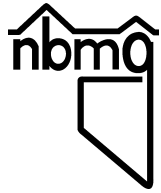


# Biennial Report of the



# Nevada Bureau of Mines and Geology



**2006**



University of Nevada, Reno  
College of Science  
Mackay School of Earth Sciences and Engineering



# Nevada Bureau of Mines and Geology



**Jonathan G. Price, State Geologist and Director**

## **Scientific Research Staff**

### **Economic Geology, Geologic Mapping, and Geologic Framework**

Stephen B. Castor, Research Geologist - mineral deposits & mineralogy  
James E. Faulds, Research Geologist - structural geology, tectonics, & paleomagnetism  
Larry J. Garside, Research Geologist - volcanic stratigraphy & energy resources  
Christopher D. Henry, Research Geologist - volcanic stratigraphy & geochronology  
John Muntean, Research Economic Geologist/Assistant Research Professor – joins staff on 1 January 2005

### **Geologic Hazards, Engineering Geology, and Geophysics**

John W. Bell, Research Engineering Geologist - Quaternary stratigraphy & urban geology  
Geoffrey Blewitt, Research Professor - geodesy & geodynamics  
Bret Pecoraro, Development Technician II - technical support on analytical & geodetic equipment  
Corné Kreemer, Assistant Research Professor – geodesy & geodynamics  
Hans-Peter Plag, Research Professor – geodesy & geodynamics  
William Hammond, Assistant Research Professor – geodesy & geodynamics  
Craig M. dePolo, Research Geologist - earthquake geology & neotectonics  
P. Kyle House, Research Geologist - fluvial geomorphology & paleohydrology  
Alan R. Ramelli, Research Geologist - neotectonics & Quaternary stratigraphy

### **Environmental Geology and Hydrogeology**

Paul J. Lechler, Chief Chemist/Geochemist - analytical geochemistry & precious metals  
Lisa Shevenell, Research Hydrogeologist - hydrogeology & geothermal resources

### **Science Education**

Daphne D. LaPointe, Research Geologist - science education & mineral deposits

## **Support Staff**

### **Cartography and Publications Support**

Elizabeth Crouse, Publication Manager & Chief Cartographer - cartography & publishing  
Christine Arritt, Cartographer – cartography, GIS, & drafting  
Jack Hursh, Jr., Cartographer - drafting & publication design  
Gary Johnson, Information Systems Specialist - GIS & systems administration  
Jennifer Mauldin, Cartographer – cartography, drafting, & publication design  
Kris R. Pizarro, Cartographic Supervisor - cartography, drafting, & publication design  
Richard O. Meeuwig, Editor - editing, publication design, & Web-site management

### **Analytical Laboratory**

Mario Desilets, Chemist and Quality Assurance Officer - analytical geochemistry

### **Information and Publication Sales**

David Davis, Geologic Information Specialist - Nevada geology & mining history  
Martha Henson, Administrative Assistant II - document scanning & publication sales backup  
Ron Hess, GIS Supervisor - GIS, remote sensing, & systems administration  
Charlotte Stock, Sales Manager - publication sales & administrative support

### **Administration**

Terri M. Garside, Program Officer I - finance, contract management, & administration  
Monique Smith, Administrative Assistant II - administration

For more information about NBMG, please check the Web ([www.nbm.unr.edu](http://www.nbm.unr.edu)).

**NEVADA BUREAU OF MINES AND GEOLOGY**

**OPEN-FILE REPORT 06-20**

**Biennial Report of the Nevada Bureau of Mines and Geology**

**2006**

Jonathan G. Price  
State Geologist and Director

PREPARED FOR

**The Board of Regents of the  
Nevada System of Higher Education**

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### Cover photograph:

Quaternary fault that displaces gravels (white) against Paleozoic sedimentary rocks (red) along a haul road at the Bald Mountain gold mine. The photograph was taken during field review of NBMG Map 145, *Geologic map of the Big Bald Mountain Quadrangle and part of the Tognini Spring Quadrangle, White Pine County, Nevada*, authored by Constance J. Nutt of the U.S. Geological Survey and Kerry S. Hart of Placer Dome. Mapping of Quaternary faults (ones that have moved within the last 1.8 million years) is critical to understanding earthquake hazards in Nevada.

**Biennial Report of the  
Nevada Bureau of Mines and Geology  
2006**

**EXECUTIVE SUMMARY**

The Nevada Bureau of Mines and Geology (NBMG) is a research and public service unit of the University of Nevada, Reno and is the State geological survey. Established by the Nevada Legislature as a department within the public service division of the Nevada System of Higher Education, NBMG is part of the Mackay School of Earth Sciences and Engineering within the College of Science and one of the Statewide Programs at the University of Nevada, Reno. NBMG's mission, to provide the State's needs for geological and mineral-resource information and research, is defined in its enabling legislation. NBMG scientists conduct research and publish reports that focus on the economic development, public safety, and quality of life in urban and rural areas of Nevada.

**NBMG Research Programs Addressing Critical Issues Facing Nevada**

**Urban Growth - Natural Hazards and Economic Stability**

- Earthquakes and volcanic hazards
- Floods
- Subsidence and fissures due to groundwater withdrawal
- Swelling and collapsing soils, landslides, and other ground failures

**Mineral, Energy, and Water Resources Vital to Economic Expansion**

- Precious metals
- Base metals
- Industrial minerals, including construction raw materials
- Geothermal energy
- Petroleum and natural gas
- Groundwater resources

**Environmental Concerns**

- Nuclear waste
- Mercury and other chemical hazards from historical mining
- Future of pit-lake water quality and other aspects of modern mining
- Groundwater quality
- Radon in air

This report provides details on the activities of NBMG scientists and support staff during the past two years. The University of Nevada, Reno is strategically planning for the future, and this report incorporates key elements of NBMG's strategic plan for the next five to ten years. As indicated in the lists of publications, research grants, and other professional activity, NBMG has been highly productive and expects to be even more valuable to the State of Nevada in the future. Planning is underway for construction of a new facility for geologic samples and for NBMG's publication sales and information office; along with the conversion of paper records to digital formats, the new Great Basin Science Sample and Records Library promises to provide excellent service to NBMG stakeholders. In accordance with Nevada Revised Statute 514.070, which calls for a biennial report on NBMG activities, it is my pleasure to transmit this report on behalf of the NBMG staff.

Jonathan G. Price  
State Geologist and Director

## INTRODUCTION

NBMG scientists conduct research and publish reports on mineral and energy resources, engineering geology, environmental geology, earthquakes and other hazards, groundwater, and geologic mapping in Nevada. The maps and geologic reports produced by NBMG provide basic information used by a broad spectrum of individuals, including engineers involved in construction, conservationists, exploration geologists, miners, highway planners, urban planners, historians, students, professors and K-12 teachers, tourists, and Nevadans enjoying outdoor recreation.

In addition, NBMG provides special services in the areas of analytical geochemistry and assay standards, mineral and rock identification, sample curation, earth-science education and in-service teacher training, continuing education for professional geoscientists, geologic and geotechnical information, mineral- and energy-resource information, geographic information systems, electronic databases, and historical information, particularly regarding mining and natural hazards. NBMG works closely with many local, state, and federal agencies. Considerable information about NBMG can be found on the Web ([www.nbmng.unr.edu](http://www.nbmng.unr.edu)).

Major research projects are being conducted throughout Nevada. Geologic maps are being produced in areas that will be undergoing urban and suburban development, in areas where environmental concerns are most critical, and in areas where the potential is high for the development of mineral and water resources. It typically takes one to two person-years of effort to complete each 7.5-minute (1:24,000-scale) quadrangle. These maps provide the basis for nearly all geological research and for many engineering applications. Significant hazards in southern Nevada include flash floods, subsidence and related open cracks in the ground (fissures), swelling and collapsing soils, and earthquakes. In northwestern Nevada, earthquake, landslide, flood, and soil-condition hazards dominate, but other concerns, including locally high concentrations of naturally occurring radon and arsenic, are also best understood from a basis of geologic maps. Geologic mapping in the Humboldt River basin is contributing to knowledge about how the river has responded to past changes in climate and stream flow, which is important information in understanding how mine dewatering may affect the river and local ecology. Geologic mapping in northeastern Nevada is also revealing much about the origin of the gold deposits that have made Nevada the nation's foremost gold-producing state and the United States the second leading producer of gold in the world.

Research on land subsidence in Las Vegas Valley provides valuable information about the rates of subsidence resulting from groundwater withdrawals and the development of fissures that can cause considerable damage to buildings. NBMG researchers, in collaboration with other experts, are using the most current technologies to attack this problem—geodetic measurements using the global positioning system (GPS) and interferometry using synthetic aperture radar (InSAR), a remote-sensing technique. NBMG is also evaluating concerns regarding subsidence and fissures in other desert valleys, where groundwater is being pumped to supply the needs of expanding populations or for mines.

NBMG and Nevada Seismological Laboratory scientists assess earthquake hazards throughout the State. NBMG geologists evaluate the geologic record for evidence of prehistoric earthquakes. There is abundant evidence that nearly all parts of Nevada have experienced earthquakes with magnitudes in excess of 6.5 during the last several hundred thousand years. NBMG's research complements the work of the Nevada Seismological Laboratory, which monitors earthquakes ranging from magnitudes less than one to the largest earthquakes in the world. From historical and instrumental records, we know that Nevada experiences a magnitude 7.0 or greater earthquake about once every 30 years. The largest earthquakes yet recorded in the State, the magnitude 7.3 to 7.8 event in Pleasant Valley near Winnemucca, occurred in 1915. The last magnitude 7 earthquake was at Fairview Peak near Fallon in 1954. Much more needs to be done, scientifically and in outreach to the public, to reduce the risks from natural hazards.

Floods along major streams and flash floods along normally dry washes are all too common phenomena in Nevada. NBMG research is helping to understand the frequency and severity of past floods. Efforts are underway in southern, northwestern, and north-central Nevada to determine the timing, magnitude, and frequency of these events.

Geological aspects of waste disposal are being addressed with the aid of geologic maps, which are essential in understanding groundwater flow at and away from all sites, including landfills and radioactive waste sites. Other important considerations regarding nuclear waste issues that are being addressed by NBMG investigations include tectonic strain and related earthquake and volcanic hazards and the potential for mineral-resource development.

Mineral-resource assessments are routinely needed by federal agencies with land-management responsibilities. NBMG scientists with expertise in economic geology have contributed to resource assessments by the Bureau of Land Management, Department of Defense, Department of Energy, Fish and Wildlife Service, and U.S. Geological Survey. NBMG has also evaluated environmental concerns about mining, such as potential acid-mine drainage and associated release of potentially toxic elements from abandoned and inactive mines; mercury pollution from the early days of mining on the Comstock and elsewhere, when amalgamation was the preferred method of extracting gold and silver from the ores; and predicting the future chemistry of pit lakes when modern-day open pits fill with water after mining stops.

NBMG publishes many maps and reports that assist in the exploration for and environmentally sound development of mineral, energy, and water resources. NBMG publishes geologic maps that are produced not only by NBMG geologists but also by geologists from industry and at universities throughout the world. The maps and reports are reviewed by peers with knowledge about the local geology.

NBMG scientists also routinely publish in peer-reviewed, internationally recognized scientific journals. NBMG scientists have fine reputations within the scientific community, and several have won awards for their extraordinary contributions. NBMG's research projects are led by teams with broad expertise in the geological sciences and geography. The geodesy team has made significant contributions to global geophysics and space science while also focusing on issues critical to Nevada. The scientists' efforts are supported by an excellent staff in the areas of cartography, drafting, geographic information systems (GIS), editing, publication design, analytical services, publication sales, information, technology, finance, and administration.

NBMG has leadership roles in several statewide efforts. NBMG, along with the Nevada Seismological Laboratory, provides operational support for the Nevada Earthquake Safety Council (with funding from a Federal Emergency Management Agency grant that is passed through the Nevada Division of Emergency Management). The Nevada Earthquake Safety Council facilitates public input, develops consensus about seismic issues within the public and private sectors, and is the public advisory body for State seismic policy and the Nevada Earthquake Risk Reduction Program of the Division of Emergency Management. The Board of Directors of the Council, which votes on policy recommendations, has 22 members, from both southern and northern Nevada, representing business and industry; city, county, and state agencies, including the Assembly and Senate; geosciences; engineering; community organizations; universities; building officials; insurance; and primary-secondary education. The Council has made significant progress in improving earthquake awareness and preparedness, largely through a number of activities supported by NBMG and the Seismological Laboratory.

The Director, Jon Price, chairs the State Mapping Advisory Committee (SMAC), and NBMG's Geographic Information Systems (GIS) Supervisor, Ron Hess, serves as its executive secretary. In the early 1980s the Governor named the NBMG Director as the chair of SMAC. SMAC provides input to the United States Geological Survey on issues related to updating topographic maps, digital map products used in GIS, and geologic mapping. The Geologic Mapping Subcommittee of SMAC helps set priorities for geologic

mapping according to the National Cooperative Geologic Mapping Program. Membership in SMAC is open to Nevada representatives of local, state, and federal agencies, universities, and individuals from the private sector with interests in mapping. SMAC's efforts in coordinating requests to the U.S. Department of Interior have helped make many new digital products available, including new statewide digital aerial photographs.

Jon Price also chairs the Nevada Hazard Mitigation Planning Committee, which advises the Division of Emergency Management on the allocation of funds set aside by the Federal Emergency Management Agency for mitigation of future disasters. Because NBMG has considerable expertise in geological hazards (particularly floods, earthquakes, landslides, subsidence, and other unstable ground conditions), NBMG has much to contribute to the efforts of reducing risks from natural disasters.

The Nevada State Board on Geographic Names, which was established by the Legislature to coordinate and approve geographic names within the State for official recommendation by the United States Board on Geographic Names, is chaired by Susan Tingley, NBMG's Emeritus Publication Manager and Chief Cartographer. The State Board has representation from NBMG, faculty of the University of Nevada, Reno and the University of Nevada, Las Vegas, the State Library and Archives, State Department of Transportation, State Department of Conservation and Natural Resources, Nevada Historical Society, U.S. Bureau of Land Management, U.S. Forest Service, and the Inter-Tribal Council of Nevada, Inc. Officially recognized geographic names must be approved by both the State and U.S. Boards.

## **STATUTORY MANDATES**

Please refer to Appendix B for the wording of NBMG's statutory mandates under NRS 514 (establishing NBMG and its mission), NRS 396 (concerning the analysis of ores, minerals, soil, and water submitted by residents of Nevada), NRS 327 (concerning the Nevada State Board on Geographic Names), NRS 519A (concerning fees collected by the Nevada Division of Environmental Protection to fund cooperative agreements between NBMG and the U.S. Geological Survey), NAC 522 (concerning responsibilities to archive samples and records from oil and gas wells), NAC 534A (concerning responsibilities to archive samples and records from geothermal wells), and 43 USC Sec. 31c (concerning requirements for participation in the National Cooperative Geologic Mapping Program).

### **Addressing Nevada's Critical Needs - Economic Development**

Geologic maps and related reports on applied research are excellent incentives for economic development. As an example, geologic mapping and related interpretation of the regional geological structures were an integral part of the discovery of the Carlin gold deposit in 1961. In the last 25 years, mining companies in Nevada have produced tens of billions of dollars worth of gold and silver from deposits of this type and have directly and indirectly provided high-paying jobs for tens of thousands of Nevadans. There is still much mineral wealth to be found in Nevada, particularly buried under volcanic rocks and alluvium in basins between the mountain ranges. In 1988, we estimated that the undiscovered mineral resources in Nevada were likely to have a value in the range of \$120 billion to \$1.2 trillion, and those figures still provide a reasonable estimate of the untapped mineral wealth of Nevada.

Geologic maps in urban areas help businesses avoid unstable areas (such as active faults and locations prone to liquefaction during earthquakes, flash floods, landslides, subsidence, and swelling soils) and help to protect valuable groundwater resources. Approximately 20% of the State is geologically mapped at a scale that is adequate for most applications in mineral, energy, and water resources; hazards; and environmental protection. At our current rate of production, including NBMG programs that encourage more geologic mapping by individuals from the U.S. Geological Survey, universities, and the private sector, we have several decades of work ahead of us in geologic mapping alone. A fact sheet explaining



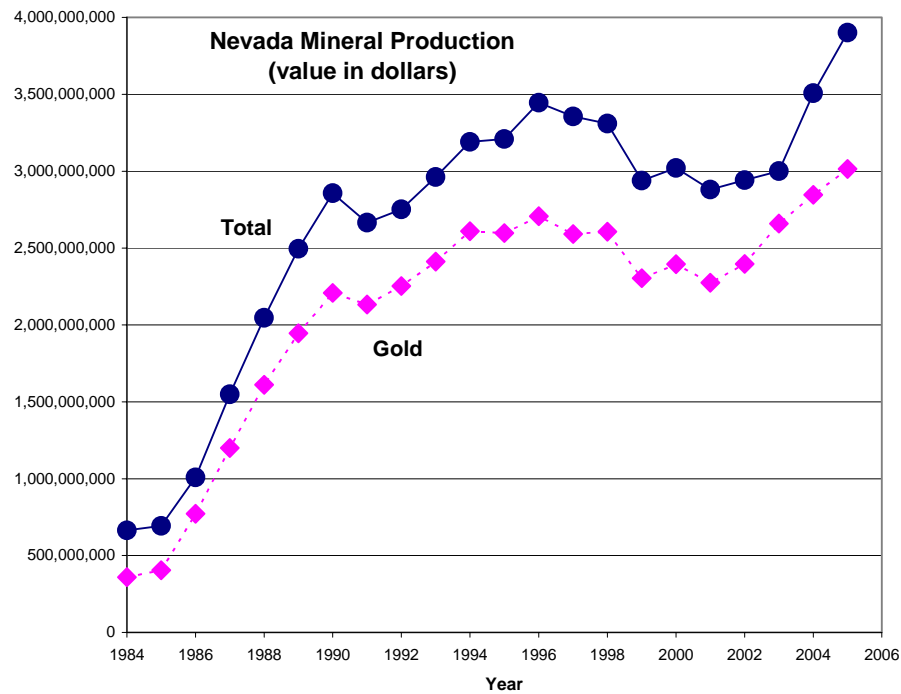
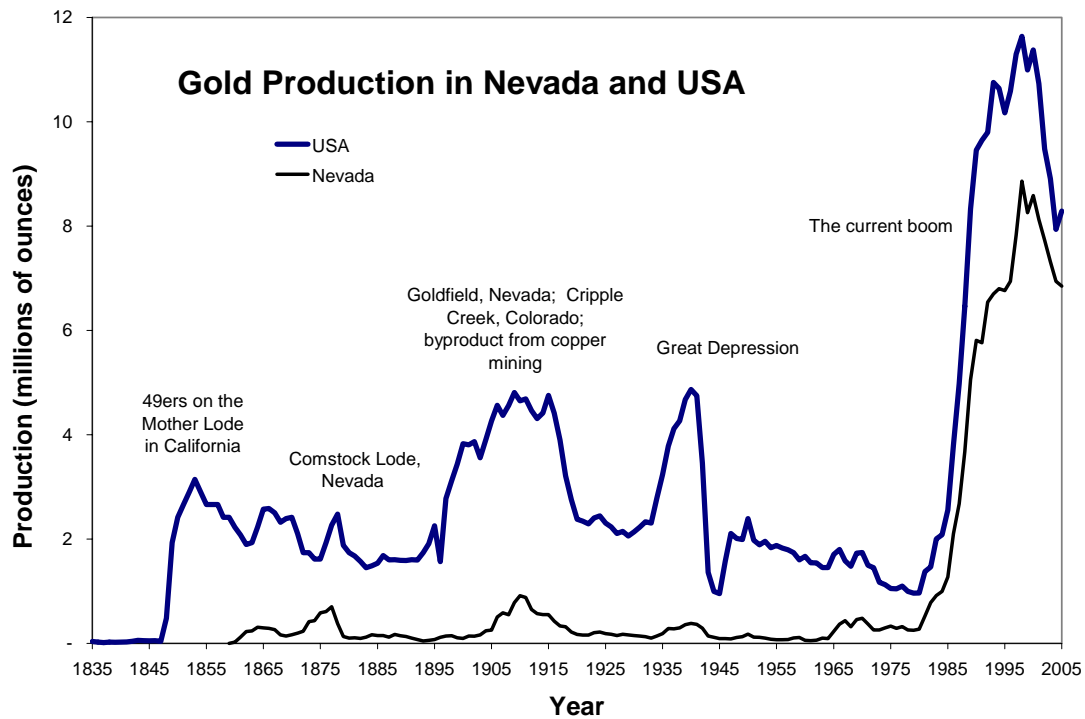
the work in Nevada through the National Cooperative Geological Mapping Program is appended at the end of this report.

Another activity that relates to economic development is the storage of records and rock and ore samples from various locations throughout the state. These are exceptionally valuable, in some cases practically irreplaceable, samples needed in exploration for mineral, oil and gas, geothermal, and groundwater resources. Through regulations of the Commission on Minerals Resources and the Division of Minerals, NBMG stores cuttings, core, and paper records from oil and gas and geothermal wells drilled in Nevada. NBMG also stores selected, representative samples of ores and typical rocks from active and inactive metal and industrial mineral mines.

We are pleased to report the initial stages of building the Great Basin Science Sample and Records Library. Phase I, funded by the U.S. Department of Energy in federal fiscal year 2006 at a level of \$3.465 million, covers construction of approximately 9,000 square feet of a building that was planned to have a footprint of 15,000 square feet. We are proposing Phase II of the Great Basin Science Sample and Records Library at a level of \$5,000,000. With Phase II, we will complete construction of the planned facility and undertake a three-year effort to capture digital data and acquire critical physical samples. The building will be on the Reno campus of the Desert Research Institute, which shares in the need for this type of facility. Construction, which will take approximately one year, is scheduled to begin in the spring or summer of 2007. The building will be staffed by the current NBMG publication sales and information office. Customers should find parking more convenient than on the University of Nevada, Reno campus.

