrial minerals including potash, perlite, and sand and gravel (New Mexico is number one in the U.S. in the production of perlite, potash, and zeolites).

The Bureau Today

In 2000 Dr. Peter Scholle assumed the directorship of the bureau. On June 15, 2001, our name was changed (by legislative act) to the New Mexico Bureau of Geology and Mineral Resources, to more accurately reflect our current emphasis and responsibilities. Our mission today, in its broadest sense, follows those duties with which we were tasked in 1927 and continues to be one of research, service, outreach, and education. We continue to maintain archives of data and materials related to the mining and energy industries in New Mexico, as well as geologic data of broader interest. Geologic mapping and field studies have been and continue to be a core part of our mission. Our staff still includes economic geolo-

Name	Title	Tenure
E. H. Wells	President, School of Mines and Director	1927–1939
C. E. Needham	President, School of Mines and Director	1939–1942
R. H. Reece	Director	1942–1944
J. M. Kelly	Director	1942; 1944–1945
A. D. Haun	Acting Director	1945
E. C. Anderson	Director	1945–1949
E. Callaghan	Director	1949–1957
A. J. Thompson	Director	1957–1968
D. H. Baker, Jr.	Director	1969-1973
F. E. Kottlowski	Acting Director	1968–1969; 1973–1974
	Director	1974–1991
C. E. Chapin	Director	1991–1999
P. A. Scholle	Director	1999–present

Twelve directors have served the bureau since its inception in 1927.

The bureau staff ca. 1962. Director Alvin Thompson is in the second row, third from the right (next to Frank Kottlowski, second from right).

gists (Drs. Virginia McLemore and Virgil Lueth), an industrial minerals geologist (James Barker), a coal geologist (Gretchen Hoffman), and a petroleum geologist (Ron Broadhead). The Mineral Museum continues to draw thousands of visitors annually to the bureau. We are also trying hard to respond to the growing and changing needs of the people of New Mexico. Some of our most significant efforts today include:

The Geologic Mapping Program

Detailed geologic maps are available for only 20 percent of New Mexico. Since 1993 the federally funded STATEMAP program has allowed the bureau to pursue an aggressive geologic mapping program throughout the state, particularly in areas where there is a need. These maps are basic to all subsequent field studies, including those related to water resources and water quality, geologic hazards, mineral resources, and environmental issues. More than one hundred quadrangles (6,000 square miles) have been mapped to date, many of which are available as free downloads from the bureau's Web site.

Sean Connell in our Albuquerque office has just completed a geologic map compilation (1:50,000) of the geology of the Albuquerque Basin, from just south of San Ysidro/Zia Pueblo in the north, east to Placitas, and south as far as Tijeras Arroyo in south Albuquerque. This map will be available to the public in both printed and electronic form in the future.

Aquifer Mapping & Hydrology

The bureau's ongoing regional studies of the complex hydrogeology of New Mexico are vital to the state's future. We worked closely with the U.S. Geological Survey in providing geologic mapping and aquifer analysis essential to the development of their Albuquerque Basin water model. Peggy Johnson's 2001 report on the hydrogeology of the Placitas area provided a new understanding of this geologically complex aquifer system. The bureau is conducting similar studies in the Española Basin, the Taos region, and the Pecos River valley, in collaboration with the Office of the State Engineer. In 2005, in recognition of the value of the work that's been done and the importance of ongoing work, the state legislature appropriated $300,000 to the bureau for aquifer mapping. There is very little work we do that does not somehow contribute to our understanding of the state's water resources.

Laboratories

The bureau houses state-of-the-art laboratory facilities that serve the analytical needs of the public and support ongoing research efforts of the entire university community. These facilities include the Argon Geochronology Lab, the Analytical Chemistry Lab, the Electron Microprobe, the X-ray Fluorescence and X-ray Diffraction facilities, the Perlite Lab, the Metallurgy Lab, and the U.S. Department of Defense ICP-MS Lab at New Mexico Tech.