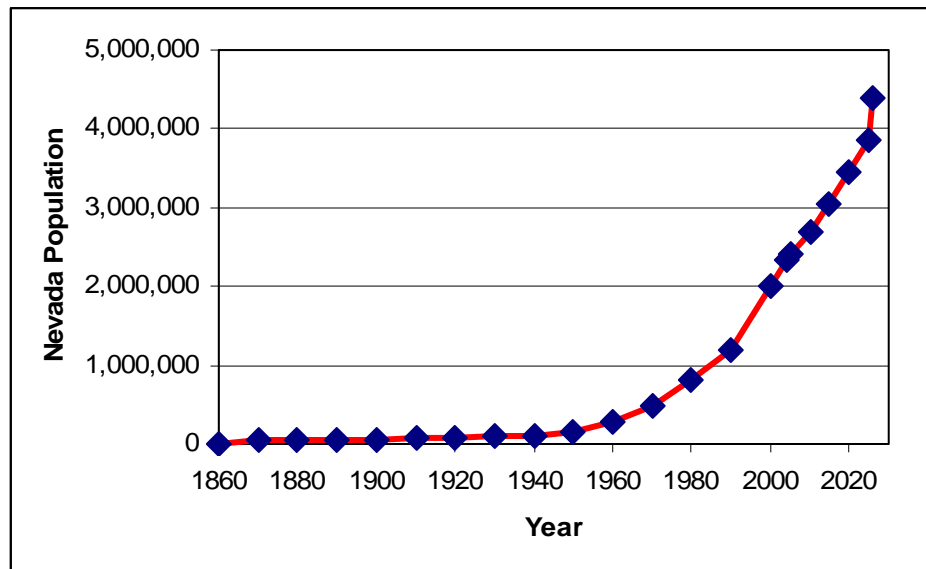
An exciting area for NBMG has been the move toward making information available free on line. We do not see the end of the era of paper maps and reports, but we do see tremendous benefits to an expanding array of users who get information on the Web. Thanks in large part to a generous donation from Mrs. Ann Burgess, the Jay A. Carpenter Fund was established in honor of her grandfather, former Director of the Nevada Bureau of Mines and Geology. This donation is being used to help convert large maps and other documents in the NBMG Information Office files into digital formats for posting on the Web. The information helps stimulate exploration for mineral and energy resources and is useful in a wide array of environmental and public safety applications.

We are in the midst of the biggest gold-mining boom in American history. Nevada accounts for approximately 83% of current annual production of gold in the United States and 9% of the world production. Value of mineral production in Nevada reached a record of \$3.9 billion in 2005. (Data are from NBMG, the Nevada Division of Minerals, and the U.S. Geological Survey.) A resurgence in the price of gold has resulted in increased exploration activity, which should help sustain the boom for at least 20 more years.



## Addressing Nevada's Critical Needs - Natural Hazards and Economic Stability

NBMG's urban-area geologic hazard investigations, particularly studies of earthquake hazards, land subsidence due to groundwater withdrawal, and flash-flood hazards, help all businesses be better prepared for natural disasters. Nevada's gaming economy would suffer greatly if we were not able to rapidly recover from a major disaster, such as an urban earthquake. NBMG goes well beyond the identification of geologic hazards on maps and in technical reports; we also publish planning scenarios for major disasters and a series of maps, pamphlets, brochures, and Web pages geared toward the general public. As an example, since its publication in 1996, NBMG Special Publication 20 (*Planning Scenario for a Major Earthquake in Western Nevada*) has been used repeatedly in emergency management, response, and recovery exercises by local, state, and federal officials. The probability of a magnitude 6 or greater earthquake occurring in the Reno-Carson City area within the next 50 years is significant - between 34 and 98%. A major earthquake would likely cause billions of dollars in damage and economic loss. Another major disaster for which we can be better prepared is flooding on alluvial fans. As Nevada's population has grown, much of the development has moved onto alluvial fans, unfortunately not always with full knowledge of the flash-flood hazards. Geologic mapping and careful evaluation of the frequencies and extents of past floods seen in the geologic record are critical to reducing the risks from these hazards.



Nevada's population will continue to rise. This will place demands on geological and other natural resources and heighten concerns regarding risks from natural hazards and environmental issues, particularly in urban areas. (Data are from the U.S. Census Bureau; the projection to 2026 is from the Nevada State Demographer.)

## Addressing Nevada's Critical Needs - Education and Services for the Public

NBMG produces many scientific publications that are used in schools. A part-time, only partially State-funded effort at NBMG is dedicated to getting these materials in the hands of teachers. Sometimes the materials are translated to formats that are more useful in the classroom, including posting them on the Web. NBMG staff members have been involved in the writing of the Nevada and National Science Education Standards, and we produce standards-based content material that can be used in schools. NBMG staff members regularly participate in the highly effective and popular teacher-education workshops that are sponsored by the Nevada Mining Association and jointly supported by the Nevada Division of Minerals. In addition, NBMG staff members help coordinate field trips and other activities for the public

and for K-12 teachers and students during Earth Science Week (second full week of October) and Earthquake Awareness and Preparedness Week (late February or early March), and staff scientists often judge science fairs. NBMG also produces some publications specifically for the general public, such as our popular field guides on the geology and natural history of the Las Vegas, Reno-Carson City-Lake Tahoe regions, and U.S. Highway 50. A similar book on U.S. Highway 93 is in the final stages of preparation, and long-term plans include books for Highways 95 and 6 and Interstate 80.

NBMG has direct contact with the public through several venues, including thousands of customers each year visiting its Publication Sales Office and its Information Office (open Monday through Friday), participation in exhibitions, Earth Science Week, Earthquake Awareness and Preparedness Week, and lectures at local schools and civic organizations. Frequently, professional staff members assist individual citizens with issues related to their personal property, such as location of groundwater wells, septic systems, faults, or soil stability. Increasingly, NBMG is reaching more of the public through its Web sites. Because many of the products that NBMG produces are heavily used by geological and engineering professionals, NBMG staff also make good efforts to participate in activities of the geological and professional organizations in the State, particularly the Geological Society of Nevada, Nevada Petroleum Society, Geothermal Resources Council, and local meetings of the Association of Engineering Geologists, American Institute of Professional Geologists, and Society for Mining, Metallurgy, and Exploration.

The following table provides some measures of workload in sales of publications (according to NRS 514.070), analytical services (according to NRS 396.600), and numbers of customers served by the NBMG Information Office and by NBMG scientists.

Year	Publication Sales <sup>1</sup>	Analytical Services	Information Office Customers Served <sup>3</sup>		
			Walk-in	Telephone <sup>2</sup>	E-mail
1998	\$134,987	\$20,655	1,067	1,423	142
1999	128,816	15,843	1,166	1,555	139
2000	160,240	15,116	1,051	1,401	232
2001	150,143	41,181	1,002	1,336	459
2002	130,675	65,399	905	1,204	271
2003	151,321	27,910	857	1,140	257
2004	152,452	37,925	788	1,049	271
2005	128,212	28,956	1,036	1,374	311

<sup>1</sup> These figures include sales of NBMG maps, bulletins, reports, electronic files on discs, and photocopies of open-file reports, topographic maps, and related items. The figures are updated from the last report using NBMG records

<sup>2</sup> Counts of walk-in customers and e-mail inquiries are kept; telephone inquiries are estimated to be about four for every three walk-in customers. Records of numbers of informational inquiries directed to individual scientists are not kept; these are estimated to be approximately 550 per year.

<sup>3</sup> Numbers do not reflect customers who are increasingly serving themselves through the NBMG Web sites.

NBMG has developed a user-friendly site for sale of publications on the Web (at [www.nbmng.unr.edu/sales.htm](http://www.nbmng.unr.edu/sales.htm)). Considerable information for teachers, the general public, and technical professionals is available for free on the Web. Many publications, including most new geologic maps and reports, are available in their entirety on the Web, and good progress is being made toward putting the non-copyrighted items in the NBMG Information Office on the Web. NBMG does not make a profit on its publication sales; revenues generated from the sales go into a revolving fund that helps pay for the production, printing, and sales of future maps and reports.

## ACTIVE PROJECTS IN 2004 AND 2005

The following is a list of active projects at the Nevada Bureau of Mines and Geology (NBMG). Titles of funded projects are listed, followed in parentheses by the names of the principal investigators. The projects are funded by a variety of federal, state, and local agencies and the private sector. Although many individual projects listed below will result in maps, reports and other publications with multiple uses, the projects are listed in this table by their intended primary applications. Please note that geologic maps and most projects in basic science that underpins applications generally have many uses; the typical geologic map in Nevada has applications in earthquake, flood, and land-surface stability hazards; mineral and water resources; and environmental protection. As publications are released, they will be posted on the NBMG Web site ([www.nbmng.unr.edu](http://www.nbmng.unr.edu)) or, for external publications in the scientific literature, listed in the next NBMG Biennial Report (also available on the NBMG Web site). Feel free to contact the NBMG principal investigators to find out more about the status of these projects.

### URBAN GROWTH - NATURAL HAZARDS AND ECONOMIC STABILITY

- **Earthquakes**

- Compilation of Effects and Analysis of Several Major Historical Earthquakes in Nevada  
(Craig dePolo)
- Determination of Fault Slip Rates, Paleoearthquake History, and Segmentation of the Warm Springs Valley Fault System  
(Craig dePolo and Alan Ramelli)
- Earthquake Mitigation Plans for Nevada  
(Craig dePolo)
- Earthquake Mitigation Workshop  
(Craig dePolo)
- Earthquake Risk Mitigation in Nevada  
(Craig dePolo, Jon Price; John Anderson and Diane dePolo, Nevada Seismological Laboratory)
- Effects and Analysis of Several Major Historical Earthquakes in Nevada  
(Craig dePolo)
- Geologic Mapping in the Pah Rah Mountain Quadrangle  
(John Bell and Kyle House)
- Geologic Mapping of the Southern Half of the Seven Lakes Mountain Quadrangle  
(Chris Henry, Alan Ramelli, and Jim Faulds)
- Hazards GIS  
(Ron Hess)
- Nonstructural Earthquake Mitigation Outreach  
(Craig dePolo)
- Paleoseismic Investigation of the Mohawk Valley Fault Zone, Sierra County, Northeastern California  
(Tom Sawyer, Rich Briggs, and Alan Ramelli)
- Paleoseismic Studies along the Eastern Carson Valley Fault System  
(Craig dePolo)
- Paleoseismic Studies of the Little Valley Fault  
(Alan Ramelli)
- Quantifying seismic hazard uncertainty in the Reno-Carson metropolitan region  
(John Anderson and others, Nevada Seismological Laboratory, Alan Ramelli)
- Seismic History of the Mead Lake Slope fault  
(Wanda Taylor, UNLV, and Craig dePolo)
- State of Nevada HAZUS-MH Planning (loss-estimation modeling for earthquakes and other hazards)  
(Christine Arritt and Gary Johnson)
- The Economic Cost of Historical Earthquakes in Nevada  
(Craig dePolo)

Upgrade and Enhancement of HAZUS Nevada Fault Database

(Craig dePolo and Ron Hess)

1954 Earthquake Sequence Damage and Response

(D.D. La Pointe and Craig dePolo)

- **Floods**

Application of MASTER, ASTER, and Landsat 7 Data and Technology to Ongoing Geologic Mapping Projects at the Nevada Bureau of Mines

(Ron Hess, Kyle House, and Steve Castor)

Funding for the Nevada Hazard Mitigation Planning Committee

(Jon Price)

Geologic Mapping in the Mt Manchester Quadrangle

(Kyle House and John Bell)

Geologic Mapping in the Spirit Mountain SE Quadrangle

(Kyle House and John Bell)

Quaternary Geologic Mapping of the Desert, Hidden Valley, McCullough Pass, and Roach Quadrangles (Kyle House and Alan Ramelli)

Surficial Geologic Mapping and Piedmont Flood Hazard Assessment in the Ivanpah Valley I-15 Corridor, Clark County, Nevada

(Kyle House, Alan Ramelli, and John Bell)

Virgin River Flood Hazard Mapping

(Kyle House)

- **Subsidence and Fissures due to Groundwater Withdrawal**

Aquifer Deformation Using GPS

(Geoff Blewitt and John Bell)

Development and Transfer of InSAR and GPS Applications to Local Government in Nevada

(John Bell and Geoff Blewitt)

InSAR-Based Aquifer Deformation Maps for Subsiding Groundwater Basins in Southern Nevada

(John Bell and Falk Amelung, University of Miami)

Subsidence Studies in the Pumpnickel-Kelly Creek Basin Area

(John Bell)

## **MINERAL, ENERGY, AND WATER RESOURCES VITAL TO ECONOMIC EXPANSION**

- **Precious and Base Metals**

Digital Compilation of Geologic Maps of the Carlin Trend

(Ron Hess and Gary Johnson)

Geologic Mapping of the Flowery Peak Quadrangle

(Steve Castor and Kyle House)

Geology and Gold Deposits of the Jerritt Canyon District

(John Muntean and Chris Henry)

Mining Cooperative Fund Research

(Jon Price)

Research at Turquoise Ridge

(John Muntean)

Significant Mineral Deposits of Nevada, Compilation and Revision of the U.S. Geological Survey's Database

(D.D. La Pointe)

Geology of the Caetano Caldera and its Relationship with the Ore Deposits near Cortez

(Chris Henry, David John and Joe Colgan, USGS)

- **Industrial Minerals, including Construction Raw Materials**

Geologic Mapping in the Fernley East Quadrangle

(Jim Faulds, Alan Ramelli, and John Bell)

Minerals of Nevada

(Steve Castor)

Southern Nevada Area of Critical Environmental Concern Mineral Evaluation Project

(Steve Castor)

- **Geothermal Energy**

Expanding Geothermal Resource Utilization in Nevada through Directed Research and Public Outreach

(Lisa Shevenell)

Exploration for Concealed Structures at Desert Peak using Mercury Soil Gas Detectors

(Paul Lechler)

Exploratory Drilling Program to Evaluate the Lifetime and Current Potential of the Humboldt House

Geothermal System, Pershing County, Nevada

(Gina Tempel, Department of Geological Sciences and Engineering, Lisa Shevenell, Richard Ellis, A. Waibel, and John Barta)

Florida Canyon Geothermal System

(Gina Tempel, Department of Geological Sciences and Engineering, and Lisa Shevenell)

Geochemical Sampling of Thermal and Non-thermal Waters in Nevada: Evaluation of Geothermal

Resources for Electrical Power Generation and Direct-use Applications

(Lisa Shevenell and Larry Garside)

Geologic and Geophysical Analysis of the Desert Peak-Brady Geothermal Fields

(Jim Faulds, Gary Oppliger, Department of Geological Sciences and Engineering, and Larry Garside)

Geothermal Assessment of Pyramid Lake Paiute Reservation Lands

(Lisa Shevenell; Mark Coolbaugh and Gary Oppliger, Department of Geological Sciences and Engineering; Jim Faulds; Wendy Calvin, Department of Geological Sciences and Engineering, and John Louie, Nevada Seismological Laboratory)

Geothermal Assessment of Salt Wells

(Jim Faulds)

Great Basin Geothermal Systems Workshop

(Lisa Shevenell)

Nevada Geothermal Resources Database and Web Site

(Lisa Shevenell and Larry Garside)

Recent Advances and Discoveries in Geothermal Systems in the Great Basin

(Lisa Shevenell)

Regional Assessment of Exploration Potential for Geothermal Systems in the Great Basin using a Geographic Information System (GIS)

(Mark Coolbaugh, Great Basin Center for Geothermal Energy; Gary Raines, U.S. Geological Survey; Lisa Shevenell; Alex Minor, University of Nevada, Reno Computing Services; Don Sawatzky, Gary Oppliger, and Jim Taranik, Department of Geological Sciences and Engineering)

Structural and Geophysical Analysis of the Desert Peak-Brady Geothermal Field: Identifying Links between Northeast-trending Structures and Geothermal Anomalies in the Great Basin

(Jim Faulds, Larry Garside; and Gary Oppliger, Department of Geological Sciences and Engineering)

Structural Controls on the Salt Wells Geothermal Field

(Jim Faulds and Mark Coolbaugh, Great Basin Center for Geothermal Energy)

Targeting Potential Geothermal Resources in the Great Basin Using Regional Relationships Between Geodetic Strain and Geological Structures

(Geoff Blewitt)

The Geothermal and Renewable Energy Laboratory of Nevada (GRELN) Overview  
(Allen Gates and Lisa Shevenell)

- **Uranium**

International Atomic Energy Agency Fellowship Training  
(Steve Castor and Chris Henry)

Geology of the McDermitt Caldera Complex  
(Chris Henry and Steve Castor)

- **Groundwater Resources**

Geologic Reconnaissance of the Granite Range Fault Zone, Washoe County, Nevada  
(Jim Faulds)

## **ENVIRONMENTAL CONCERNS**

- **Mercury and Other Chemical Hazards from Historical Mining**

Analysis of the Transport and Storage of Contaminated Sediments in the Rio Pilcomayo Basin, Bolivia  
(Paul Lechler)

- **Global Change**

Preliminary Assessment of the Potential for Sequestration of Carbon Dioxide in Geological Settings in Nevada  
(Jon Price)

Appraisal of Relative Sea-Level Rise Scenarios for Venice

(Hans-Peter Plag, Geoff Blewitt, and Bill Hammond, with help from an international team of experts)

- **Nuclear Waste**

Geodetic Monitoring of the Yucca Mountain Region using Continuous Global Positioning System Measurements  
(Jon Price, Geoff Blewitt, Hans-Peter Plag, Corné Kreemer, and Bill Hammond)

- **Recreation**

Geologic Mapping and Digital Conversion of the Mojave Mine Quadrangle, Lake Mead National Recreation Area  
(Jim Faulds)

- **Riparian Restoration**

Ecosystem Flow Recommendation Study, Bill Williams River, Arizona  
(Kyle House)

## **SCIENCE TO UNDERPIN THE APPLICATIONS**

- **Global Geodesy**

Earth's Shape, Geoid, Rheology, and Water Storage  
(Geoff Blewitt)

Global Geodetic Science: Surface Mass Transport and Solid Earth Mechanics  
(Geoff Blewitt)

National Geodetic Infrastructure: Status Today and Future Requirements  
(Hans-Peter Plag)



Synthesis of NASA Data on Earth's Changing Geometrical and Gravitational Shapes to Assess Change in Terrestrial Water Storage and its Effect on Sea Level, Lithospheric Loading, and Earth Rotation, and to Image Mantle Rheology

(Geoff Blewitt)

Terrestrial Reference Frame Theory and Practice for Solid Earth and Global Change Research

(Geoff Blewitt)

- **Tectonics**

Neogene Development of the Northern Walker Lane: An Evolving Transform Plate Boundary

(Jim Faulds, Chris Henry and Pat Cashman, Department of Geological Sciences and Engineering)

Kinematics and geodynamics of intra-plate dextral shear in eastern California and western Nevada,

Geological Society of America, Penrose Conference

(Jeff Lee, Central Washington University; Danny Stockli, University of Kansas, Chris Henry, and Tim Dixon, University of Miami)

Structural Modeling Software: Enhancing 3D Visualization of the Earth's Subsurface

(Jim Faulds)

Paleotopography of the Great Basin

(Chris Henry, Larry Garside, and Jim Faulds)

- **Other Earth Processes**

Elucidating Physical Processes in Upper Crustal Magma Systems - Evidence from Miocene Intrusive and Extrusive Sequences in Southern Nevada

(Jim Faulds)

Processing Magma and Constructing Plutons in the Upper Crust

(Jim Faulds and colleagues at Vanderbilt University)

## **EARTH SCIENCE EDUCATION AND OUTREACH TO THE PUBLIC**

Educational Supplies for Teachers

(D.D. La Pointe)

Traveling Earth-Science Education Kits for the W.M. Keck Museum at the Mackay School of Earth Sciences and Engineering

(Rachel Dolbier, W.M. Keck Museum, and D.D. La Pointe)

Traveling the Great Basin Highway: A Guide to the Geology and Natural History along U.S. Highway 93 in Nevada and Arizona

(Jon Price, Joe Tingley, and Kris Pizarro).

## BUDGET

Nearly half of the funds expended by NBMG come from the Legislature as part of the Statewide Program funding for the University of Nevada, Reno. The bulk of these funds covers salaries and fringe benefits for NBMG employees. The State does not provide a substantial amount of operating funds (\$42,357 per year in recent years), and the amount of money required to be returned for mandated salary savings was \$40,497 for the fiscal year 2004-2005 and \$42,358 in fiscal year 2005-2006. This results in very little operating funds at the beginning of any fiscal year, unless someone is on sabbatical leave or there is a vacancy. In part because the workforce is quite stable and few employees leave before retirement, and because other employees cannot always fill in when vacancies do occur, this forces NBMG to seek external funds from a variety of grants and contracts to help pay for the essential work. Fortunately there are a number of opportunities for cost sharing with federal, state, and local agencies, such that generating sufficient external research funds has not been a large problem. Seeking grants and contracts is a significant duty of the Director and of many of the senior staff. The University provides support through its Office of Sponsored Projects Administration.

<u>State-funded budget item</u>	<u>Fiscal year 2004-2005 budget</u>	<u>Fiscal year 2005-2006 budget</u>
Professional	\$1,067,774	\$1,135,809
Classified	432,838	465,418
Graduate Assistants	28,000	28,000
Fringe Benefits	364,370	358,279
Operating	<u>42,357</u>	<u>42,357</u>
Subtotal	1,935,339	2,029,863
- Mandated Salary Savings	<u>-40,497</u>	<u>-42,358</u>
Total	1,894,842	1,987,505

## STAFFING LEVELS AND CHANGES

As of July 1, 2006, NBMG had 12.31 faculty full-time equivalent positions (FTE), 9.29 classified staff FTE, and two half-time graduate research assistants funded by the State. An additional 4.69 faculty FTE, one postdoctoral researchers, 4.71 classified staff FTE, and generally between 5 and 15 undergraduate and graduate student assistants were covered by various grants and contracts, mostly from federal and local agencies plus some from state agencies and the private sector. Wages are competitive with those at comparable universities, and we have been able to attract a staff with excellent national and international scientific reputations. Turnover has been at an acceptable level; some, but few, staff members have left before retirement.

We are saddened to report the passing of **Keith Papke**, who wrote many of the NBMG publications on industrial minerals. From his retirement in 1987 until his death in 2006, Keith remained active as an emeritus faculty member and consultant on industrial minerals. He was a key volunteer for the 39<sup>th</sup> Forum on the Geology of Industrial Minerals, which was hosted by NBMG in 2003. The proceedings of that meeting, edited by Steve Castor, Keith, and Dick Meeuwig, were published in 2004 as NBMG Special Publication 33. Keith was also the lead author (along with Steve Castor) in NBMG Map 142, *Industrial Mineral Deposits in Nevada*.

We welcome the additions of **Monique Smith** and **Martha Henson** to the NBMG administrative staff. Monique's pleasant attitude helps makes bureaucratic paperwork tolerable for others on the NBMG staff. Martha juggles two major tasks – leading NBMG's efforts in scanning historical documents, particularly in the Jay A. Carpenter Mining District Files, and assisting with publication sales.

A list of current NBMG staff, divided by major areas of responsibility and annotated with principal areas of expertise, is given below. Listed in parentheses are the amounts of State-funded FTE for each person. Individuals whose salaries come entirely from grants and contracts are listed with 0 FTE. All work full time.

**Jonathan G. Price, State Geologist and Director** - management, mineral deposits & geochemistry (1.0 FTE)

## **Scientific Research Staff**

### **Economic Geology, Geologic Mapping, and Geologic Framework**

Stephen B. Castor, Research Geologist - mineral deposits & mineralogy (1.0 FTE)  
 James E. Faulds, Research Geologist - structural geology, tectonics, & paleomagnetism (1.0 FTE)  
 Larry J. Garside, Research Geologist - volcanic stratigraphy & energy resources (1.0 FTE)  
 Christopher D. Henry, Research Geologist - volcanic stratigraphy & geochronology (1.0 FTE)  
 John Muntean, Research Economic Geologist/Assistant Research Professor – metallic mineral deposits (0.77 FTE)

### **Geologic Hazards, Engineering Geology, and Geophysics**

John W. Bell, Research Engineering Geologist - Quaternary stratigraphy & urban geology (1.0 FTE)  
 Geoffrey Blewitt, Research Professor - geodesy & geodynamics (1.0 FTE)  
 Bret Pecoraro, Development Technician II - technical support on geodetic equipment (0 FTE)  
 Corné Kreemer, Assistant Research Professor – geodesy & geodynamics (0 FTE)  
 Hans-Peter Plag, Research Professor – geodesy & geodynamics (0 FTE)  
 William Hammond, Assistant Research Professor – geodesy & geodynamics (0 FTE)  
 Craig M. dePolo, Research Geologist - earthquake geology & neotectonics (0 FTE)  
 P. Kyle House, Research Geologist - fluvial geomorphology & paleohydrology (1.0 FTE)  
 Alan R. Ramelli, Research Geologist - neotectonics & Quaternary stratigraphy (0 FTE)

### **Environmental Geology and Hydrogeology**

Paul J. Lechler, Chief Chemist/Geochemist - analytical geochemistry & precious metals (1.0 FTE)  
 Lisa Shevenell, Research Hydrogeologist - hydrogeology & geothermal resources (1.0 FTE)

### **Science Education**

Daphne D. LaPointe, Research Geologist - science education & mineral deposits (0.31 FTE)

## **Support Staff**

### **Cartography and Publications Support**

Elizabeth Crouse, Publication Manager & Chief Cartographer - cartography & publishing (0.92 FTE)  
 Christine Arritt, Cartographer – cartography, GIS, & drafting (0.53 FTE)  
 Jack Hursh, Jr., Cartographer - drafting & publication design (0.53 FTE)  
 Gary Johnson, Information Systems Specialist - GIS & systems administration (0.53 FTE)  
 Jennifer Mauldin, Cartographer – cartography, drafting, & publication design (0.29 FTE)  
 Kris R. Pizarro, Cartographic Supervisor - cartography, drafting, & publication design (1.0 FTE)  
 Richard O. Meeuwig, Editor - editing, publication design, & Web-site management (1.0 FTE)

### **Analytical Laboratory**

Mario Desilets, Chemist and Quality Assurance Officer - analytical geochemistry (1.0 FTE)

### **Information and Publication Sales**

David Davis, Geologic Information Specialist - Nevada geology & mining history (1.0 FTE)  
 Martha Henson, Administrative Assistant II – document scanning & publication sales backup (0 FTE)  
 Ron Hess, GIS Supervisor - GIS, remote sensing, & systems administration (1.0 FTE)  
 Charlotte Stock, Sales Manager - publication sales & administrative support (0.49 FTE)

### **Administration**

Terri M. Garside, Program Officer I - finance, contract management, & administration (0.92 FTE)  
 Monique Smith, Administrative Assistant II - administration (1.0 FTE)

## RELATIONS WITH OTHER AGENCIES

There are no alternate providers of NBMG services. NBMG works closely with several other state agencies and with some federal and local agencies, but in all cases the programs of these agencies are complementary with those of NBMG and are not overlapping. The U.S. Geological Survey (USGS) also produces geologic maps, but their priorities are established by federal needs. NBMG works closely with the USGS through the State's Mining Cooperative Fund (see NRS 514.060 and NRS 519A.260), the National Cooperative Geologic Mapping Program (see 43 USC Sec. 31c), and, along with the Federal Emergency Management Agency and the Nevada Division of Emergency Management, the National Earthquake Hazards Reduction Program.

NBMG also works closely with the Nevada Division of Minerals. The Division of Minerals regulates drilling operations of oil, gas, and geothermal wells; administers a program to identify, rank, and secure dangerous conditions at abandoned mines; and manages the State reclamation performance bond pool. NBMG does none of these activities, but our programs are complementary. NBMG co-produces with the Division of Minerals annual mineral and energy production statistics, and we jointly support educational efforts regarding mineral and energy resources. We also have worked together on projects with the Western Governors Association regarding issues of abandoned mines. NBMG's role is in scientific research and related scientific data collection. NBMG also archives and makes available to the public records and samples collected from oil, gas, and geothermal wells regulated by the Division of Minerals (according to NAC 522 and NAC 534A).

NBMG's participation in several statewide bodies helps insure that there is no unnecessary duplication of services or efforts. The Nevada Earthquake Safety Council and the Nevada Hazard Mitigation Planning Committee include representatives from a wide range of state and local governmental agencies, nonprofit groups, and the private sector; NBMG's participation in these groups helps to coordinate efforts. In the case of the Nevada Earthquake Safety Council and in areas of earthquake research, NBMG works closely with the Nevada Seismological Laboratory, another statewide program in the Mackay School of Earth Science and Engineering at the University of Nevada, Reno. Whereas the Laboratory covers earthquake hazards largely from a seismic monitoring and research perspective, NBMG's expertise is in earthquake geology (neotectonics), geodesy, and geodynamics. In addition, NBMG has an advisory committee that includes representatives of several organizations with which we interact regularly.

NBMG works with the W.M. Keck Museum at the Mackay School of Earth Sciences and Engineering to further the collection of geological and mineralogical specimens and with the DeLaMare Library to improve the collection of published and unpublished information on the geology and mineral resources of the State (see NRS 514.040). NBMG scientists often volunteer to help with university classes and frequently help graduate students with supervision, advice, and financial support. Many graduate and undergraduate students gain practical experience through work on NBMG projects.

## GOALS AND OBJECTIVES

From discussions that have been ongoing over the last six years, NBMG developed the following goals and objectives for the next five to ten years.

### Earth-Science Research

Our goal is **to improve the quality of life of Nevada citizens by conducting applied and basic earth-science research that encourages economic development; minimizes losses to lives, property, and businesses from natural disasters; and protects the environment.** We strive to anticipate issues, such as new areas for urban growth and new waves of mineral exploration, before they arise. NBMG's research productivity is measured in terms of publications and grants. Other measures include recognition from

peers, such as honors and awards from scientific and professional organizations. In recent years, NBMG has become an important contributor to the University's grant and contract acquisition, mainly from governmental funds. We expect to contribute even more in this arena, and to develop additional research programs that are supported by private industry. In addition to applied research, NBMG recognizes the need for basic research in earth sciences, particularly in Nevada, and our research objectives include both types of work. Part of this goal is to maintain high levels of significant research publications, including ones released by NBMG and ones in the broader scientific literature.

Specific objectives under this goal include the following:

- Accelerate the construction and completion of fully reviewed, published **geologic maps**. Geologic maps at various scales are needed to support resource exploration and assessment, research on natural hazards, hydrogeologic investigations, environmental work, and fundamental science. With total costs to adequately map a quadrangle being on the order of \$120,000 each, the task is enormous. Nonetheless, by setting priorities with the help of the State Mapping Advisory Committee and other governmental and private groups, our goal is to continue to map, and to support mapping by others, in the highest priority areas. The ultimate objective of our geologic mapping efforts is to cover the entire state with 1:24,000-scale geologic maps. Publishing five new geologic maps per year would be a laudable accomplishment for a geological survey of our size.
- Expand programs to reduce risks from **natural hazards**, particularly earthquakes and floods, in urban and rural communities in Nevada. The compilation and public communication of information on geologic and environmental hazards in Nevada, particularly in metropolitan areas but also in small communities and rural areas, is an important responsibility. Although we have accomplished much, our goal is to do even more in the following areas: earthquake hazards, flood and landslide dangers, land subsidence and other engineering-construction problems, groundwater resources, and natural and human-induced geochemical hazards. Assistance in emergency planning and mitigation efforts in these areas is an important part of this responsibility. We expect to work closely with local governments in these efforts.
- Expand programs in **natural resources**. As mandated by the Nevada Legislature, NBMG intends to continue to provide information on the natural resources needed to sustain a well-diversified State economy. This includes research in economic geology for assessment and environmentally sound development of **metal and industrial mineral resources** in Nevada. Mining of metals and industrial minerals has been, and will continue to be, important to Nevada. Participation in the development of wise land-use decisions involving natural resources is part of this objective. We also plan to expand programs in **water quality and resources**, particularly as related to geological factors, such as natural contamination from mineralized areas and structural controls on the flow of groundwater. We are developing new programs in **energy resources**, with the intent of helping Nevada to be more secure in its production of electricity and other uses of energy. We are pleased that Lisa Shevenell has taken a leadership role, as Director, of the Great Basin Center for Geothermal Energy at the University of Nevada, Reno. Research funded through this center is stimulating geothermal exploration and development in Nevada and nearby states. Opportunities exist for more NBMG involvement in assessing wind, solar, uranium, oil, and gas resources and for conducting research on these resources. High prices and recent discoveries of oil in Utah may prompt increased exploration for oil and gas in eastern Nevada. Our objective is to supply, in collaboration with other governmental agencies and industry, the information that is needed to develop these resources in environmentally and economically responsible ways.

- Develop **management structures for support staff** that facilitate improved service to NBMG researchers and the public. With funding from grants, we are adding additional support staff.
- Develop **project and program teams** that facilitate building of NBMG research programs, creating opportunities for funding, and being prepared to respond to emerging issues. Our geodesy team, now with four professional positions, one technician, and several collaborators within and outside NBMG, is likely to continue to expand in response to exciting scientific opportunities and applications in GPS and InSAR.

## Geological Information

Our goal is to **make information regarding geological issues in Nevada available to the public via the Internet and other means**. We want to assure that the State of Nevada is adequately integrating **geographic and geologic information** into policy decisions and government programs. To assist in this effort, our objective is to develop a **digital information office** and work closely with the University of Nevada, Reno library, federal agencies, local and state agencies, and the Geographic Information Systems Subcommittee of the State Mapping Advisory Committee to provide easily accessible, publicly available digital products. Our current information office files are progressively being converted to digital format. With available budgets, it will take us several years and considerable expense to capture all our map and report data digitally, but the process can be accelerated with federal funding. NBMG will also work closely with the W.M. Keck Museum to build and maintain useful **sample collections**, including samples from petroleum and geothermal wells (which we are required by State regulations to curate), mineral deposits, and characteristic altered and unaltered rocks from Nevada.

## Earth-Science Education

Our goal is to **translate scientific information to help the public make informed decisions regarding resources, hazards, and the environment**. NBMG has had a long tradition of providing earth-science information to not only the geological and engineering communities but also to K-12 teachers, students, and the general public. In addition, we have participated with the University of Nevada, Reno Department of Geological Sciences and Engineering and external geoscience organizations in offering short courses for continuing education of professionals. The National Science Education Standards, which were published in 1996 by the National Research Council and are being integrated into Nevada curricula, call for placing earth sciences on equal footing with chemistry, physics, and biology. Our objective is to expand our programs in educational outreach. We will continue to work with the W.M. Keck Museum at the Mackay School of Earth Sciences and Engineering, the Nevada Mining Association, the Geological Society of Nevada, the Nevada Earthquake Safety Council, and the American Geological Institute's Earth Science Week in our K-12 and general public outreach efforts.

## STRATEGIES TO REACH THESE GOALS AND OBJECTIVES

### Increase Staff

Most of these objectives require adding new faculty and/or support staff in the classified ranks. We think it appropriate for the University to ask for some of these additions to come from State funds. Two to five new positions per biennium would be realistic. The NBMG Strategic Plan, a document prepared for use within the University and frequently updated, contains specific requests for the next four years.

NBMG's level of staffing is not adequate to meet all the demands that we have for geologic maps and applied geologic research. NBMG could more effectively carry out its mission with the addition of several new positions in both research faculty and support staff. Specifically, we have immediate needs for additional staff in the following technical (both scientific and support) areas:

earthquake geology and neotectonics (1 FTE or full-time-equivalent position) - to assure continuity in NBMG's highly successful efforts in earthquake preparedness, including outreach to the public and non-geoscience professionals; this position would interface closely with the Nevada Seismological Laboratory; currently most of the activity in this area is supported by grants and contracts; more work is needed in both southern and northern Nevada; this is a priority item for state fiscal year 2007-2008 in NBMG's strategic plan and in the budget request of the Board of Regents;

geodesy and geodynamics (2 FTE) - to further build expertise in the exciting areas of geodynamics and space geodesy, which has wide applications in geological hazards and weather; this position would also work closely with the Nevada Seismological Laboratory; one of the two positions is a priority item for state fiscal year 2007-2008 in NBMG's strategic plan and in the budget request of the Board of Regents;

outreach specialist and science education (0.69 FTE) - to dedicate a full position to the important function of translating applied research for more immediate use by the public; NBMG's strategic plan places this position as a priority item for state fiscal year 2008-2009;

geologic mapping, with an emphasis on Mesozoic and Paleozoic stratigraphy and structural geology (2 FTE) - to cover much of southern and eastern Nevada, including areas with potentials for oil and gas, mineral, and water resources; NBMG's strategic plan places one of these positions as a priority item for state fiscal year 2008-2009; the position could be stationed in Las Vegas, in which case additional operating funds for a Las Vegas office would be needed;

geologic information, marketing, and publication sales (1.51 FTE) - to better reach the public with NBMG's useful publications; NBMG's strategic plan places 0.51 FTE as a priority item for state fiscal year 2008-2009; this would make the NBMG publication sales clerk a full-time, state-funded position; this is needed because revenues from sales are likely to decline as more items are made available for free on line; the duties of the sales clerk are evolving into more of a geologic information specialist, helping customers find the generally free materials that they need.

information systems (1.47 FTE) - to build and link statewide databases, including ones in geographic information systems, to design and implement state-of-the-art systems for archiving digital information, and to assist in NBMG research; NBMG's strategic plan places 1 FTE as a priority item for state fiscal year 2009-2010;

management assistant or managing editor (1 FTE) - to assist with non-technical tasks in support of the cartography of geologic maps, graphic design, layout, and other aspects of publication preparation.

grants management (2 FTE) - to free up time for scientists to devote to applied research rather than spending as much time as we currently do with research-proposal generation, budgeting, monitoring, and contract reporting; NBMG's strategic plan calls for an administrative assistant at 1 FTE as a priority item for state fiscal year 2009-2010;

geologic mapping, with an emphasis on geothermal and hydrothermal systems (1 FTE) - to better assess mineral and geothermal resource potentials; NBMG's strategic plan places this position as a priority item for state fiscal year 2009-2010;

laboratory and field assistant (1 FTE) - to assist in geothermal, geodetic, and other field and laboratory research efforts; NBMG's strategic plan places this position as a priority item for state fiscal year 2010-2011;

hydrogeology, with an emphasis on transport modeling, evaporation, and recharge (1 FTE) - to link with geological investigations that will help protect existing groundwater resources and find new ones; NBMG's strategic plan places this position as a priority item for state fiscal year 2010-2011;

geologic mapping, with an emphasis on Quaternary and Tertiary stratigraphy (2 FTE) - to stay ahead of expanding urban development, particularly in southern Nevada;

geological and geotechnical engineering (1 FTE) - to deal with urban-area geological hazards;

remote sensing (1 FTE) - to assist in the next generation of geologic, mineralogical, and lithologic mapping and in emerging technologies, such as interferometry using synthetic aperture radar;

cartography (1 FTE) - to stay just behind the cutting edge of technological developments in computer-aided drafting and map production; the current staff is highly productive but stretched to the limit;

geophysics, with an emphasis on gravity and electromagnetic techniques (1 FTE) - to better model the three-dimensional structures in Nevada's complicated geology;

geophysics, with an emphasis on reflection seismic techniques (1 FTE) - to better image specific areas of interest, such as petroleum fields, major ore-deposit trends, and alluvial basins that supply most of the groundwater resources in the State;

geochronology, with emphasis on isotopic and paleontological approaches (2 FTE) - to assist geologic mappers and other researchers with unraveling geological histories;

limnology (1 FTE) - to study how the chemistry and habitat-supporting characteristics of natural lakes and man-made lakes (particularly pit lakes from mining) will change over time.

Two positions (one in earthquake geology and one in geodesy) are included in an initiative endorsed by the Board of Regents in their request for Nevada legislative funding during the 2007-2009 biennium. This initiative, titled *Reducing Risks from Natural Hazards*, also includes three positions to strengthen and expand network operations of the Nevada Seismological Laboratory and one position to expand the work of the Nevada State Climate Office.

Setting priorities for positions and for filling of vacancies as they occur is an ongoing process with input from NBMG staff, the NBMG Advisory Committee, University administrators, and representatives of local, state, and federal agencies and the private sector who have good ideas regarding needs and opportunities for applied geological research. The full needs outlined above would add 23.67 FTE to NBMG's staff; this would about double the number of positions at NBMG. Ideally, some of the new positions would be located in Las Vegas, where issues of urban growth are creating large demands for geologic maps and applied research. Appropriate operational, travel, communications, and facilities costs would need to be added along with the increases in FTE.

NBMG currently has an efficient, flat supervisory structure. The Director directly supervises all 15 scientists who are faculty members, two administrative faculty members, and seven of the fourteen classified staff members. A significant expansion in staff would require the delegation of more supervisory responsibility to others.

We also recognize that major additions of research faculty and research-support staff are likely to come from soft money. An important strategy for increasing research funds is to keep attuned to opportunities for research funding from all major sources, including federal, state, and local agencies, industry, and private foundations. We will continue to do so.

### **Great Basin Science Sample and Record Library - Geoscience Collections and Data Preservation**

There is currently a tremendous opportunity to preserve geoscience data and sample collections. These data and samples, which have been collected at the cost of hundreds of millions of dollars by local, state, and federal agencies and the private sector in Nevada alone, have many applications for the public good. Among the applications most relevant to Nevadans are:

- assessment of groundwater resources and water-quality protection;
- minimization of environmental impacts from land disturbance;
- economic development and land management in areas of potential mineral and energy resource extraction and urban growth;
- evaluation of natural hazards, particularly earthquakes, landslides, and floods;
- long-term monitoring of waste disposal sites and ground impacted by nuclear explosions;
- improvement of the scientific knowledge of Earth processes and expansion of research opportunities.

The University already has much of this information in hand, but with additional funding considerably more information can be collected from the private sector (geothermal, oil and gas, mining companies; engineering and geotechnical firms; geological consultants) and other agencies, and essentially all the information can be converted to more useful, geographically located digital format for quick retrieval from the Web. One of the direct benefits to the University is that this information, once in digital format and easily retrievable from the Web, will greatly enhance our ability to attract funding for research, particularly from the National Science Foundation, whose EarthScope Program will be deploying geophysical equipment in Nevada over the next few years.

The need for space and facilities to house critical geoscience data and samples is a national issue. The



National Research Council highlighted the problem in its 2002 report on *Geoscience Collections and Data: National Resources in Peril*. Congress has authorized the National Geoscience Data Preservation Program Act as part of the Energy Policy Act of 2005. As the State agency authorized by the Legislature to curate geoscience collections and data, NBMG is eligible to be a part of the national data archive system. We hope that this national recognition, coupled with the fact that approximately 87% of the land in Nevada is managed by the federal government, will aid in securing federal funds for geoscience data and sample preservation in Nevada. We envision three repositories, one funded by the federal government and State/NBMG operational funds in the Reno area, one supported primarily by the federal funds in Elko, and one supported by federal funds through the U.S. Department of Energy in southern Nevada. A substantial step forward has been made with \$3.465 million allocated for the Great Basin Science Sample and Records Library in the appropriations for the Department of Energy in fiscal year 2006. A site for this Reno facility has been selected on the Desert Research Institute (DRI) campus.

Our estimates of the initial costs for completion of the project are as follows:

Completion of facility in Reno (to expand it to 15,000 square feet)	\$ 2.2 million
Cost of digital data capture and selective acquisition of samples from key localities throughout the State, \$2.8 million for first 3 years; plus \$2 million per year for each of the following two years	\$ 2.8 million \$ 4.0 million
Facility on Nevada System of Higher Education land in or near Elko	\$ 5.7 million
Facility on Nye County or federal land in southern Nevada	<u>\$ 4.0 million</u>
TOTAL needs for Geoscience Collections and Data Preservation in Nevada	\$18.7 million.