Education & Outreach

These two functions have been an important part of our mission since the beginning, and are no less so today. Both the Mineral Museum and our programs for New Mexico teachers are long standing. In 2001 we initiated a program of Decision-Makers Field Conferences on topics of vital interest to all New Mexicans. The 2001 conference focused on water and watershed issues in the Santa Fe region. This was followed by conferences on energy, water issues along the lower Pecos River, and mining in New Mexico. This important program will be with us for years to come.

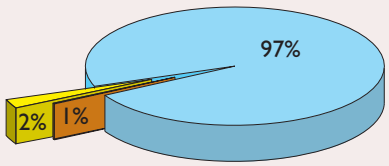
Our publishing program has expanded to include more publications of general interest, and many of our maps, technical publications, and databases are now available electronically on CD or online. We hope to continue publishing a diverse assortment of publications, in a variety of formats, with the end user in mind. Dissemination of information, to the professional geologic community and to the general public, remains a high priority for the bureau.

Our primary partner has been New Mexico Tech since our establishment in 1927. Many of our scientific staff teach and supervise graduate student research. Grant funding supports overhead at the university, as well as graduate and undergraduate students. Part-time student employees are incorporated into many of our day-to-day operations.

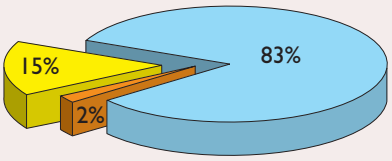
The importance of the bureau to New Mexico is perhaps greater today than it ever has been. In the years since our founding the population of New Mexico has increased five fold. The geologic studies the bureau provides are vital to continuing growth and development, and to environmental protection. We work closely with the Department of Public Safety on issues related to geologic hazards. We provide important guidance on the wise use of the state's resources, especially water. The work of the bureau brings a direct economic ben-

REVENUE
Exclusive of Grants and Contracts

State Appropriation	$	3,889,500
Carryover from Previous Year	$	8,628
Publication Sales	$	97,581



EXPENDITURES



Staff (salaries & benefits)	$	3,372,529
Operating Expenses		
Fixed	$	332,000
Variable	$	291,180
Students	$	88,747

Additional grant funding for 2004–2005 came to us from:

Bureau of Land Management
Mine Safety & Health Administration
Molycorp, Inc.
National Aeronautics and Space Administration
National Science Foundation
New Mexico Department of Public Safety
New Mexico Energy, Minerals and Natural Resources Department
New Mexico Office of the State Engineer
New Mexico State Land Office
Pecos Valley Artesian Conservancy District
Picuris Pueblo
Santa Fe County
Taos County
U.S. Army/White Sands Missile Range
U.S. Bureau of Land Management
U.S. Department of Energy
U.S. Department of Justice/Bureau of Indian Affairs
U.S. Fish & Wildlife Service
U.S. Forest Service
U.S. Geological Survey

Most of our funding comes from state appropriations, supplemented by grants from a variety of sources (listed above) and income from publication sales. Figures shown are for the period from July 1, 2004, to June 30, 2005 (our FY 2004).

efit to the state of New Mexico. In the May 12, 2003 issue of the *Oil and Gas Journal*, the editor commended Ron Broadhead's work on attracting exploration to New Mexico by developing new, unconventional plays. Ron has also been involved in studies helping small operators squeeze as much oil as possible from existing New Mexico operations. A one percent increase in production volumes from the Permian Basin of New Mexico and Texas alone could result in production of an additional one billion barrels of oil. That provides a boost not only to the private sector but to the state's tax base, a large part of which is derived from taxes on oil and natural gas production.

The very real economic benefit of the bureau to New Mexico can be measured in dollars and cents. A recent study by the Illinois Geological Survey determined that in Kentucky (the only state in the U.S. that has been completely mapped) the state saw a return of $26 for each dollar spent on geologic mapping. The enormous diversity of New Mexico resources has guided our past and will ultimately determine our future. As we continue to shape our program to match the growing and changing needs of the people of New Mexico, we hope to provide a firm scientific background for many of the crucial decisions that will be made in the years ahead.

—L. Greer Price

Greer is an associate director and chief editor at the New Mexico Bureau of Geology and Mineral Resources, where he manages the publishing program.