The University has temporarily handled storage space for some physical samples (cores and cuttings from deep wells drilled in Nevada, primarily during exploration for oil, geothermal, mineral, and water resources but also for other projects; representative samples of ore and rock types from mines; thesis, dissertation, and research collections; museum-quality specimens for which there is not enough display space) in windowless rooms in the first floors of several buildings on campus, in two small metal buildings on the edge of campus, and in storage containers on University land at Stead. There is sufficient demand and research need for storage of other rock samples, particularly from mining and geothermal operations, that we could easily quadruple our storage space, if funding and land were available. The Nevada Bureau of Mines and Geology (NBMG) Information and Publication Sales Offices are evolving into a combined effort with the vision that, in a few years, all our paper information (NBMG maps, reports, bulletins, and open-file reports; one-of-a-kind and rare documents in file cabinets; paper records from oil and gas and geothermal wells; geological reports donated by consultants and industry representatives; aerial photographs; etc.) will be made free to the public on the Web. As paper records are scanned, we intend to transfer the originals to University Archives for professional long-term care. This will free up space for expanding research activities. The Nevada Seismological Laboratory's paper seismic records also need to be scanned and made readily available for research and hazard analysis.

The cost of \$5.7 million for each of the facilities in Reno and Elko is based on estimates by the University's Facilities Management group. The initial \$3.465 million will allow us to build a building with approximately 9,000 square feet of examination and storage capacity. We estimate needing an additional \$2.2 million to expand the Reno facility to 15,000 square feet. We anticipate being able to build a similar facility in or near Elko, perhaps on land near Great Basin College or on other Nevada System of Higher Education land. The estimated cost for the facility in southern Nevada is the additional cost for 12,000 square feet to be added to a building that Nye County is considering in discussions with the Department of Energy. The County anticipates that the Department of Energy will pay for the curation of samples from the Yucca Mountain Project. The additional 12,000 square feet would handle space for samples from the Nevada Test Site and from other parts of southern Nevada and adjoining states, and this would include approximately 1,000 square feet of heated and air conditioned work space and 2,000 square feet of storage space for the Nevada Seismological Laboratory, whose seismic network is partially supported by funding from the Department of Energy.

Annual operating costs for these facilities are a challenge. Currently, NBMG invests approximately \$265,000 per year in personnel and operating expenses for its Information and Publication Sales offices, which will become part of the Reno facility. We anticipate the following additional needs:

Reno facility	\$ 50,000
Elko facility	\$100,000
Southern Nevada facility	<u>\$100,000+</u>
SUBTOTAL, Additional annual operating costs	\$250,000+/year

Options for funding of these additional operating costs include future requests for additional State funding, private donations for endowments, user fees, arrangements with volunteer organizations, and grants (from federal agencies whose samples are curated). The operating expenses for the southern Nevada facility depend on which sets of samples from the Department of Energy would be managed within the facility. Economies of scale can be gained by employing the same people to manage samples from the Yucca Mountain Project, Nevada Test Site, and other locations. The \$100,000 minimum would cover the non-Department of Energy samples.

The W.M. Keck Museum in the Mackay School of Earth Sciences and Engineering has complementary responsibilities to NBMG in terms of preserving geoscience samples and historical documents. The NBMG and Museum sample databases are being merged together for one-stop-shopping by users, and the facility in Reno should be large enough to accommodate non-display items of the Museum. In addition, many universities require that representative samples from master's theses and Ph.D. dissertations in geology be curated by the departments, as these samples are key to future research projects. The facility in Reno ought to be able to accommodate such items from the Department of Geological Sciences and Engineering and the Department of Geography, along with research collections of faculty from DRI, NBMG, and the academic departments. These samples would be catalogued along with the combined NBMG-Museum sample database.

The substantial costs of digital data capture and selective acquisition of samples are patterned after similar efforts in Alaska, which were supported by federal funds.

## **OUTCOME-RELATED PERFORMANCE MEASURES FOR NBMG**

### **Research Productivity**

Reports, maps, and special publications produced by NBMG, including articles published in scientific journals and elsewhere by the NBMG staff, serve as the best performance indicators. These publications are the chief products of research. Other measures that could be used, such as the numbers of presentations made about NBMG research or the number of research grants or dollars received for research grants and contracts, are proxies for research productivity. Yearly totals of numbers of publications are not necessarily an ideal measure, however, because with a small staff, the workload can vary considerably from year to year as large projects start and finish. Therefore, averages over a number of years are better measures.

The publications are the result of research projects that fall into the following categories of applications:

#### **URBAN GROWTH - NATURAL HAZARDS AND ECONOMIC STABILITY**

- Earthquakes
- Floods
- Subsidence and Fissures due to Groundwater Withdrawal

#### **MINERAL, ENERGY, AND WATER RESOURCES VITAL TO ECONOMIC EXPANSION**

- Precious and Base Metals
- Industrial Minerals, including Construction Raw Materials
- Geothermal Energy
- Uranium
- Groundwater Resources

#### **ENVIRONMENTAL CONCERNS**

- Mercury and Other Chemical Hazards from Historical Mining
- Global Change
- Nuclear Waste
- Recreation
- Riparian Restoration

#### **SCIENCE TO UNDERPIN THE APPLICATIONS**

- Global Geodesy
- Tectonics
- Other Earth Processes

#### **EARTH SCIENCE EDUCATION AND OUTREACH TO THE PUBLIC**

#### **NBMG Publications Produced**

<u>Year</u>	<u>Geologic Maps</u>	<u>Yearly Totals<sup>1</sup></u>	<u>Average (of past three years)</u>	<u>Number of scientists<sup>2</sup></u>	<u>Average number of NBMG publications per scientist per year</u>
1991	0	15		11	
1992	2	20		11	
1993	7	16	17	11	1.5
1994	4	12	16	11	1.5
1995	6	18	15	11	1.4
1996	3	16	15	11	1.4
1997	4	14	16	11	1.5
1998	5	26	19	11	1.7
1999	21	40	27	11	2.4
2000	8	25	30	11	2.8
2001	10	24	30	11	2.7
2002	3	17	22	11	2.0
2003	26	53	31	11	2.8
2004	8	30	33	11	3.0
2005	13	29	37	11	3.4

<sup>1</sup> Numbers of NBMG publications, including geologic maps, produced during that year.

<sup>2</sup> The number of NBMG scientists supported on grants and contracts rose from three (from 1991 to 2003) to six (from 2003 to the present). In recent years the number of State-funded scientists has been steady at eleven.

### External Publications Produced by NBMG Scientists

Year	Yearly <u>Totals</u>	Average <u>(of past three years)</u>	Number of <u>scientists</u>	Average number of external publications <u>produced per scientist per year</u>
1991	52		11	
1992	52		11	
1993	49	51	11	4.6
1994	72	58	11	5.2
1995	54	58	11	5.3
1996	66	64	11	5.8
1997	76	65	11	5.9
1998	91	78	11	7.1
1999	75	81	11	7.3
2000	72	79	11	7.2
2001	56	68	11	6.2
2002	63	64	11	5.8
2003	70	63	11	5.7
2004	88	74	11	6.7
2005	91	83	11	7.5

### Overall Productivity (Total number of publications per State-funded scientist)

	Average <u>of past three years</u>	Average number of publications (NBMG and external) <u>produced per State-funded scientist per year</u>
1993	68	6.2
1994	74	6.7
1995	74	6.7
1996	79	7.2
1997	81	7.4
1998	96	8.8
1999	107	9.8
2000	110	10.0
2001	97	8.6
2002	86	7.8
2003	94	8.6
2004	107	9.7
2005	120	10.9

With only 17 full-time scientists on the NBMG staff during 2004 and 2005 (only 11 of whom were funded by State appropriations and six of whom were funded by grants and contracts), NBMG has been highly productive. Measured on a per person basis, publication productivity is outstanding. The rise in 2005 is in part the result of adding additional scientists supported on grants and contracts.

These measures of publication productivity allow quantitative comparisons over time and with other organizations, but they don't necessarily indicate the quality of the publications or their applicability to issues in Nevada and beyond. The fact that NBMG scientists are publishing in a broad array of leading, peer-reviewed scientific journals demonstrates the quality of the scientific work; in the last two years, these journals have included *Bulletin of the Seismological Society of America*, *Earth and Planetary Science Letters*, *Earth-Science Reviews*, *Economic Geology*, *Geological Society of America Bulletin*, *Geology*, *Geophysical Journal International*, *Geophysical Research Letters*, *International Geology Review*, *Geophysics*, *Journal of the American Water Resources Association*, *Journal of Geodynamics*, *Journal of Geophysical Research*, *Journal of Hydrology*, *Science*, and *Tectonics*. In addition, NBMG scientists contribute frequently to applied science publications, such as the *Geothermal Resources Council*

*Transactions* and the symposium proceedings of the Geological Society of Nevada, and to news in professional and trade journals, including *Mining Engineering*, *Geotimes*, the *SEG Newsletter*, *GSA Today*, and *The Professional Geologist*.

NBMG's flagship publications (geologic maps, reports, and bulletins) undergo generally as rigorous a peer review as the refereed journals (more so in the case of geologic maps). A few anecdotal statements from users of NBMG maps and other reports demonstrate some of the applicability of NBMG work.

Gale W. Fraser, II, General Manager/Chief Engineer with the Clark County Regional Flood Control District, in an e-mail dated 26 October 2004, wrote:

"The CCRFCD has contracted with and made financial contributions to the 3.5 year project that maps, in part, surficial geologic features in the Ivanpah Valley in Clark County, NV. The CCRFCD is using the maps produced by the Nevada Bureau of Mines and Geology, which identify areas that have and have not been flooded in the geologic past, to assist in planning and designing flood control measures in this area of Clark County, NV. This area is being planned for major developments in the near future."

In a letter supporting our geologic mapping efforts in the Stockton Flat Well and Fernley West Quadrangles, dated 20 October 2004, Donna H. Kristaponis, County Manager for Lyon County, stated:

"Lyon County strongly supports your efforts to do geologic mapping of central Lyon County. Lyon County is the fastest growing county in Nevada, and in order to accommodate this growth we will be conducting a drainage study of the same area that you are trying to obtain funds for a geologic map. The information that will be gathered from your geologic mapping will greatly enhance our drainage study, as well as our GIS system."

Michael C. Widmer, Hydrogeologist with the Washoe County Department of Water Resources, in a letter dated 18 October 2004, stated:

"It has come to my attention that the Nevada Bureau of Mines and Geology is contemplating the geologic mapping of . . . areas of interest to Washoe County. . . . This correspondence is in support of those efforts. Washoe County has spent a considerable time and effort in the understanding of the hydrogeology of the Fernley area. Our interest has been in the discharge to the Truckee River of poor quality groundwater, particularly the area of the Forty Mile Desert. This is the result of irrigation practices in the Fernley area. We have identified fault structures that may or may not impede groundwater movement. These possible "Walker Lane" faults could be of regional significance and are important to our hydrogeologic understanding. Mapping of this quad could very well assist us in future analyses."

Michel Houseman, Senior Geologist with World Minerals Inc., a diatomite producer in the area, in a letter received on 25 September 2003, stated:

"The Fernley area produces as much as 50,000 tons of diatomite and 500,000 tons of cement-grade limestone annually making it one of the more significant industrial mineral producing regions within Nevada. Curiously, there has been little research or mapping done in this area and it remains poorly understood. It is geologically complex, and we believe a proper understanding of the Neogene geology of the region could help outline new deposits. World Minerals hopes that NBMG elects to proceed with this project as it could provide a valuable contribution towards understanding an important industrial mineral producing district."

Michael Goddard, Project Leader for the U.S. Fish and Wildlife Service in Fallon, Nevada, wrote on 24 August 2005 concerning NBMG's mapping of the Lahontan Mountains Quadrangle:

"I believe this project would provide valuable geological information related to Lake Lahontan, which will be beneficial to the U.S. Fish and Wildlife Service and the management of the Stillwater National Wildlife Refuge."

Michael Ward, Manager of Exploration for Queenstake Resources USA, Inc., wrote, in a letter dated 2 September 2005, concerning NBMG's mapping project in the Jerritt Canyon district:

"The collaboration between Queenstake and NBMG will yield a product (that would) not be easily obtained by the individual groups. During Chris Henry's brief 2-day visit, he quickly recognized regional tuff units in the mill-site volcanic field. This recognition has the potential to significantly improve our understanding of the tectonics in the Independence Mountains. John Muntean's leadership, geological and organizational skills are much appreciated and will be a great asset in this effort. I would like to reiterate the enthusiasm Queenstake's geology group has for this project."

Del Fortner, Deputy State Director for the U.S. Bureau of Land Management in Nevada, in an e-mail dated 3 October 2005, wrote:

"The BLM appreciates the opportunity to comment on the proposed projects. The Jerritt Canyon mine will eventually require closure and reclamation. The proposed project should provide valuable geologic information for BLM to use in making our determinations for all mines in the Jerritt Canyon Mining District. The technical report of findings in the Stockton Flat Well Quadrangle will help explain the gold resource values for BLM to use in mineral reports and planning documents. The BLM is not a research agency but as a land management agency relies on the good work of those that are such as the Nevada Bureau of Mines and Geology. . . . Our field geologists have expressed a desire to carry the latest and best information to the field to help interpret the geology and ensure appropriate public land management decisions. Thank you for the opportunity to participate in making these decisions."

James Werle, Professional Engineer and Professional Geologist with Converse Consultants in Las Vegas, in an e-mail dated 27 September 2005, wrote about NBMG's efforts to create geographic information system datasets of geologic maps:

"The engineering community eagerly awaits the digital and GIS conversion of existing geologic maps from the urban areas of Nevada. Assessing geologic constraints are a prime concern as development around Reno and Las Vegas leaves the valleys and begins building in the surrounding foothills. Most, if not all of the maps used by developers, civil engineers, planners, and agencies are already in GIS format and are transmitted back and forth electronically so conversion of the geologic maps to this media is overdue. Additionally, geologic mapping that adds new information and insight to the seismicity of Nevada and its related hazards will be beneficial."

Steven Fechner, Mineral Team Leader for the Humboldt-Toiyabe National Forest, in an e-mail dated 28 September 2005, wrote:

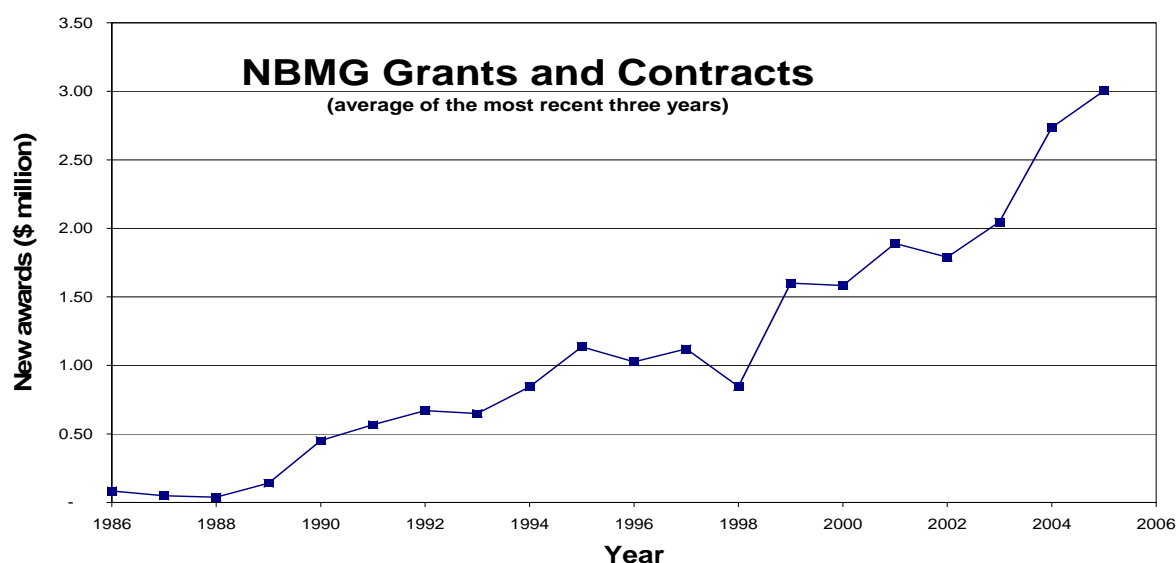
"The Humboldt-Toiyabe National Forest supports the mapping and digitizing proposals that were discussed at the August 10, 2005 meeting. The efforts of NBMG will greatly aid the Forest Service in understanding the geology of Forest lands in Nevada and will be used by the Forest to facilitate the on-going planning efforts."

In a letter of support dated 18 October 2004, USGS geologist Steve Ludington stated:

"I want to express my excitement about your proposal to map the Searchlight quadrangle as a StateMap project. This project will contribute directly to the mineral-resource assessment of selected parts of Clark County that I am conducting. Your mapping in the Nelson SW quad has been a cornerstone of my studies so far, and completion of the Searchlight quad would be a further very important component. I would be happy to cooperate with you in the field and provide information about the alteration and mineralization in the Searchlight district. I support your proposal absolutely."

To collect new geological information and conduct geological research, operating money is needed. These funds pay for such expenses as fieldwork, base maps, aerial photographs, research equipment, and chemical analyses of rocks. Grants and contracts also pay salaries of additional researchers and support

staff. NBMG also uses some grant funds and some donations to the University of Nevada, Reno Foundation to pay geologists outside the University to submit geologic maps to NBMG for review and publication. Grants and contracts bring new money into the Nevada economy, and they expand the State's research capabilities and increase knowledge about Nevada's geology; mineral, energy, and water resources; natural hazards; and environment. NBMG continues to provide many vital public services to the State with the help of these grants and contracts. In addition, the fact that other agencies and organizations are willing to contribute money to support NBMG projects is a statement of the value and applicability of the work.



### Research and Non-Research Grants and Contracts Awarded

Year	Number of Grants and Contracts	Total Awards	Average (of past three years)
1984	4	\$182,389	
1985	3	37,970	
1986	3	32,790	\$84,383
1987	3	74,450	48,403
1988	1	7,186	38,142
1989	7	337,658	139,765
1990	15	1,009,440	451,428
1991	4	351,298	566,132
1992	15	650,801	670,513
1993	23	944,687	648,929
1994	14	932,270	842,586
1995	32	1,529,343	1,135,433
1996	14	615,509	1,025,707
1997	17	1,215,298	1,120,050
1998	29	708,603	846,470
1999	32	2,873,711	1,599,204
2000	29	1,164,626	1,582,313
2001	25	1,630,994	1,889,777
2002	41	2,571,242	1,788,954

2003	22*	1,936,308*	2,046,181*
2004	25*	3,698,781*	2,735,444*
2005	19*	3,373,403*	3,002,831*

\* These numbers include projects of the Great Basin Center for Geothermal Energy, managed by NBMG scientists.

## Customer-Service Questionnaire

In January 2006, NBMG began distributing a questionnaire to patrons (see Appendix C). The quantitative results from 33 respondents through 30 June 2006 are summarized below, using a standard grade-point average (where A = 4, B = 3, C = 2, D = 1, and F = 0).

### Overall Performance of the Nevada Bureau of Mines and Geology

How well is the Nevada Bureau of Mines and Geology serving you? **3.76**

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#### NBMG Publications and Information Office

Quality of NBMG publications	<b>3.76</b>
Usefulness of the publications	<b>3.64</b>
Number and variety of publications	<b>3.38</b>
Quality of NBMG geologic maps	<b>3.76</b>
Detail of NBMG geologic maps	<b>3.82</b>
Current coverage of geologic maps	<b>2.67</b>
Free publications on the Web	<b>3.63</b>
Cost of publications for sale	<b>3.16</b>
Customer service for sales	<b>3.89</b>
Ease of Web sales	<b>3.39</b>
Timeliness of receiving Web, mail, and fax orders	<b>3.74</b>
Service from Information Office	<b>3.63</b>
Air photo coverage	<b>3.11</b>
Content of mining district files	<b>3.19</b>
Free mining-district, geothermal, and other information on the Web	<b>3.56</b>
Hours of operation (currently MWThF, 7:30 a.m. to 3 p.m., Tu 7:30 a.m. to 5:00 p.m.)	<b>2.93</b>

#### External Publications and Professional Service

External publications	<b>3.41</b>
Professional service	<b>4.00</b>

#### Outreach to the General Public, K-12 Teachers, and Students

Publications for the general public	<b>3.60</b>
Earth Science Week field trips	<b>3.63</b>
Helpfulness in answering questions	<b>3.56</b>

#### Analytical Laboratory

Quality of assays	<b>3.40</b>
Cost of assays	<b>3.00</b>
Turnaround time	<b>2.40</b>

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We feel that the results of the customer-service questionnaire are quite positive. A few areas that stand out with less than a B average, and a few additional written comments, point to significant concerns, but we feel that our strategies are moving us in the right direction to address these concerns.



More geologic maps are needed; only approximately 20 percent of the state is adequately mapped at scales needed for most applications (generally 1:24,000 or larger). Our staffing plans call for more emphasis in geologic mapping, including urban-area maps to help address issues regarding growth and rural maps to address issues regarding economic development.

The hours of operation for our publication sales and information office are restricted because of budget. We have only 1.49 State-funded FTE dedicated to what are currently two offices. We supplement this with soft-money staff and student hires, who are funded in part from sales revenues and in part from various grants and contracts related to information gathering and electronic capture. In the future, when the Great Basin Science Sample and Records Library is built off campus, we will combine the sales and information offices. This may allow us to expand the hours of operation, and it should improve access for parking. With additional staff, funded from State dollars or increased sales revenue, we should be able to better serve the public with their needs for paper and digital information, including geologic and topographic maps, NBMG reports and bulletins, and open-file records.

The cost of NBMG assays is slightly higher than costs at some commercial laboratories that have large volumes of samples. We try to avoid competition with commercial laboratories and commonly provide assaying services to individuals who are seeking a second or third opinion. We also assist the customers and commercial laboratories by making assay standards from rocks commonly found in Nevada's gold and silver deposits.

### **Quality of the Research and Public Service Products**

NBMG faculty and some classified staff members are recognized within the state, regionally, nationally, and internationally for their contributions to science and society. Many of these contributions are listed in Appendix A, which provides some details of the activities of the NBMG staff. As examples, in 2004 and 2005 NBMG scientists and members of the technical support staff:

- served on 14 advisory panels, task forces, and committees for the federal government;
- served 13 times on advisory panels and committees for the Nevada state government;
- served as officers in one international, one national, and three state scientific and technical organizations;
- chaired 25 committees of international, national, regional, and state scientific organizations;
- served 67 times as committee members, field trip leaders, technical session chairs, or in other capacities for national and international scientific organizations;
- served 20 times as committee members, field trip leaders, workshop instructors, or other positions for state and regional scientific and professional organizations;
- served 39 times as advisors, field-trip leaders, science-fair judges, or in other capacities for local governmental and educational organizations;
- made 253 technical presentations, often with published abstracts, at scientific meetings and other venues;
- made over 141 presentations to K-12 school children;
- taught 8 classes at the University of Nevada, Reno (six in geographic information systems and two years of the geology summer field course);
- served as review coordinator for one National Research Council - National Academy of Sciences study;
- served as editor of one book published by a scientific organization;
- provided free technical assistance to various consultants, engineers, lawyers, and citizens of Nevada and elsewhere;
- reviewed numerous articles for scientific journals and U.S. Geological Survey publications and several proposals for funding of research by the National Science Foundation and other agencies;

- elected to the board of directors of two scientific societies and elected as fellows of two other societies;
- received seven awards for scientific achievement and contributions to the profession from national, regional, and state organizations; and
- had their research featured in the popular press after the publication of two scientific papers with broad public interest.

In recent years NBMG has made a concerted effort to create special publications for the general public and for users who are pursuing economic development opportunities in Nevada. In addition to several new items in the Educational Series for teachers and students, books and maps added in the last two years include:

*Proceedings of the 39th Forum on the Geology of Industrial Minerals*: Nevada Bureau of Mines and Geology Special Publication 33, 294 p. (2004, edited by Steve Castor, Keith Papke, and Dick Meeuwig) – This publication includes new material on several industrial mineral deposits in Nevada, for which little, if anything, had previously been available in the public domain.

*Minerals of Nevada*: Nevada Bureau of Mines and Geology Special Publication 31, 512 p. (2004, edited by Steve Castor and Greg Ferdock) – This book, co-published by NBMG and the University of Nevada Press, serves as both a coffee-table book showing excellent photographs of Nevada minerals and an encyclopedic reference for collectors and exploration geologists.

*Nevada Geothermal Resources*, (2nd edition): Nevada Bureau of Mines and Geology Map 141, 1:750,000 scale (2005, 2<sup>nd</sup> edition, by Lisa Shevenell and Larry Garside) – This updated map complements NBMG's geothermal Web site and is being used to stimulate exploration for geothermal resources.

*Geologic and Natural History Tours in the Reno Area*, expanded edition: Nevada Bureau of Mines and Geology Special Publication 19, 184 p. (2005, by Joe Tingley, Kris Pizarro, Chris Ross, Becky Purkey, and Larry Garside) – This book is part of a series of guidebooks for the general public, including ones for the Las Vegas area and for U.S. Highway 50 across Nevada.

Several NBMG Special Publications are reaching users in bookstores throughout Nevada and other parts of the country. All publications can be ordered on line ([www.nbmng.unr.edu](http://www.nbmng.unr.edu)), and selected publications, several Educational Series items, NBMG's annual publication on the *Nevadamineral industry*, and the joint publication with the Nevada Division of Minerals on *Major Mines of Nevada*, are provided to the public for free on the Web. As costs for data storage have dropped, and as more people have gained access through the Web at home, businesses, schools, and libraries, NBMG now provides most new maps and reports to the professional users and general public for free on the Web.

For more information about the Nevada Bureau of Mines and Geology, or about the geology, resources, and environmental issues in Nevada, please feel free to contact us.

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## APPENDIX A

### Activities of NBMG in 2004 and 2005

This appendix includes citations of publications produced by NBMG and authored by NBMG scientists; grants awarded to principal investigators on the NBMG staff; invited lectures, public presentations, and other professional activities of the NBMG staff; and awards and honors during the past two years.

#### PUBLICATIONS—2004

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- Balistrieri, L.S., Tempel, R.N., Stillings, L.S., **Shevenell, L.**, 2004, Predicting spatial and temporal variations in temperature, salinity, and conservative elements during stratification and overturn in Dexter Pit Lake, Tuscarora, Nevada, U.S.A. Pit Lakes 2004 (conference sponsored by USEPA in November 2004), p. 24–25.
- Bell, J.W.**, 2004, Annual Contract Report, NASA Research Grant 13-02017, Development and transfer of InSAR and GPS applications to local government in Nevada: groundwater management and land subsidence mitigation: Report presented at NASA Headquarters, Washington, DC.
- Bell, J.W.**, and Amelung, F., 2004, Detection of preseismic and coseismic fault slip with interferometric data: Final Technical Report to the European Space Agency for ERS-AO3 Project. Research results are featured on the ESA website (<http://eopi.esa.int/esa/esa/>): InSAR unravels source mechanisms of Double Spring Flat earthquake.
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#### ACTIVE RESEARCH GRANTS—2004 AND 2005

- AMP Capital Partners: Salt Wells reconnaissance mapping of surface geothermal features and structure, 12/04–3/05, \$13,627, **Faulds, J.E.**, and Coolbaugh, M.
- Applied Research Initiative, University of Nevada, Structural Controls on the Salt Wells Geothermal Field, Churchill County, Nevada: Geothermal Resource Characterization and Targeting in the Great Basin, \$13,627, 5/05–12/05,

- Faulds, J.E.**, and Coolbaugh, M.  
Barrick Goldstrike Mining Corporation, 9/05–8/06, \$35,000, InSAR research in the Boulder Valley area, **Bell, J.W.**  
Clark County Regional Flood Control District, Surficial Geologic Mapping And Piedmont Flood Hazard Assessment  
In the Ivanpah Valley I-15 Corridor, Clark County, Nevada, 5/02–1/06, \$150,000, **House, P.**  
Cumuriyet University Research Council, Investigation of the Origin of World-Class Celestite Deposits in the Sivas  
Basin, Central Turkey, 1/05–12/05, \$75,000, **Lechler, P.J.**  
Department of Energy-Idaho Operations Office: Expanding geothermal resource utilization in Nevada through  
directed research and public outreach, 5/03–9/06, \$963,364, **Shevenell**, Long.  
Department of Energy-Idaho Operations Office: Expanding geothermal resource utilization in Nevada through  
directed research and public outreach, 1/02–9/06, \$936,000, **Shevenell**, Taranik.  
ESA, Determination of geodetic coordinates for EGNOS RIMS and NLES, GeoCorr, 1/03–5/04, **Plag, H.-P.**  
ESA, Geodetic Galileo: High accuracy applications of Galileo, GeoGal, 6/02–3/04, **Plag, H.-P.**  
European Commission, European Sea Level Service – Research Infrastructure, ESEAS-RI, 11/02–10/05, **Plag, H.-P.**  
European Commission, Exploitation of ground-based GPS for Operational Numerical Weather Prediction and  
Climate Applications, COST 716, 12/98–5/04, **Plag, H.-P.**  
European Commission, Geoid and Ocean Circulation in the North Atlantic, GOCINA, 11/02–10/05, **Plag, H.-P.**  
European Space Agency, InSAR-based aquifer deformation maps for subsiding groundwater basins in southern  
Nevada, 4/04–3/06, \$200,000, **Bell, J.W.**, and Amelung, F.  
Faculty Senate Technology Committee, University of Nevada, Reno: Structural modeling software: Enhancing 3D  
visualization of the Earth's subsurface, \$2,000, **Faulds, J.E.**  
Federal Emergency Management Agency, 1954 Earthquake Sequence Damage and Response, 2/04–9/04, \$9,936,  
**dePolo, C.M.**  
Federal Emergency Management Agency, Earthquake Mitigation Plans for Nevada, 10/03–9/05, \$30,360, **dePolo,**  
**C.M.**  
Federal Emergency Management Agency, Earthquake Mitigation Workshop, 10/03–9/05, \$19,444, **dePolo, C.M.**  
Federal Emergency Management Agency, Earthquake risk mitigation in Nevada, 10/03–9/04, \$83,671, **dePolo, C.M.**  
Federal Emergency Management Agency, Nevada Division of Emergency Management, Funding for the Nevada  
Hazard Mitigation Planning Committee, 10/03–8/05, \$40,000, **Price, J.G.**  
Federal Emergency Management Agency, Nevada Division of Emergency Management, Earthquake Risk Mitigation  
in Nevada, 10/04–12/05, \$88,973 **dePolo, C.M.**, **Price, J.G.**, Anderson, J.G., and dePolo, D.  
Federal Emergency Management Agency, Nonstructural Earthquake Mitigation Outreach, 2/04–9/04, \$10,353,  
**dePolo, C.M.**  
Federal Emergency Management Agency, Seismic history of the Mead Lake Slope fault, 2/04–9/04, \$6,958, **dePolo,**  
**C.M.**  
High Desert Geoculture, LLC: Geothermal Assessment of Pyramid Lake Paiute Reservation Lands, 9/05–2/06,  
\$35,959, **Faulds, J.E.**, and **Shevenell, L.**  
International Lithosphere Program, Temporal and Spatial Changes of Stress and Strain, 1/05–12/09, \$25,000 (\$5,000  
awarded for 2005), Heidbach, O., Friedrich, A., and **Kreemer, C.**  
National Aeronautics and Space Administration, 3/02–2/06, \$593,552, Development and transfer of InSAR and GPS  
applications to local government in Nevada, **Bell, J.W.**, and **Blewitt, G.**  
National Aeronautics and Space Administration, Alaska Satellite Facility, 7/05–6/07, \$8,200 data grant, “Detection  
of horizontal displacements associated with heavy groundwater pumping in Las Vegas, Nevada, **Bell, J.W.**, and  
Amelung, F.  
National Aeronautics and Space Administration, Application of MASTER, ASTER, and Landsat 7 data and  
technology to ongoing geologic mapping projects at the Nevada Bureau of Mines and Geology, 11/02–9/04,  
\$49,766, **Castor, S.B.**, **House, K.**, and **Hess, R.**  
National Aeronautics and Space Administration, Development and transfer of InSAR and GPS applications to local  
government in Nevada, 3/02–2/06, \$593,552, **Bell, J.W.**, and **Blewitt, G.**  
National Aeronautics and Space Administration, Development and transfer of InSAR and GPS applications to local  
government in Nevada, Groundwater management issues, 01/02–12/04, \$539,552, **Bell, J.**, and **Blewitt, G.**  
National Aeronautics and Space Administration, Synthesis of NASA Data on Earth's Changing Geometrical and  
Gravitational Shapes to Assess Change in Terrestrial Water Storage and Its Effect on Sea Level, Lithospheric  
Loading, and Earth Rotation, and to Image Mantle Rheology, 10/04–9/07, \$500,100, **Blewitt, G.**  
National Aeronautics and Space Administration, Terrestrial reference frame theory and practice for solid Earth and  
global change research, 10/03–9/06, \$276,211, **Blewitt, G.**  
National Aeronautics and Space Administration/Jet Propulsion Laboratory, Application of MASTER, ASTER, and

- Landsat 7 Data and Technology to Ongoing Geologic Mapping Projects at the Nevada Bureau of Mines and Geology, 10/02–1/05, \$49,766, **House, P., Castor, S., and Hess, R.**
- National Earthquake Hazard Reduction Program titled, Compilation of effects and analysis of several major historical earthquakes in Nevada, 5/04–4/05, \$35,000, **dePolo, C.M.**
- National Earthquake Hazard Reduction Program, Determination of fault slip rates, paleoearthquake history, and segmentation of the Warm Springs Valley fault system, 4/04–4/05, \$58,000, **dePolo, C.M.**
- National Earthquake Reduction Program, Paleoseismic studies along the Eastern Carson Valley fault system, 4/03–3/04, \$72,330, **dePolo, C.M.**
- National funding, Central Bureau for ESEAS, 7/01–1/05, **Plag, H.-P.**
- National Park Service, Geologic Mapping and Digital Conversion of the Mojave Mine Quadrangle, Lake Mead National Recreation Area, 10/04–9/05, \$9,492, **Faulds, J.E.**
- National Renewable Energy Laboratory, Spatial and Temporal Systematics of Multi-Gas Geochemistry at Steamboat/Redfield area, Reno, Nevada, 1/05–12/05, \$20,000 **Lechler, P.J.**
- National Science Foundation, Analysis of an Evolving Transform Plate Boundary: The Northern Walker Lane, Northwest Nevada and Northeast California, 1/02–12/06, \$272,596, **Faulds, J.E., Henry, C.D., and Cashman, P.**
- National Science Foundation, Analysis of the Transport and Storage of Contaminated Sediments in the Rio Pilcomayo Basin, Bolivia, 1/05–12/05, \$43,829, **Lechler, P.J.**
- National Science Foundation, Aquifer deformation using GPS, 7/01–6/04, \$97,131, **Blewitt, G., and Bell, J.W.**
- National Science Foundation, EarthScope, Workshops to Establish a Stable North America Reference Frame for EarthScope, 01/06–12/2007, \$40,314, **Blewitt, G.**
- National Science Foundation, Geological Society of America, Penrose Conference student attendance: Kinematics and geodynamics of intra-plate dextral shear in eastern California and western Nevada, 2005, \$33,600, Lee, J.E., Stockli, D., **Henry, C.D.**, and Dixon, T.
- National Science Foundation, Global geodetic science: Surface mass transport and solid Earth mechanics, 12/01–10/04, \$197,069, **Blewitt, G.**
- National Science Foundation, Neogene development of the northern Walker Lane: An evolving transform plate boundary, 1/02–12/06, \$272,596, **Faulds, J.E., Henry, C.D.**, and Cashman, P.
- National Science Foundation, Processing magma and constructing plutons in the upper crust, 1/02–6/04, \$10,278, **Faulds, J.E.**
- National Science Foundation: Elucidating physical processes in upper crustal magma systems - Evidence from Miocene intrusive and extrusive sequences in southern Nevada, \$85,036, 7/04–6/07, **Faulds, J.E.**
- National Science Foundation, Travel Award, UNAVCO-IRIS Joint Workshop, Stevenson, Washington, 2005, **Kreemer, C.**
- National Science Foundation, Travel Award, Earthscope National Meeting, Santa Ana Pueblo, New Mexico, 2005, **Kreemer, C.**
- Nevada Earthquake Safety Council, The Economic Cost of Historical Earthquakes in Nevada, 2/04–9/04, \$18,185, **dePolo, C.M.**
- Nevada Earthquake Safety Council, Upgrade and Enhancement of HAZUS Nevada Fault Database, 2/04–9/04, \$33,332, **dePolo, C.M.**
- Newmont Mining Corporation, 7/05–6/07, \$142,231, Subsidence research in the Pumpernickel-Kelly Creek Basin area, **Bell, J.W.**
- Norwegian Mapping Authority, National geodetic infrastructure: status today and future requirements, NatGeoInf, 12/04–8/05, **Plag, H.-P.**
- Norwegian Research Council, OCTAS, Ocean Circulation and heat transport between the North Atlantic and the Arctic Sea, 1/02–12/06, **Plag, H.-P.**
- Placer Dome, Turquoise Ridge, 2/05–2/07, \$41,600, **Muntean, J.L.**
- Queenstake Resources, Jerritt Canyon, 6/05–6/08, \$88,000 expected, \$20,548 awarded for 2005, **Muntean J.L., and Henry, C.D.**
- Southwest Geology, Inc., Geologic reconnaissance of the Granite Range fault zone, Washoe County Nevada, 11/04–2/05, \$17,498, **Faulds, J.E.**
- State of Nevada, Mining Cooperative Fund Research, 7/04–6/05, \$70,000, **Price, J.G.**
- State of Nevada, Mining Cooperative Fund Research, 7/05–6/06, \$70,000, **Price, J.G.**
- U.S. Bureau of Land Management, Traveling the Great Basin Highway, A Guide to the Geology and Natural History along U.S. Highway 93 in Nevada and Arizona, \$137,574, **Price, J.G., and Tingley, J.V.**
- U.S. Department of Energy, 10/05–09/06, \$98,658, Pattern and timing of active faulting along Nevada geothermal



- systems: Is there a connection?, **Bell, J.W.**, and **Ramelli, A.R.**
- U.S. Department of Energy, California Institute for Energy Efficiency, University of California, Office of the President, Preliminary Assessment of the Potential for Sequestration of Carbon Dioxide in Geological Settings in Nevada, 1/04–12/05, \$49,000, **Price, J.G.**
- U.S. Department of Energy, Characterizing Structural Controls on Geothermal Systems in the Northwestern Great Basin through Integrated Geologic and Geophysical Analyses, 7/05–9/07, \$212,823, **Faulds, J.E.**, **Oppliger, G.**, and **Coolbaugh, M.**
- U.S. Department of Energy, Exploration for Concealed Structures at Desert Peak using Hg Soil Gas Detectors, 1/05–12/05, \$33,984, **Lechler, P.J.**
- U.S. Department of Energy, Geochemical Sampling of Thermal and Non-Thermal Waters in Nevada: Continued Evaluation of Geothermal Resources, 1/05–12/05, \$48,508, **Lechler, P.J.**
- U.S. Department of Energy, Geodetic Monitoring of the Yucca Mountain Region using Continuous Global Positioning System Measurements, 10/03–9/08, \$8,656,182, **Price, J.**, and **Blewitt, G.**
- U.S. Department of Energy, Geothermal Applications of Multi-Gas Geochemistry, 1/05–12/05, \$47,118, **Lechler, P.J.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy Office: Geologic and geophysical analysis of the Desert Peak-Brady geothermal fields: Structural controls on geothermal reservoirs in the Humboldt structural zone, 10/03–9/05, \$135,392, **Faulds, J.E.**, **Oppliger, G.**, and **Garside, L.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geologic and geophysical analysis of the Desert Peak-Bradys Geothermal Fields: Structural controls on geothermal reservoirs in the Humboldt structural zone, 3/02–10/06, \$135,393, **Faulds, J.**, **Oppliger, G.**, **Garside, L.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geothermal applications of multi-gas geochemistry, 3/02–10/06, \$79,092, **Lechler, P.**, **Garside, L.**, **Coolbaugh, M.**, and **Shevenell, L.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geochemical sampling of thermal and non-thermal waters in Nevada: Continued evaluation of geothermal resources, 3/02–10/06, \$152,475, **Shevenell, L.**, **Lechler, P.**, **Garside, L.**, and **Coolbaugh, M.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Structural and geophysical analysis of the Desert Peak-Bradys Geothermal Fields: Identifying links between northeast-trending structures and geothermal anomalies in the Great Basin, 3/02–10/06, \$95,811, **Faulds, J.**, **Garside, L.**, **Oppliger, G.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geochemical Sampling of Thermal and Non-thermal Waters in Nevada: Evaluation of geothermal resources for electric power generation and direct-use applications, 3/02–10/06, \$117,359, **Shevenell, L.**, and **Garside, L.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geothermal Spring Sampling, 7/03–9/06, \$122,933, **Shevenell, L.**, and **Garside, L.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Targeting of Potential Geothermal Resources in the Great Basin from Regional to Basin-Scale Relationships between Geodetic Strain and Geological Structures, 7/05–9/06, \$295,665, **Blewitt, G.**, **Hammond, W.C.**, and **Kreemer, C.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Revival of Grass-Roots Geothermal Exploration in the Great Basin—A New Approach to Assessing Geothermal Potential Using a Geographic Information System parts IV and V, 7/05–9/06, \$350,162, **Coolbaugh, M.**, **Zehner, R.**, **Kreemer, C.**, **Sawatzky, D.**, **Oppliger, G.**, **Blackwell, D.**, **Shevenell, L.**, **Taranik, J.**, **Raines, G.**, and **Faulds, J.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Crustal strain state analysis through deep electrical anisotropy mapping: an alternative tool for identifying the orientation of critically stressed fractures for EGS projects, 7/05–9/06, \$318,302, **Oppliger, G.**, **Coolbaugh, M.**, and **Kreemer, C.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geothermal sampling of thermal and non-thermal waters in Nevada: Continued evaluation of geothermal resources 6/05–5/06, \$28,710, **Shevenell, Lechler, Garside, Coolbaugh.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Management of the research and outreach programs at the Great Basin Center for Geothermal Energy, 6/05–5/06, \$309,258, **Shevenell.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Revival of grass-roots geothermal exploration in the Great Basin—a new approach to assessing geothermal potential using a geographic information system: parts IV and V, 6/05–5/06, \$149,996, **Coolbaugh, Zehner, Kreemer, Sawatzky, Oppliger, Blackwell, Shevenell, Taranik, and Raines.**
- U.S. Department of Energy, Great Basin Center for Geothermal Energy. Satellite InSAR Ground Displacement Analysis for Geothermal Reservoir Management and Development, 6/05–5/06, \$104,005, **Oppliger, Coolbaugh, Shevenell, Widmer**