Many thanks to George Austin, Ron Broadhead, Nelia Dunbar, Bob Eveleth, Gretchen Hoffman, Marshall Reiter, and Peter Scholle, all of whom offered their own insights on the bureau's history for this article.

Visit Our Web Site

For a wealth of information on the bureau, its staff, and additional resources including geologic tours of New Mexico, information on our laboratory facilities, free downloads of digital geologic maps, and our complete publications catalog, visit our Web site at www.geoinfo.nmt.edu

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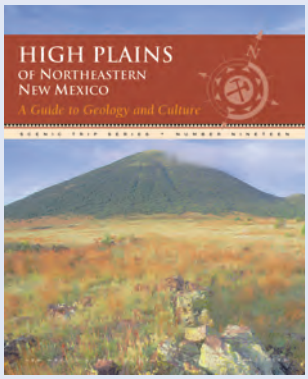
New Publications



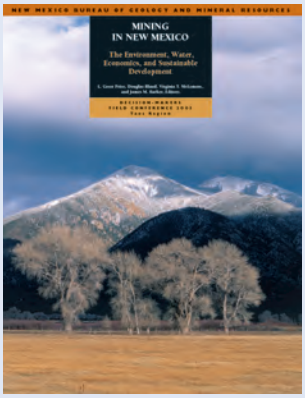
Scenic Trip 19—High Plains of Northeastern New Mexico: A Guide to Geology and Culture, by William R. Muehlberger, Sally J. Muehlberger, and L. Greer Price, 2005, 110 pp., color throughout, ISBN 1-883905-20-6. $14.95 plus shipping and handling.

This is the newest Scenic Trip to be published by the bureau. In addition to two introductory chapters (on Volcanoes of Northeastern New Mexico *and* The Geologic History of Northeastern New Mexico*), the book contains four detailed road logs from Raton to Clayton.*

The northeast corner of New Mexico is home to the largest volcanic field east of the Rocky Mountains and encompasses some of the most attractive scenery in the Southwest, including Johnson Mesa, the Dry Cimarron River, and Capulin Mountain, one of the most beautifully preserved cinder cones in the U.S.

As well as the discussion on volcanism, the book examines the Mesozoic strata exposed in this part of New Mexico, including the Cretaceous–Tertiary boundary in the Raton Formation, exposed on Goat Hill outside Raton, and the dinosaur trackways exposed in sandstones near the spillway at Clayton Lake.

Like others in the series, this book contains information on the rich cultural heritage of the region, including the Santa Fe Trail and the Folsom site, one of the most significant Paleo-Indian sites in North America. This book provides a look at one of the least visited parts of New Mexico, giving the reader a new appreciation for this corner of the state.



Mining in New Mexico—The Environment, Water, Economics, and Sustainable Development, edited by L. Greer Price, Douglas Bland, Virginia T. McLemore, and James Barker, 2005, 176 pp., color throughout, ISBN 1-883905-22-2. $15.00 plus shipping and handling

Mining has played a significant role in the history and development of New Mexico and continues to play an important role in the state's economic prosperity. The future of this industry will depend upon achieving a balance between our needs and desires, the changing economy, and our growing concern over environmental and social issues. This anthology of 30 articles is a timely look at some of those science and policy issues, including:

- *The geology and landscape of the Taos region*
- *Watershed protection and restoration in New Mexico*
- *Mineral and aggregate resources in New Mexico*
- *An overview of the regulatory framework in New Mexico*
- *Abandoned mine lands issues*
- *Financial assurance and bonding*
- *Sustainable development*

Produced in conjunction with the fourth Decision-Makers Field Conference held in Taos in May 2005, this volume provides a broad overview of issues that go beyond mining in New Mexico.

For more information about these and other bureau publications: visit our Web site at geoinfo.nmt.edu; write or visit our Publications Office on the campus of New Mexico Tech, 801 Leroy Place, Socorro, New Mexico 87801; call (505) 835-5490 or e-mail us at pubsofc@gis.nmt.edu. Payment (check or money order payable to NMBGMR) must be enclosed with mailed orders. Telephone orders may be paid with VISA, Discover, American Express, or MasterCard.

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