- U.S. Department of Energy, Great Basin Center for Geothermal Energy. Geothermal applications of multi-gas geochemistry, 6/05–5/06, \$45,108, **Lechler, Garside**, Coolbaugh, **Shevenell**.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Regional Assessment of Exploration Potential for Geothermal Systems in the Great Basin using a Geographic Information System–Part II, 7/03–9/06, \$93,023, Coolbaugh, Raines, **Shevenell**, Minor, Sawatzky, Oppliger.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geochemical sampling of thermal and non-thermal waters in Nevada: Evaluation of geothermal resources for electrical power generation and direct-use applications, 10/04–9/06, \$59,000, **Shevenell** and **Garside**.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Management of the research and outreach programs at the Great Basin Center for Geothermal Energy, 3/02–9/06, \$430,000, **Shevenell**.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geochemical sampling of thermal and non-thermal waters in Nevada: Evaluation of geothermal resources for electrical power generation and direct-use applications, 7/03–9/06, \$63,933, **Shevenell, Garside**.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Management of the research and outreach programs at the Great Basin Center for Geothermal Energy, 3/02–9/06, \$286,890, **Shevenell**, Long.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Geochemical sampling of thermal and non-thermal waters in Nevada: Evaluation of geothermal resources for electrical power generation and direct-use applications, 3/02–9/06, \$117,359, **Shevenell, Garside**.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Regional Assessment of Exploration Potential for Geothermal Systems in Nevada using a Geographic Information System, 3/02–9/06, \$146,026, Taranik, Coolbaugh, Raines, **Shevenell**, Minor.
- U.S. Department of Energy, Great Basin Center for Geothermal Energy, Management of the research programs at the Great Basin Center for Geothermal Energy, 3/02–9/06, \$113,770, **Shevenell**, Taranik.
- U.S. Department of Energy, IAEA Fellowship Training, DOE/Univ Chi-Argonne Nat Lab grant, 6/13/05–9/12/05, \$6,262, **Castor, S.B.**, and **Henry, C.**
- U.S. Department of Energy, National Renewable Energy Laboratory Continuation of Exploratory drilling program to evaluate the lifetime and current potential of the Humboldt House geothermal system, Pershing County, Nevada, 5/04–9/05, \$110,000, Tempel, **Shevenell**.
- U.S. Department of Energy, National Renewable Energy Laboratory, The Geothermal and Renewable Energy Laboratory of Nevada, Overview, 2005, \$1,000,000, Gates and **Shevenell**.
- U.S. Department of Energy, National Renewable Energy Laboratory, Continuation of Exploratory drilling program to evaluate the lifetime and current potential of the Humboldt House geothermal system, Pershing County, Nevada, 12/04–6/05, \$110,617, Tempel, **Shevenell**.
- U.S. Department of Energy, National Renewable Energy Laboratory, Exploratory drilling program to evaluate the lifetime and current potential of the Humboldt House geothermal system, Pershing County, Nevada, 4/03–4/04, \$499,494, Tempel, **Shevenell**, Ellis, Waibel, Barta.
- U.S. Department of Energy, Nevada State Energy Office, Geothermal Division, Nevada Geothermal Resources Database and Web Site, 9/01–6/04, \$74,728, **Shevenell, L.**, and **Garside, L.**
- U.S. Department of Energy, Nevada State Energy Office, Highlight Recent Advances and Discoveries in Geothermal Systems in the Great Basin, 10/04–5/05, \$27,894, **Shevenell**.
- U.S. Department of Energy, Pattern and timing of active faulting along Nevada geothermal systems: Is there a connection?, 10/05–09/06, \$98,658, **Bell, J.W.**, and **Ramelli, A.R.**
- U.S. Department of Energy, Pyramid Paiute Indian Tribe, Geothermal Assessment of Pyramid Lake Paiute Reservation Lands, 10/04–10/05, \$134,951, **Shevenell**, Coolbaugh, Oppliger, **Faulds**, Calvin, Louie.
- U.S. Department of Energy, Targeting potential geothermal resources in the Great Basin using regional relationships between geodetic strain and geological structures, 10/04–09/05, \$124,555, **Blewitt, G.**
- U.S. Department of Energy, Targeting potential geothermal resources in the Great Basin using regional relationships between geodetic strain and geological structures, 10/05–9/07, \$236,532, **Blewitt, G.**, **Hammond W.**, and **Kreemer, C.**
- U.S. Department of Energy, Targeting potential geothermal resources in the Great Basin using regional relationships between geodetic strain and geological structures, 03/03–09/04, \$189,975, **Blewitt, G.**
- U.S. Department of Energy: Geodetic Monitoring of the Yucca Mountain Region using Continuous Global Positioning System Measurements, Nevada System of Higher Education Cooperative Agreement Task 3, 10/03–9/08, \$8,656,182 expected, \$3,593,757 awarded for 10/03–9/05, **Price, J.G.**, and **Blewitt, G.**
- U.S. Department of Energy–Golden Field Office, Expanding geothermal resource utilization in Nevada through directed research and public outreach, 6/05–5/06, \$992,133, **Shevenell**.

- U.S. Department of Energy–Golden Field Office: Expanding geothermal resource utilization in Nevada through directed research and public outreach 10/04–9/06, \$981,000 **Shevenell**.
- U.S. Department of Homeland Security, FFY05 Pre-Disaster Mitigation HAZUS Data Update, 10/05–10/07, \$60,063, **Johnson, G.**, and **Arritt, C.**
- U.S. Fish and Wildlife Service, Ecosystem Flow Recommendation Study, Bill Williams River, Arizona, 8/04–7/09, \$10,000, **House, P.**
- U.S. Geological Survey STATEMAP, Flowery Peak 7.5' Quadrangle, Nevada (east half), 5/04–4/05, \$26,254, **House, P.**, and **Castor, S.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in Ivanpah Valley, 5/04–4/05, \$52,044, **House, P.K.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Spirit Mountain SE Quadrangle, 5/04–10/05, \$24,991, **House, P.K.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Fernley East Quadrangle, 5/04–10/05, \$29,136, **Faulds, J.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP, Geologic mapping in the Fernley West Quadrangle, 05/05–10/06, \$22,062, **Faulds, J.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Searchlight Quadrangle, 5/05–10/06, \$27,211, **Faulds, J.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, ACEC Mineral Evaluation, So Nevada and MRDS studies, Clark and southern Nye Counties, 9/03–11/06, \$195,000, **Castor, S.B.**
- U.S. Geological Survey, Humboldt Basin New Geologic Mapping Project, 5/05–9/06, \$38,769, **Muntean, J.L.**, and **Henry, C.D.**
- U.S. Geological Survey, National Earthquake Hazards Reduction Program, Paleoseismic studies of the Little Valley fault, 5/02–10/04, \$71,151, **Ramelli, A.R.**, **dePolo, C.M.**, and **Bell, J.W.**
- U.S. Geological Survey, National Earthquake Hazards Reduction Program, Paleoseismic studies of the Warm Springs fault, 4/01–12/04, \$68,962, **dePolo, C.M.**, and **Ramelli, A.R.**
- U.S. Geological Survey, National Earthquake Hazards Reduction Program, Piedmont Geosciences, Inc., Paleoseismic investigation of the Mohawk Valley fault zone, Sierra County, Northeastern California, 3/04–2/05, \$10,378 subcontract, Sawyer, T.L., Briggs, R., and **Ramelli, A.R.**
- U.S. Geological Survey, National Earthquake Hazards Reduction Program, Paleoseismic studies of the Peavine fault, 4/01–3/03, \$69,745, **Ramelli, A.R.**, **Bell, J.W.**, and **dePolo, C.M.**
- U.S. Geological Survey, National Earthquake Hazards Reduction Program, Paleoseismic studies of East Carson Valley, 3/03–2/04, **dePolo, C.M.**, and **Ramelli, A.R.**
- U. S. Geological Survey, National Earthquake Hazards Reduction Program, Liquefaction Susceptibility mapping in Carson Valley, West-Central Nevada, 3/05–2/06, \$63,682, **dePolo, C.M.**, and **Ramelli, A.R.**
- U. S. Geological Survey, National Earthquake Hazards Reduction Program, Quaternary faulting and seismic source characterization in the Las Vegas Metropolitan Area, 1/05–12/05, \$59,408, **dePolo, C.M.**
- U.S. Geological Survey, Southern Nevada and MRDS Studies, 6/04–11/06, \$118,000 **Castor, S.B.**, and **LaPointe, D.D.**
- U.S. Geological Survey, Southern Nevada and MRDS Studies: Searchlight district, 11/05–11/06, \$30,998, **Faulds, J.E.**
- U.S. Geological Survey, Statemap portion of the National Cooperative Geologic Mapping Program, Geologic Mapping in Urban and Rural Nevada, Jerriitt Canyon mining district, 5/05–4/06, \$38,769, **Muntean, J.**, and **Henry, C.D.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in Ivanpah Valley, 5/03–4/04, \$69,634, **House, P.K.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in Ivanpah Valley, 5/04–4/05, \$52,044, **House, P.K.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Pah Rah Mountain Quadrangle, 5/03–10/04, \$23,554, **Bell, J.W.**, and **House, P.K.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Mt Manchester Quadrangle, 5/03–10/04, \$29,136, **House, P.K.**, **Faulds, J.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Fernley East Quadrangle, 5/04–10/05, \$29,136, **Faulds, J.**, **Ramelli, A.R.**, and **Bell, J.W.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Spirit Mountain SE Quadrangle, 5/04–10/05, \$24,991, **House, P.K.**, and **Bell, J.W.**

- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Flowery Peak (west half) Quadrangle, 5/04–10/05, \$26,254, **Castor, S.B.**, and **House, K.**
- U.S. Geological Survey, STATEMAP program, Geologic mapping in the Flowery Peak (east half) Quadrangle, 5/05–4/06, \$22,841, **Castor, S.B.**, and **House, K.**
- U.S. Geological Survey, STATEMAP, 2004, Geologic mapping of the north half of the Fernley West Quadrangle: 5/05–8/06, \$22,062, **Faulds, J.E.**, and **Ramelli, A.R.**
- U.S. Geological Survey, STATEMAP, 2004, Geologic mapping of the north half of the Searchlight Quadrangle: 5/05–8/06, \$27,211, **Faulds, J.E.**, and **Ramelli, A.R.**
- U.S. Geological Survey, STATEMAP, Geologic mapping in urban and rural Nevada, south half Seven Lakes Mountain, 5/04–4/05, \$29,714, **Henry, C.D.**, **Faulds, J.**, and **Ramelli, A.R.**
- U.S. Geological Survey, STATEMAP, Geologic mapping in urban and rural Nevada, north half Seven Lakes Mountain, 5/05–4/06, \$24,149, **Henry, C.D.**, and **Ramelli, A.R.**
- U.S. Geological Survey, STATEMAP, Geologic mapping of the Jean, east half of Goodsprings, west half of Roach, and west half of State Line Pass 7.5-minute Quadrangles, 5/02–9/03, \$87,433, **House, P.K.**, and **Ramelli, A.R.**
- U.S. Geological Survey, STATEMAP, Geologic mapping of the Russells 7.5-minute Quadrangle, 5/02–10/03, \$32,462, **Ramelli, A.R.**, and **House, P.K.**
- U.S. Geological Survey, STATEMAP, Quaternary geologic mapping of the Desert, Hidden Valley, McCullough Pass, and east half of Roach 7.5-minute Quadrangles, 5/03–10/04, \$69,634, **House, P.K.**, **Ramelli, A.R.**, and **Bell, J.**
- U.S. Geological Survey, STATEMAP, Spirit Mountain Southeast 7.5' Quadrangle, Nevada and Arizona (west Half), 5/04–4/05, \$24,991, **House, P.**, and **Bell, J.**
- Women's Auxiliary to American Institute of Mining, Metallurgical, and Petroleum Engineers, Education for Tomorrow program, 1/04–1/05, \$3000, **LaPointe, D.D.**

#### **OTHER PROFESSIONAL ACTIVITIES—2004 AND 2005**

NBMG scientists are active professionally at local, state, regional, national, and international levels. Many frequently serve as peer reviewers of manuscripts published in refereed journals and of proposals submitted to funding agencies. NBMG employees also serve on numerous committees and assignments within the University of Nevada, Reno, College of Science, Mackay School of Earth Sciences and Engineering, and NBMG. Below is a partial list of additional professional service provided by NBMG staff.

##### **Arritt, C.**

###### 2005

Registration chairman, Nevada Geographic Information Society 15<sup>th</sup> annual conference, Sparks, Nevada.  
Interim Secretary, California/Nevada Chapter, Geospatial Information Technology Association.

##### **Bell, J.W.**

###### 2004

Institutional representative, Western North America InSAR (WinSAR) Consortium.  
*Member, Quantifying seismic hazard uncertainty in the Reno-Carson City metropolitan area workshop, U.S. Geological Survey and the University of Nevada, Reno Seismological Lab.*  
Member, InSAR Workshop, groundwater hydrology committee; sponsored by NASA.  
*Member, Steering Committee for the Las Vegas Fissure Preserve; sponsored by the Association of Engineering Geologists, Las Vegas section.*  
Reviewer, international journal *Engineering Geology*.  
Consultant (unpaid), Nevada geotechnical industry, public agencies, teachers, and general public.  
Contributor to ongoing efforts by city and county agencies in the Las Vegas area to mitigate land subsidence and fault and earth fissure hazards. Efforts this evaluation period included working with City of Pahrump and Nye County to develop a groundwater management plan that incorporates subsidence mitigation; and with the Virgin Valley Water District and the City of Mesquite to monitor subsidence effects associated with new municipal wells.

Assistant, Nye County Water Well Association, evaluating geologic maps and soils in Pahrump Valley.  
 Assistant, *TriCorp Planners, Inc.*, developing land-use planning guidelines for faults and fissures in Pahrump Valley.  
 Assistant, City of Glendale, Arizona, developing subsidence mitigation strategies.  
 Reviewer, U.S. Geological Survey open-file report and website related to InSAR data for Las Vegas.

## 2005

Technical session organizer and chair, Symposium on Earth Fissures, Association of Engineering Geologists 2005 Annual Meeting in Las Vegas, Nevada.  
 Field trip leader, Geology, hydrology, subsidence and earth fissures, Pahrump Valley, Nevada, Association of Engineering Geologists 2005 Annual Meeting in Las Vegas.  
 Field trip co-leader, Birth of the lower Colorado River, Geological Society of America 2005 Annual Meeting in Salt Lake City.  
 Institutional representative for the Western North America InSAR (WInSAR) Consortium.  
 Member, Steering Committee, Las Vegas Fissure Preserve, Association of Engineering Geologists, Las Vegas section.  
 Head of nomination committee for election of D.B. Slemmons (UNR Professor Emeritus) to Honorary Membership in the Association of Engineering Geologists.  
 Reviewer for the journal *Science*.  
 Reviewer for the journal *Geology*.  
 Reviewer for the journal *Environmental and Engineering Geoscience*.  
 Consultant for the Nevada geotechnical industry, public agencies, and general public.  
 Conducted meetings and provided technical assistance on groundwater issues to public agencies: Southern Nevada Water Authority; Virgin Valley Water District; Nye County/Town of Pahrump; Clark County Building Department.  
 Conducted meetings and provided technical assistance on groundwater issues to private industry: Newmont Mining Corporation and Barrick Goldstrike Mining Corporation.  
 Provided technical assistance to various consultants, engineers, developers, lawyers on land subsidence in Las Vegas: JLM Realty; Matrix Construction Services; VF Corporation; Western Technologies; Converse Consultants; Sky Las Vegas Development Corporation; Las Vegas paralegal services.  
 Provided technical advice to out-of-state groups on land subsidence in Las Vegas: Houston Geological Society; Houston private consultant; Stanislaus County, California.  
 Provided technical assistance on regional seismic hazards: U.S. Forest Service; Black Eagle Consultants.

## **Blewitt, G.**

## 2004

Chair, PBO Stable North America Reference Frame Working Group.  
 Governing Board, International GPS Service.  
*Science Advisory Team Member, for JPL NASA REASoN project, Inter-Service Data Integration for Geodetic Operations.*  
*Member, UNAVCO elections committee.*  
*Chair, UNAVCO membership committee.*  
*Member, EarthScope Plate Boundary Observatory Siting Committee for the Basin and Range Province.*  
*Founding Member of Special Bureau for Loading, Global Geophysical Fluids Center, International Earth Rotation Service.*  
*Special Session Convenor, Reference Frames Procedures in Practice to Enhance Scientific Investigations, American Geophysical Union Meeting, San Francisco, California.*  
 Special Session Convenor, Toward a Stable North America-Fixed Reference Frame, American Geophysical Union Joint Assembly, Montreal.  
*Organizing Committee, EarthScope GreatBREAK Workshop.*  
 Chair, EarthScope Stable North America Reference Frame Working Group.  
 National Science Foundation EarthScope Proposal Review Panel.  
*Invited No-Fee Consultant on Natural Resources Canada Strategic Plan.*  
*Member, Interagency Committee on the North American Reference Stations.*

2005

Governing Board, International GPS Service.

Special Session Convenor, Earth Rotation and Geocenter, Fall 2005 Meeting, San Francisco, California.

Special Session Chair, Natural Hazards and Coastal Processes: Monitoring and Mitigation, Fall 2005 Meeting, San Francisco, California.

Science Advisory Team Member, for JPL NASA REASoN project, Inter-Service Data Integration for Geodetic Operations.

Member, UNAVCO elections committee.

Chair, UNAVCO membership committee.

Member, EarthScope Plate Boundary Observatory Siting Committee for the Basin and Range Province.

Founding Member of Special Bureau for Loading, Global Geophysical Fluids Center, International Earth Rotation Service.

Member, Interagency Committee on the North American Reference Stations.

**Castor, S.B.**2004

Member, Geological Society of Nevada Education Committee, 2004.

Member, Forum on the Geology of Industrial Minerals organizing committee, Bloomington, Indiana, 2004.

2005

Member, Geological Society of Nevada Education Committee, 2005.

Supervisor for visiting International Atomic Energy Association scientist Khaled Ali from Egypt, June 13–September 12, 2005.

Associate editor and contributor, Industrial Minerals and Rocks 7th Edition, Society for Mining, Metallurgy, and Exploration, 2005.

Steering Committee, 41st Forum on the Geology of Industrial Minerals, Istanbul, Turkey, 2005.

Chair, Industrial Minerals Session, Geological Society of Nevada Symposium, Reno/Sparks, Nevada, 2005.

**dePolo, C.M.**2004

Speaker/developer, State conference, effective nonstructural mitigation strategies for earthquakes in Nevada, Verdi, Nevada, 2004.

Chaired, steering committee for, prepared the proceeding volume for, and presented posters at the “Basin and Range Province Seismic Hazard Summit II,” held in Sparks, Nevada on May 16–19, 2004.

Developer, earthquake response scenario for the University of Nevada, Reno, 2004.

Chairman, Basin and Range Province Committee, Western States Seismic Policy Council, 2004.

Developer, earthquake hazard mitigation power point presentation for rural Nevada, 2004.

Speaker, earthquakes and earthquake hazards to the Churchill County Museum, the Carson Valley Museum, the Public Entities Safety Conference in Carson City, the HAZUS working group meeting, the nonstructural mitigation conference, the Basin and Range Province Seismic Hazard Summit II, and at the Nevada Earthquake Safety Council meetings, 2004.

Supervisor, HAZUS earthquake models, 2004.

Developer, shear-wave velocity map for west-central Nevada, Nevada Earthquake Safety Council and the California Seismic Safety Commission, 2004.

Co-leader, field trip portion of a soil tectonics class sponsored by the Association of Engineering Geologists, 2004.

Managed, nonstructural mitigation conference for Nevada in 2004.

2005

Symposium developer, Association of Engineering Geologists, earthquake hazards of the southern Basin and Range Province, Las Vegas, Nevada, 2005.

Member, Nevada Earthquake Safety Council, 2005.

Member, Basin and Range Province Committee, Western States Seismic Policy Council, 2005.

Leader, Geological Society of America Annual Meeting field trip stop, paleoseismic trenches along the Warm Springs Valley fault system, 2005

Speaker, Association of Engineering Geologists meeting, Warm Springs Valley fault system, 2005.

### **Desilets, M.O.**

#### 2004

Science Fair Judge, Western Regional Science Fair, Reno, Nevada.

Facilities committee chairman, Window on the World: Geological Society of Nevada Symposium 2005.

#### 2005

Science Fair Judge, Western Regional Science Fair, Reno, Nevada.

Facilities committee chairman, Window on the World: Geological Society of Nevada Symposium 2005.

### **Faulds, J.E.**

#### 2004

Leader, Paleomagnetic Laboratory, University of Nevada, Reno.

Leader, 3-day field trip, Lake Mead National Recreation Area for staff from the Interpretive and Resource Management Divisions of the National Park Service.

Leader, Department of Geological Sciences Open-House field trip, Brady's and Desert Peak geothermal fields.

Director and Teacher, 2004 Geology Summer Field Camp, University of Nevada Department of Geological Sciences and Engineering.

#### 2005

Keynote speaker, Walker Lane, Penrose Conference.

Presenter, potential flood hazards in the Mogul area related to the Somerset development, Washoe County Water Resources Division and County Commissioners.

Leader, field trip for staff at Katherine's Landing Office of the National Park Service, Lake Mead National Recreation Area.

Co-chair, NPS scholarship committee, Nevada Petroleum Society.

Speaker, University of Nevada Department of Geological Sciences and Engineering, John Louie's geophysics class on the geology of the Fernley area.

Co-chair, and organizer, session on Quaternary deformation in the Walker Lane, central Nevada seismic belt, and eastern Sierra Nevada margin, Seismological Society of America.

Co-leader, field trip on Miocene volcano-plutonic systems, southern Nevada: A window into upper crustal magmatic processes, Geological Society of America, Cordilleran Meeting.

Speaker, Geological Society of Nevada 2005 Symposium.

Member, technical program review committee, Geothermal Resources Council 2005 Meeting.

Director and Teacher, 2005 Geology Summer Field Camp, University of Nevada Department of Geological Sciences and Engineering.

Organizer, symposium honoring Ernie Anderson for the October Annual Meeting, Geological Society of America, Salt Lake City.

Speaker, U.S. Department of Energy, Peer Review Meeting, Reno.

Leader, field trip to the Desert Peak-Brady's geothermal fields, Geothermal Resources Council meeting, Reno.

Leader, field trip, Transect Across the Northern Walker Lane, Northwest Nevada and Northeast California: An Incipient Transform Fault Along the Pacific-North American Plate Boundary, Geological Society of America Annual Meeting, Salt Lake City.

Chair, symposium entitled Controversies, conundrums, and innovative approaches in extensional tectonics: A tribute to Ernie Anderson for the Geological Society of America Annual Meeting in Salt Lake City.

**Garside, L.J.**

2005

Field trip co-leader, Earth Science Week, The Frenchman Lake Frolic.  
Field trip co-leader, Bradys/Desert Peak, Geothermal Resources Council.  
Judge, Best student paper, Geological Society of Nevada 2005 Symposium.  
Reviewer, U.S. Geological Survey report on the geologic assessment of oil and gas in the eastern Great Basin.

**Garside, T.**

2004

Executive assistant, Nevada Earthquake Safety Committee.  
Member, Nevada Hazard Planning Committee.  
Organizer, Basin and Range Province Seismic Hazards Summit II  
Organizer, HAZUS Workshop, University of Nevada.  
Organizer, EarthScope Workshop, Lake Tahoe.  
Nevada representative, Western States Seismic Policy Council Annual Meeting, St. Louis, Missouri.  
Coordinator, cooperative agreement between the U.S. Fish and Wildlife Service and the University of Nevada.  
Coordinator, grant between the University of Nevada and the Bureau of Land Management for U.S. Highway 93 tour guide.

2005

Executive assistant, Nevada Earthquake Safety Committee.  
Member, Nevada Hazard Planning Committee.  
Co-treasurer, Geological Society of Nevada Symposium.  
Field trip organizer, Geological Society of America.  
Preparer, Benefit-Cost Analysis, Disaster Resistant University, University of Nevada.  
Public Liaison, Nevada Bureau of Mines, Association of Engineering Geologists Annual meeting, Las Vegas, Nevada.  
Nevada representative, Western States Seismic Policy Council Annual Meeting in Boise, Idaho;

**Hammond, W.C.**

2004

Reviewer, manuscripts for Science, EPSL, BSSA, US Geological Society, IAG, University of Utah.  
Reviewer, proposals for NSF, Swiss Federal Institute of Technology Zurich.  
Member, Site Selection Working Group, EarthScope/Plate Boundary Observatory.

2005

Reviewer, manuscripts for Science, EPSL, BSSA, US Geological Society, IAG, University of Utah.  
Reviewer, proposals for NSF, Swiss Federal Institute of Technology Zurich.  
Member, Site Selection Working Group, EarthScope/Plate Boundary Observatory.

**Henry, C.D.**

2005

Field trip, co-leader, Transect across the northern Walker Lane, northwest Nevada and northeast California: An incipient transform fault along the Pacific–North American plate boundary: Geological Society of America.  
 Co-organizer, Great Basin regional geology, Geological Society of Nevada Symposium 2005–Window to the World.  
 Invited panel member, Controversies on the origin of world-class gold deposits: Carlin and Witswatersrand, Society of Economic Geologists.  
 Co-organizer, Penrose Conference, Kinematics and geodynamics of intra-plate dextral shear in eastern California and western Nevada.

### **Hess, R.H.**

#### 2004

Granted the title of Certified Mapping Scientist-GIS/LIS, GS114, by the American Society for Photogrammetry and Remote Sensing, 1994, Re-certified 1999 and 2004.

#### 2005

Certified Geographic Information Systems Professional (GISP) by the GIS Certification Institute, 2005.  
 Microsoft Certified Professional (MCP), 2005.

### **House, P.K.**

#### 2005

Field trip leader, Geological Society of American Annual Meeting, Birth of the Lower Colorado River—Stratigraphic and geomorphic evidence for its inception near the conjunction of Nevada, Arizona, and California.  
 Co-convenor, Technical Session T56, Annual Meeting of the Geological Society of America Annual Meeting, Salt Lake City, Carving the Western Landscape—The Evolution of the Colorado River from Source to Sink.  
 Principal Physical Science Advisor (Geomorphology and Hydrology), Bill Williams River Ecosystems Flow Workshop, Tempe, Arizona.

### **Hursh, J.P.**

#### 2004

Board of Directors and tour leader, Historic Reno Preservation Society.  
 Director, Nevada Land Conservancy, Truckee Meadows Remembered project, Bartley Ranch Regional Park, Reno, Nevada.  
 Nevada Magazine, May/June issue, co-author, invited featured photographer, adventure article: Bagging the Bard—A trek to the top of King Lear Peak offers the high-blown theater above the Black Rock Desert.  
 University of Nevada Impact newspaper, v. 1, no. 1, September 2004, contributed two featured photographs for article: Meet the University's world-class earthquake team!

#### 2005

Invited featured photographer for children's book: Valleys, Capstone Press, Mankato, Minnesota.  
 Program chairman, Nevada Geographic Information Society 15<sup>th</sup> annual conference, Sparks, Nevada.

### **Johnson, G.L.**

#### 2004

Member, State Mapping Advisory Committee, GIS subcommittee.  
 Lecturer, Usages of GIS in the Reno Community to Lion's Club.



Instructor, University of Nevada, Reno Applied GIS, Fall Semester for Applied Statistics Department.  
 Instructor, University of Nevada, Reno, Intro To GIS, Spring Semester.  
 Instructor, University of Nevada, Reno, Advanced GIS, Fall Semester.

#### 2005

Member, State Mapping Advisory Committee, GIS subcommittee.  
 Treasurer, Nevada Chapter, Urban and Regional Information Systems Association.  
 Treasurer, 7th Annual Nevada State GIS Conference organizing committee.  
 Speaker, Updates of The Model Law, 2005 Nevada Geographic Information Society Conference, Sparks, Nevada.  
 Speaker, Digital Mapping Techniques, Conference, Portland, Oregon.  
 Lecturer, NBMG GIS efforts in Nevada, PEO organization, Reno, Nevada.  
 Lecturer, Usages of GIS in the Reno Community to Lion's Club.  
 Instructor, University of Nevada, Reno Applied GIS, Fall Semester for Applied Statistics Department.  
 Instructor, University of Nevada, Reno, Intro To GIS, Spring Semester.  
 Instructor, University of Nevada, Reno, Advanced GIS, Fall Semester.

#### **Kreemer, C.**

#### 2004

Convenor special session, Integrated studies of lithosphere-mantle interaction and lithospheric deformation,  
 American Geophysical Union Fall Meeting.  
 Convenor special session, New advances in global plate kinematics and dynamics from space geodesy, American  
 Geophysical Union /CGU Joint Assembly, Montreal.

#### 2005

Co-teacher, guest lecture for GEOG210, Exploring, measuring, and mapping planet earth, University of Nevada,  
 Reno.  
*Co-chair, Task Force VII, International Lithosphere Program: Temporal and Spatial Changes of Stress and Strain.*  
*Judge, Regional Science Fair, University of Nevada, Reno.*

#### **LaPointe, D.D.**

#### 2004

Education committee co-chair, Geological Society of Nevada.  
 Member, education committee, Nevada Mining Association.  
 Instructor, Minerals Education Workshops, Las Vegas and northern Nevada.  
 Leader, Earth Science Week field trips.  
 Leader, Mackay student field trips to mines and geological sites in Nevada.  
 Leader, Earth Day public education and outreach.  
 Leader, Mackay School of Earth Sciences and Engineering tours.  
 Leader, National Minerals Education Foundation annual conference field trips, Crystal Bay, Nevada.  
 Leader, Kids University, University of Nevada.  
 Instructor to 60 groups of students, teachers, campers, and civic groups visiting the University campus.  
 Instructor to 6 K-12 classrooms off campus.

#### 2005

Education committee co-chair, Geological Society of Nevada.  
 Member, education committee, Nevada Mining Association.  
 Instructor, Minerals Education Workshops, Las Vegas and northern Nevada.  
 Leader, Earth Science Week field trips.  
 Leader, Mackay student field trips to mines and geological sites in Nevada.

Leader, Earth Day public education and outreach.

Leader, Mackay School of Earth Sciences and Engineering tours.

*Leader, Kids University, University of Nevada.*

Instructor to over 50 groups of students, teachers, campers, and civic groups visiting the University campus.

Instructor to 25 K-12 classrooms off campus.

## **Lechler, P.**

### 2004

Participant, IGCP Project: Sustainable use of Platinum Group Elements in the 21<sup>st</sup> Century.

Member, Bureau of Land Management, Abandoned Mine Lands task force.

Member, Nevada Attorney General's Mining Fraud Task Force.

Consultant, Gold placer evaluation in Quillabamba, Peru for Peru American Gold Resources.

Consultant, Review of nickel deposit in Quebec for North American Diversified Resources.

Consultant, Gold placer and lode potential evaluation in Monclova, Mexico.

### 2005

Participant, IGCP Project: Sustainable use of Platinum Group Elements in the 21<sup>st</sup> Century.

Member BLM Abandoned Mine Lands task force.

Member Nevada Attorney General's Mining Fraud task force.

Consultant, Polymetallic vein evaluation in Quillabamba, Peru for Peru American Gold Resources.

## **Mauldin, J.**

### 2004

Featured professional profile, Western Nevada Community College Spring Catalog cover article: Grad Finds

Formula for Success—Graphics + Geology + GIS x WNCC = Great Job.

Planning committee, Nevada Geographic Information Society 15<sup>th</sup> Annual Conference, Sparks, Nevada.

Graphics/Promotions and Web subcommittees, Nevada Geographic Information Society Annual Conference, Sparks, Nevada.

### 2005

Web subcommittees, Nevada Geographic Information Society 16<sup>th</sup> Annual Conference, Sparks, Nevada.

## **Muntean, J.**

### 2004

Instructor, SEG-sponsored short courses, Carlin-type deposits, Moscow, Russia.

### 2005

Presenter, three 1<sup>st</sup> grade classes at Brown Elementary, Reno, Nevada.

Organizer, SEG-sponsored forum, World Class Controversies – Genesis of the Witwatersrand and Carlin gold systems.

Coordinator, SEG-sponsored student-mentor workshop, Geological Society of Nevada Symposium.

## **Plag, H.-P.**

2004

Member, Advisory Committee, IERS Conventions  
 External Expert member, Project Team, European Sea Level Service Research Infrastructure.  
 IAG delegate, GEO Subgroup, User requirements and Outreach.  
 Chair, GGOS working group, Copyrights, Data access policy, Publishing and Certification.  
 Associate Member, International Earth Rotation Service.  
 Principal investigator, Determination of geodetic coordinates of the EGNOS RIMS and NLES sites.  
 Coordinator, Norwegian Research Project OCTAS, Ocean Circulation and Transport between North Atlantic and Arctic Sea.  
 Coordinator, EU-Project, ESEAS-Research Infrastructure.  
 Principal investigator, Galileo System Test Bed V1 Stand-alone Test Case, Geodetic Galileo.  
 Co-chair, Special Bureau for Loading of the Global Geophysical Fluid Center of the IERS, since 2004 sole chairperson.  
 Associated Member of the International VLBI Service.  
 Director, Central Bureau of the European Sea Level Service.  
 Secretary, EGS subsection II.B2: Global and Regional Interdisciplinary Networks.  
 Member, Ny-Alesund Science Manager Committee.  
 Associated member of the International GPS Service.  
 National Delegate, COST Action 716: Exploitation of ground- based GPS for climate and numerical weather prediction applications.

2005

Member, Advisory Committee, IERS Conventions  
 External Expert member, Project Team, European Sea Level Service Research Infrastructure.  
 IAG delegate, GEO Subgroup, User requirements and Outreach.  
 Chair, GGOS working group, Copyrights, Data access policy, Publishing and Certification.  
 Associate Member, International Earth Rotation Service.  
 Co-chair, Special Bureau for Loading of the Global Geophysical Fluid Center of the IERS, since 2004 sole chairperson.  
 Associated Member of the International VLBI Service.  
 National Delegate, IAG Commission V and XIV.  
 Secretary, EGS subsection II.B2: Global and Regional Interdisciplinary Networks.  
 Associated member of the International GPS Service.  
 National Delegate, COST Action 716: Exploitation of ground- based GPS for climate and numerical weather prediction applications.

**Price, J.G.**2004

Secretary-Treasurer and Member of the Board of Trustees, SME Foundation, Society for Mining, Metallurgy, and Exploration of AIME.  
 Past President, Society of Economic Geologists.  
 General Co-Chair, Geological Society of Nevada Symposium 2005, Window to the World.  
 Member, Federal Advisory Committee for the National Cooperative Geologic Mapping Program, U.S. Department of Interior, U.S. Geological Survey.  
 Member, Scientific Earthquake Studies Advisory Committee, U.S. Department of Interior, U.S. Geological Survey.  
 Member, Steering Committee for the Advanced National Seismic System, U.S. Geological Survey.  
 Member, EarthScope Science and Education Committee, National Science Foundation.  
 Chair, State Hazard Mitigation Planning Committee.  
 Chair, State Mapping Advisory Committee.  
 Member, Steering Committee, American Geological Institute National Geoscience Data Repository.  
 Member, Geology and Public Policy Committee, Geological Society of America.  
 Secretary, Nevada Earthquake Safety Council.

Administrator, Mining Cooperative Fund, State of Nevada.  
 Member, Program Review Team for the Delaware Geological Survey, University of Delaware.  
 Field Trip Co-Leader, Earth Science Week.  
 Chair, Government Affairs, Mineral and Energy Resources Section, National Association of State Universities and Land Grant Colleges.  
 Field Trip Leader, Winnemucca area, National Mineral Education Conference.  
 Facilitator, Basin and Range Province Seismic Hazard Summit, Reno, Nevada.  
 Co-Organizer, EarthScope Great Basin Conference, National Science Foundation, Tahoe City, California.

## 2005

Keynote speaker, Association of Environmental and Engineering Geologists annual meeting.  
 Councilor, Geological Society of America.  
 Geology and public policy committee, Geological Society of America.  
 General Co-Chair, Geological Society of Nevada Symposium 2005, Window to the World.  
 Vice President and President-Elect, Nevada Petroleum Society.  
 Secretary-Treasurer and Trustee, SME Foundation, Society for Mining, Metallurgy, and Exploration of AIME.  
 Member, Federal Advisory Committee for the National Cooperative Geologic Mapping Program, U.S. Department of Interior, U.S. Geological Survey.  
 Member, Scientific Earthquake Studies Advisory Committee, U.S. Department of Interior, U.S. Geological Survey.  
 Member, Steering Committee for the Advanced National Seismic System, U.S. Geological Survey.  
 Field Trip Co-Leader, Earth Science Week.  
 Organizer, Career Day, Nevada Section of the American Institute of Professional Geologists.  
 Judge, Regional Science Fair, Reno.  
 Instructor, Nevada Mining Association Teachers' Workshop, Winnemucca.  
 Chair, State Hazard Mitigation Planning Committee.  
 Member, Audit Committee, Geological Society of America.  
 Member, Annual Program Committee, Geological Society of America.  
 Member, Geology and Public Policy Committee, Geological Society of America.  
 Member, EarthScope Science and Education Committee, National Science Foundation.  
 Chair, State Mapping Advisory Committee.  
 Secretary, Nevada Earthquake Safety Council.  
 Administrator, Mining Cooperative Fund, State of Nevada.  
 Member, Hazards Committee, American Institute of Professional Geologists.  
 Review Coordinator, National Research Council, for report on "Mine Placement of Coal-Combustion Residues."  
 Assistant to the 2005 Annual Meeting Committee of the Association of Engineering Geologists.

## **Ramelli, A.R.**

## 2004

Judge, Outstanding International Graduate Student award.  
 Liaison between private land owners and the Nevada Division of Forestry for a fuels reduction program.

## 2005

Speaker, Annual Meeting of the Seismological Society of America, Incline Village, Nevada.

## **Shevenell, L.**

## 2004

Associate Director, and Director, Great Basin Center for Geothermal Energy.  
 Presenter, U.S. Department of Energy, Industry meeting held at Lawrence Berkeley National Laboratory.  
 Presenter, States of Alaska and Nevada Geothermal Trade Mission, Reno, Nevada.  
 Presenter, Geothermal Resources Council meeting, Palm Springs, California.

Chair, Great Basin Studies session at the Geothermal Resources Council meeting, Palm Springs, California.  
 Organizer, Great Basin Geothermal Workshop highlighting geothermal research in the Great Basin.  
 Preparer, white paper to advance the idea of increasing the DOE geothermal budget by \$5 million.  
 Technical Program Co-Chair, 2004 Annual Geothermal Resources Council Meeting, Palm Springs, California.  
 Technical Program Chair, 2005 Annual Geothermal Resources Council Meeting in Reno, Nevada.  
 Co-chair and organizer, Geothermal Resources in the Great Basin, 2005 Geological Society of Nevada.  
 Advisor, Eureka County, Nevada, geothermal resources and development.  
 Participated in the U.S. Department of Energy Review at Lawrence Berkeley National Laboratory, Berkeley, California.

## 2005

Director, Great Basin Center for Geothermal Energy.  
 Reviewer, Nevada Southwest Energy Project Program, Las Vegas, Nevada.  
 University of Nevada representative, meeting with Desert Research Institute, Reno Transportation Commission, and the National Renewable Energy Laboratory discussing collaboration to use geothermal energy at the University of Nevada, Redfield campus to produce Hydrogen for use in RTC buses for the future, Reno, Nevada.  
 Contributing author with other researchers in the western U.S., on a white paper to promote increased funding for the DOE geothermal program.  
 Representative to Washington, D.C. to meet with DOE representatives and congressional delegations.  
 Reviewer, Nevada Southwest Energy Program funded projects at the Redfield and University of Nevada, Reno campuses.  
 Host, workshop to Review and Update Geothermal Resource Estimates at University of Nevada, Reno organized in collaboration with the Geothermal Energy Association.  
 Host, DOE geothermal exploration peer review of funded proposals on the University of Nevada, Reno Campus.  
 Technical Program Chair, 2005 Annual Geothermal Resources Council Meeting, Reno, Nevada.  
 Host, Ethiopian engineers and scientists meeting at the University of Nevada, Reno with discussions on how the Great Basin Center for Geothermal Energy can assist them in needed training in geothermal plant operation and maintenance, Reno, Nevada.  
 Reviewer, engineering-related proposals submitted to the Renewable Energy Center.  
 Participant, Bureau of Land Management Meeting on managing geothermal energy, Reno, Nevada.  
 Member advisory board, USGS National Geothermal Assessment study group.  
 Member, Design Review Board for the Renewable Energy Center at the Redfield campus.  
 Assisted consultant Terry Katzer regarding the Wabuska geothermal area and power plant.  
 Advisor, GeoTek Energy (Glenn Lovelace; Dripping Springs TX) regarding geothermal potential in Nevada and possible sites to demonstrate down-hole heat exchanger.

## **Tingley, J.V.**

## 2004

Executive Secretary, Nevada State Board on Geographic Names.

## 2005

Executive Secretary, Nevada State Board on Geographic Names.

## **Tingley, S.L.**

## 2004

Chair, Nevada State Board on Geographic Names.

## 2005

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## HONORS AND AWARDS

### Arritt, C.

Second Place, People’s Choice Poster, Nevada Geographic Information Society 15<sup>th</sup> Annual Conference, 2005.

### Bell, J.W.

Edward B. Burwell, Jr. Award by the Geological Society of America Engineering Geology Division. This award was established in 1968 in memory of one of the founding members of the GSA Division, and the first chief geologist of the US Army Corps of Engineers. It is awarded annually to the author of a published paper of distinction that advances knowledge concerning principles of engineering geology. Awarded at the Geological Society of America Annual Convention in Denver for paper “Land subsidence in Las Vegas, Nevada, 1935-2000: New geodetic data show evolution, revised spatial patterns, and reduced rates” by J.W. Bell, F. Amelung, A.R. Ramelli, and G. Blewitt published in 2002 in the journal Environmental and Engineering Geoscience.

Elected a Fellow in the Geological Society of America (GSA) in 2005. A member of the GSA is elected to Fellowship in recognition of significant contributions to the science of geology, which in my case was for the publication of the results of geologic research. Only 40 Fellows were elected from the GSA membership of more than 18,000 in 2005.

### Blewitt, G.

The Space Foundation's Space Technology Hall of Fame, Certificate of Commendation, Creation of Precision GPS Software System technology and successful transfer of space technology to Earth applications.

Mackay Faculty Achievement Award, Mackay School of Earth Science and Engineering.  
 Certificate of Recognition, UNAVCO Inc., Appreciation for service as Chairman of the Board of Directors.  
 Edward B. Burwell, Jr. Award by the Geological Society of America Engineering Geology Division. (for paper by J.W. Bell, F. Amelung, A.R. Ramelli, and G. Blewitt).  
 Nationwide press coverage for discovery of magma under Lake Tahoe [Smith et al., 2004].  
 International press coverage for discovery of mechanism for Earth's wobble [Gross et al., 2004, presented at Spring AGU, Montreal: Blewitt et al., 2004] with distribution at 13 million, broadcast coverage on 6 stations, and link to 40 web sites (estimated by UNR Office of Marketing and Communications).  
 Elected Fellow of the American Geophysical Union.  
 Co-Inventor on UK Patent Number GB2382482 for "Method for the reduction of errors in raw measured data related to predefined data."

#### **Crouse, E.C.**

First Place, Cartographic Poster, Nevada Geographic Information Society 15<sup>th</sup> Annual Conference, 2005.  
 ESRI Map Book, featured the Geothermal Map of North America, 2005.

#### **Faulds, J.E.**

Winner, best paper award for symposium at the Geothermal Resources Council Meeting, 2005.

#### **Hursh, J.P.**

Invited member, Artists Cooperative Gallery of Reno.  
 Distinguished citizen ten questions feature: Reno Magazine, September/October 2005, p. 144.  
 Appointed Deputy Sheriff, Nevada Westerners Corral.

#### **Muntean, J.**

Elected to the Council of the Society of Economic Geologists, 2005.  
 Elected to be Vice-Chair for the 2008 meeting and Chair for the 2012 meeting for the Gordon Research Conference on Geochemistry of Ore Deposits.

#### **Price, J.G.**

Dedication of the Proceedings Volume, Basin and Range Province Seismic Hazards Summit II, Western States Seismic Policy Council, Utah Geological Survey Miscellaneous Publication 05-2, 2005 ("to Dr. Jonathan G. Price in recognition of his leadership in the WSSPC, his participation and support of BRPSHS I and II, and his support of basic and applied seismic-hazard-reduction research in the Basin and Range Province").  
 Elected to the Council of the Geological Society of America, 2004.

#### **Ramelli, A.R.**

Edward B. Burwell, Jr. Award by the Geological Society of America Engineering Geology Division. (for paper by J.W. Bell, F. Amelung, A.R. Ramelli, and G. Blewitt).

#### **Shevenell, L.**

Named by Radar Energy as one of 2004's Key Women in Energy in the Americas.  
 Named Director of the Great Basin Center for Geothermal Energy, November 1, 2004.

## APPENDIX B

### STATUTORY MANDATES OF THE NEVADA BUREAU OF MINES AND GEOLOGY

#### Nevada Revised Statutes related to the Nevada Bureau of Mines and Geology

##### CHAPTER 514 - BUREAU OF MINES AND GEOLOGY

NRS 514.002 Definitions. As used in this chapter, unless the context otherwise requires, the words and terms defined in NRS 514.005 and 514.007 have the meanings ascribed to them in those sections.

(Added to NRS by 1997, 2977)

NRS 514.005 "Professional geologist" defined. "Professional geologist" means a person who:

1. Possesses a baccalaureate or higher degree from an accredited college or university with at least 30 semester hours or 45 quarter hours of course work in the science of geology and has at least 5 years of experience in the science of geology, which may include no more than 2 years of postgraduate course work in the science of geology;
2. Has at least 12 years of experience in the science of geology, at least 3 years of which must have been completed under the supervision of a professional geologist; or
3. Is currently licensed or certified as a professional geologist:
  - (a) In another state; or
  - (b) By a national nonprofit geological organization with members in at least 10 states who are licensed or certified, if the requirements for his current licensure or certification included requirements at least equal to those set forth in either subsection 1 or 2.

(Added to NRS by 1997, 2978)

NRS 514.007 "Science of geology" defined. "Science of geology" means the:

1. General study of the earth, including its origin, processes and history;
2. Collection and investigation of specimens of the constituent rocks, minerals, fossils, solids, mineralizing fluids, gasses and other materials of the earth that are located from the center of the core of the earth to the surface of the earth; and
3. Application of the knowledge set forth in subsections 1 and 2 for the benefit of the general public and the general welfare of this state.

(Added to NRS by 1997, 2978)

NRS 514.010 Establishment. There is hereby established a bureau of mines and geology of the State of Nevada which shall be in the public service division of the University and Community College System of Nevada.

[Part 1:127:1935; 1931 NCL § 4311.01]-(NRS A 1971, 368; 1993, 411)

NRS 514.020 Compensation and expenses of board of regents. Members of the board of regents shall serve without compensation, but shall be reimbursed for the actual expenses incurred in the performance of their official duties.

[Part 1:127:1935; 1931 NCL § 4311.01]

NRS 514.030 Employment and compensation of director and other employees.

1. The board of regents of the University of Nevada shall appoint as director a competent scientist or engineer, to be known as the director of the bureau of mines and geology, who must be a:
  - (a) Graduate of a recognized college or university with a degree in some branch of earth science or mineral engineering; and
  - (b) Professional geologist with expertise in the science of geology.
2. Upon the director's nomination, the board of regents of the University of Nevada shall employ such assistants and employees as the board deems necessary.
3. The board of regents of the University of Nevada may also determine the compensation of all persons employed by the bureau of mines and geology and may remove them at will.

[Part 1:127:1935; 1931 NCL § 4311.01]-(NRS A 1971, 369; 1993, 411; 1997, 2978)

NRS 514.040 Duties. The bureau of mines and geology shall:

1. Serve as a bureau of information and exchange on Nevada mineral industry, mineral resources and geology.

2. By questionnaire, field investigations, laboratory studies or otherwise, conduct a thorough survey of the mineral resources and geology of the state.
  3. Apply geologic engineering principles to problems of conservation, environment, construction, mineral industry and other scientific matters that may be of importance to the welfare of the state.
  4. Make studies of mineral materials to determine the most economical and practical methods of concentrating and processing these resources and to promote their conservation.
  5. Collect, in collaboration with the Mackay school of mines, a library and bibliography of all literature pertaining to Nevada mineral industry, geology and mineral resources.
  6. Collect, in collaboration with the Mackay school of mines, typical geological and mineralogical specimens and models, drawings and descriptions of appliances used in the mineral industry and earth science. Collections of these materials may be maintained and displayed elsewhere within or without the state.
  7. Provide for the dissemination of information on the mineral industry, geology and mineral resources of the state through lectures and publications.
  8. Consult with, advise, and assist state and local governmental agencies on geological problems of importance to the citizens of Nevada.
  9. Consider such other kindred scientific and economic questions as in the judgment of the board of regents shall be deemed of value to the people of the state.
- [2:127:1935; 1931 NCL § 4311.02]-(NRS A 1971, 369)

NRS 514.050 Cooperation of state departments. All departments of the state government shall render full cooperation to the bureau of mines and geology in the acquisition and compilation of all data required by NRS 514.040

[3:127:1935; 1931 NCL § 4311.03]-(NRS A 1971, 370)

NRS 514.060 Agreements with United States Geological Survey.

1. The director of the bureau of mines and geology, for and on behalf of the State of Nevada, with the approval of the governor, is authorized to enter into agreements with the United States Geological Survey for cooperation in investigating mineral and geological conditions within the state and in the topographic and geologic mapping of Nevada. The expenses of such work must be divided between the parties upon a basis whereby the State of Nevada will not pay more than 50 percent of such expenses.
2. Money necessary to carry out the provisions of this section must be provided pursuant to NRS 519A.260.
3. All claims against such money must be approved by the director of the bureau of mines and geology, and, when thereafter approved by the state board of examiners, must be paid in the same manner as other claims against the state.

[1:40:1953] + [2:40:1953] + [3:40:1953]-(NRS A 1971, 370; 1995, 828)

NRS 514.070 Reports: Distribution and sale.

1. The board of regents shall cause to be prepared before September 1 of each even-numbered year a report covering the biennium ending June 30 of such year, showing the progress and condition of the bureau of mines and geology, together with such other information as the board may deem necessary or useful, or as the board may require.
2. The regular and special reports of the bureau of mines and geology shall be printed as the board of regents may direct, and the reports may be distributed or sold by the board as the interest of the state or science may demand. All moneys obtained by the sale of such reports shall be retained by the bureau of mines and geology to be used for costs of printing and distribution as the board of regents may direct.

[5:127:1935; 1931 NCL § 4311.05] + [6:127:1935; 1931 NCL § 4311.06]-(NRS A 1969, 1458; 1971, 370)

NRS 514.080 Unlawful acts. It shall be unlawful for the director or any attaché of the bureau of mines and geology:

1. To receive a commission or to act as agent or broker of or for any purchaser, owner, or his or their agents, of a mining property.
2. To act in any other than a wholly impartial way while so employed.

[4:127:1935; 1931 NCL § 4311.04]-(NRS A 1971, 370)

## CHAPTER 396 - UNIVERSITY AND COMMUNITY COLLEGE SYSTEM OF NEVADA

### PUBLIC SERVICE DIVISION

#### In General

NRS 396.600 Composition. The public service division of the system consists of the following public service departments:

1. Agricultural extension.
2. Agricultural experiment station.
3. Bureau of mines and geology.
4. Such other departments as the board of regents may designate.

[1:98:1915; 1919 RL p. 3209; NCL § 7765] + [Part 2:98:1915; 1919 RL p. 3210; NCL § 7766] + [3:98:1915; 1919 RL p. 3210; NCL § 7767] + [5:98:1915; 1919 RL p. 3210; NCL § 7769]-(NRS A 1957, 766; 1959, 618; 1969, 1437; 1971, 368; 1985, 1125; 1993, 352)

NRS 396.610 Rules and regulations. All rules and regulations necessary for the proper administration and enforcement of the public service division of the system must be made by the presidents, the chancellor and the board of regents.

[4:98:1915; 1919 RL p. 3210; NCL § 7768]-(NRS A 1969, 1438; 1993, 352)

### BUREAU OF MINES AND GEOLOGY

NRS 396.620 Analyses of ores, minerals, soil and water: Submission of samples by residents of this state; fee; maintenance of records and samples.

1. Subject to the limitations specified in NRS 396.620 to 396.660, inclusive, the chancellor shall cause to be analyzed by an appropriate employee of the system any ores, minerals, soil or water taken from within the boundaries of the State of Nevada and sent by any resident of the state for that purpose. Persons sending samples from post offices in states bordering Nevada may be required to furnish evidence that their samples are taken in Nevada and that they are Nevada residents. Any resident of the state may send any such substance for analysis. The report of the results of the analysis must be mailed to him within 10 working days after it has been received if he has supplied the information for the maintenance of records as provided in this section. The report sent to him must also contain as nearly as possible an explanation of the uses and market value of the substance.
2. For each sample sent for analysis, the system shall charge a fee of \$5 which must be used to defray the expense of conducting the analysis and storing the sample.
3. The system shall keep a record, open for inspection, under such rules as may be made by the board of regents, of all minerals, ores or other matters so sent, with a history of the minerals or other matters, stating the name and residence of the person from whom received, as nearly as possible the location from which the material was taken, including the district and county, and any other relevant information. This information for the records may be required to be filed with the system before any work is done on the material sent, and the 10-day limit for reports will count from the time the information is received by the system. Forms for providing the information must be printed by the state printing division of the department of administration and distributed at no charge.
4. A portion of the sample analyzed must be kept by the system for 3 months after the report is sent out, in case any question should arise in relation to the report or additional information be desired. After that time expires, samples may be destroyed or used for any desirable purpose.

[1:84:1895; A 1931, 229; 1933, 147; 1931 NCL § 7754]-(NRS A 1969, 1526; 1981, 1715; 1985, 466; 1993, 352, 1597; 1995, 579; 1997, 20)

NRS 396.630 Assay to be run when same material sent from same district. If the same general kind of matter for analysis is sent from the same district and previous analyses have shown its character and values, it shall not be necessary to analyze the same, but an assay shall be run to determine the value thereof, and shall be sent by mail to the person desiring the same.

[2:84:1895; A 1933, 147; 1931 NCL § 7755]

NRS 396.640 Analyses of samples in order received. Samples for analysis shall be analyzed in the order received, as far as possible.

[3:84:1895; A 1933, 147; 1931 NCL § 7756]

NRS 396.650 Limitations on number of samples and quantitative analyses.

1. Gold and silver samples requiring assays and exact quantitative determinations are limited to two in any 30-day period; and of the so-called strategic or war minerals, such as antimony, arsenic, beryllium, manganese, magnesium, tungsten, molybdenum, quicksilver, zinc, lead, copper, tin, chromium, cadmium, or other strategic minerals for the assaying of which the average assay office is not equipped, there shall be run up to five assays or quantitative determinations for any single person or associated group of persons. Samples sent for ordinary rock and mineral determinations are limited to 10 in any 30-day period.
2. In order to save the state unnecessary expense, if preliminary examinations by microscope and qualitative tests indicate material of no economic value, exact quantitative analyses are not to be run on such samples, and reports on such material will indicate why such material has no commercial value.

[Part 4:84:1895; A 1897, 91; 1925, 29; 1931, 229; 1933, 147; 1943, 180; 1943 NCL § 7757]

NRS 396.660 Purpose and applicability of NRS 396.620 to 396.660 inclusive.

1. The main object of NRS 396.620 to 396.660, inclusive, as it relates to ore samples, is to aid the prospector in the discovery of new mineral deposits.
2. NRS 396.620 to 396.660, inclusive, shall not apply in the following cases:
  - (a) To operating mines. The term "operating mines" as used in this subsection means those properties milling or shipping ore or being worked by hired labor.
  - (b) To engineers sampling mines or prospects for purposes of valuation.
  - (c) To so-called "control assays" to check other assayers on ore known to be of value.

[Part 4:84:1895; A 1897, 91; 1925, 29; 1931, 229; 1933, 147; 1943, 180; 1943 NCL § 7757]

## CHAPTER 327 - NEVADA COORDINATE SYSTEM; GEOGRAPHIC NAMES

NRS 327.100 "Board" defined. As used in NRS 327.110 to 327.150, inclusive, unless the context otherwise requires, the term "board" means the Nevada state board on geographic names.  
(Added to NRS by 1985, 588)

NRS 327.110 Nevada state board on geographic names: Creation; purpose. The Nevada state board on geographic names is hereby created to coordinate and approve geographic names within the state for official recommendation to the United States Board on Geographic Names.  
(Added to NRS by 1985, 588)

NRS 327.120 Nevada state board on geographic names: Composition. The board consists of:

1. One representative of each of the following agencies or organizations:
  - (a) **Bureau of mines and geology of the State of Nevada.**
  - (b) Faculty of the University of Nevada, Reno.
  - (c) Faculty of the University of Nevada, Las Vegas.
  - (d) State library and archives.
  - (e) Department of transportation of the state.
  - (f) State department of conservation and natural resources.
  - (g) Nevada historical society.
  - (h) United States Bureau of Land Management.
  - (i) United States Forest Service.
  - (j) Inter-Tribal Council of Nevada, Inc.

Each agency or organization shall designate a representative and one alternative representative for this purpose.

2. An executive secretary who is a nonvoting member of the board. The state resident cartographer shall serve in this position. If there is not such a cartographer, the voting members of the board shall select the executive secretary.

(Added to NRS by 1985, 588; A 1993, 507)

NRS 327.130 Nevada state board on geographic names: Officers; rules; quorum; meetings; compensation.

1. The board shall designate from among its members a chairman and a vice chairman and shall adopt rules for its own management.

2. A majority of the voting members of the board constitutes a quorum for the transaction of business.

3. The board shall meet at such times and places as are specified by the chairman, but may not hold more than four meetings in any 1 year.

4. Members of the board shall serve without compensation, travel expenses or subsistence allowances except as they may be provided by the members' respective agencies and organizations.

(Added to NRS by 1985, 588)

NRS 327.140 Nevada state board on geographic names: Powers and duties.

1. The board shall:

(a) Receive and evaluate all proposals for changes in or additions to names of geographic features and places in the state to determine the most appropriate and acceptable names for use in maps and official documents of all levels of government.

(b) Make official recommendations on behalf of the state with respect to each proposal.

(c) Assist and cooperate with the United States Board on Geographic Names in matters relating to names of geographic features and places in Nevada.

(d) Maintain a list of advisers who have special knowledge of or expertise in Nevada history, geography or culture and consult with those advisers on a regular basis in the course of its work.

2. The board may:

(a) Adopt regulations to assist in carrying out the functions and duties assigned to it by law.

(b) Initiate proposals for changes in or additions to geographic names in the state. Any proposal initiated by the board must be evaluated in accordance with the same procedures prescribed for the consideration of other proposals.

(Added to NRS by 1985, 588)

NRS 327.150 Changes in or additions of geographic names: Submission of proposal; preliminary consideration; final action and notice.

1. Any person, group or agency of federal, state or local government may propose a change in or the addition of any geographic name within the state by submitting it to the board for evaluation and recommendation.

2. Upon receipt of any such proposal, together with sufficient supporting information, the board shall:

(a) Place the proposal on the agenda for preliminary consideration at its next meeting.

(b) Give appropriate notice to persons and groups who are affected by the proposal or might have an interest in it.

(c) Provide opportunities for public comment.

(d) Conduct such research and field investigations as it deems necessary.

3. The board may not take final action on any proposal until it has been given preliminary consideration at one or more previous meetings.

4. Whenever the board takes final action on a proposal, it shall notify the person, group or agency who submitted the proposal and shall transmit the official recommendation to the United States Board on Geographic Names.

(Added to NRS by 1985, 589)



**CHAPTER 519A - RECLAMATION OF LAND SUBJECT TO MINING OPERATIONS OR EXPLORATION PROJECTS** (under the Division of Environmental Protection of the Department of Conservation and Natural Resources)

NRS 519A.260 Annual submission of reports and payment of fees by operator; disposition of money received.

1. Each operator shall, on or before April 15 of each year, submit to the administrator a report relating to the status and production of all mining operations and exploration projects in which he has engaged and identifying each acre of land affected and land reclaimed by that mining operation or exploration project through the preceding calendar year, and shall pay to the division a fee of:
  - (a) One dollar and fifty cents for each acre of public land administered by a federal agency; and
  - (b) Five dollars and fifty cents for each acre of privately owned land, which has been disturbed by mining operations or exploration projects engaged in by the operator and not reclaimed.
2. **All money received by the state treasurer pursuant to paragraph (a) of subsection 1 together with three-elevenths of all money received by the state treasurer pursuant to paragraph (b) of subsection 1, up to a maximum of \$100,000 annually, must be distributed directly to the bureau of mines and geology of the State of Nevada to be used to carry out the provisions of NRS 514.060.** Any money in excess of the maximum and the balance collected pursuant to paragraph (b) of subsection 1 must be credited to the appropriate account for the division and used to administer the provisions of this chapter.

(Added to NRS by 1989, 1287; A 1991, 201)

**Nevada Administrative Code related to the Nevada Bureau of Mines and Geology**

**CHAPTER 522 - OIL AND GAS** (under the Division of Minerals, Commission on Mineral Resources)

NAC 522.215 Cuttings: Requirements for permit; availability and use; notification of shortage. The taking of cuttings and the filing thereof is a condition for approval of the drilling permit, and this condition will be stated on the permit. **A minimum of two 15-milliliter sets of cuttings per sampling interval must be cleaned, dried and placed in sample envelopes, and the cuttings and a split of any core submitted to the bureau of mines and geology as soon as the drilling of the well is complete. The bureau shall remove a 15-milliliter set and place the set in permanent storage. The rest of the cuttings must be made available for public inspection and testing at that time or, if the records concerning the well are to be kept confidential pursuant to NAC 522.540, upon the expiration of the period of confidentiality. Destructive tests may be performed on the cuttings made available for public inspection and testing. The administrator of the division must be notified by the bureau of any sample envelopes containing less than 5 milliliters of cuttings.**

[Div. of Mineral Res., § 204, eff. 12-20-79]—(NAC A by Dep't of Minerals, 9-16-92)

NAC 522.510 Form 5: Well completion report.

1. Form 5, the well completion report, must be filed for all wells drilled in Nevada. In the case of a dry hole, this report may accompany Form 4. In the case of a well placed in commercial production, Form 5 must be filed with the division within 30 days after the well is placed in production. Only one Form 5 is required for each well. A second Form 5 is not required upon the abandonment of any producing well.
2. Two copies of all logging surveys run in the wellbore by the operator must be filed with the division. **The division will file one of the sets with the bureau of mines and geology. The copy at the bureau will be available for public inspection when the records are no longer confidential.**

[Div. of Mineral Res., § 707, eff. 12-20-79]—(NAC A by Dep't of Minerals, 7-22-87)

NAC 522.540 Confidentiality of well records.

1. Records concerning a well will not be kept confidential by the division unless the owner of the well requests confidentiality in writing or marks "confidential" on the logs of an exploratory well. Upon receiving such a request or log, the division will keep the records confidential for 6 months after their receipt unless the owner provides a written authorization for an earlier release.
  2. An operator who plans to drill a series of exploratory wells within a given region or area may apply to the division to have the records for all his exploratory wells kept confidential. Such an application must specifically describe the area to be explored and the number and location of exploratory wells contemplated. Upon approval of the application, the administrator will keep all records of the project confidential for 6 months after receipt of the record. The operator may amend the plan of the project with the written approval of the administrator.
- (Added to NAC by Dep't of Minerals, eff. 7-22-87)

#### **CHAPTER 534A - GEOTHERMAL RESOURCES** (under the Division of Minerals, Commission on Mineral Resources)

NAC 534A.310 Taking of cuttings is condition for approval; submission to bureau of mines and geology. The taking of cuttings at least every 30 feet, and filing thereof, is a condition for approval of the drilling permit. The cuttings must be cleaned, dried, marked for location and depth and placed in envelopes. **The cuttings and a split of any core must be submitted to the bureau of mines and geology of the State of Nevada within 30 days after the well is completed.**

(Added to NAC by Comm'n on Mineral Resources, eff. 11-12-85)

NAC 534A.550 Filing of report of completion and well logs.

1. Within 30 days after the completion of the construction of a well, the owner of the geothermal resource or the operator shall file with the division:
    - (a) A report setting forth the manner in which the well was completed.
    - (b) Two sets of all well logs.
  2. **The division shall file one set of the well logs with the bureau of mines and geology of the State of Nevada.**
- (Added to NAC by Comm'n on Mineral Resources, eff. 11-12-85; A 12-16-92)

NAC 534A.140 Hole logs: Subsurface information; confidentiality. Information about the subsurface obtained as a result of exploration drilling disclosed on hole logs as required by NAC 534A.130 must be filed with the state engineer within 30 days after it is acquired. **Such information together with other information concerning the exploration appearing on the logs and the cards containing the notice of intent to drill is confidential for a period of 5 years from the date of filing the cards or logs and must not be disclosed during that time without the express written consent of the driller's client.**

[St. Engineer, Exploration Drilling Reg. Art. VIII, eff. 12-13-77]

## United States Code (Federal Laws) related to the Nevada Bureau of Mines and Geology

### 43 USC Sec. 31c

01/26/98

#### TITLE 43 - PUBLIC LANDS

#### CHAPTER 2 - UNITED STATES GEOLOGICAL SURVEY

#### Sec. 31c. **Geologic mapping program**

#### STATUTE

- (a) Establishment
  - (1) In general
 

**There is established a national cooperative geologic mapping program between the United States Geological Survey and the State geological surveys, acting through the Association.**
  - (2) Design, development, and administration
 

The cooperative geologic mapping program shall be -

    - (A) designed and administered to achieve the objectives set forth in subsection (c) of this section;
    - (B) developed in consultation with the advisory committee;
    - and
    - (C) administered through the Survey.
- (b) Responsibilities of the Survey
  - (1) Lead agency
 

The Survey shall be the lead Federal agency responsible for planning, developing priorities, coordinating, and managing the geologic mapping program. In carrying out this paragraph, the Secretary, acting through the Director, shall -

    - (A) develop a geologic mapping program implementation plan in accordance with section 31e of this title, which plan shall be submitted to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate within 300 days after August 5, 1997;
  - (B) appoint, with the advice and consultation of the Association, the advisory committee within 90 days after August 5, 1997, in accordance with section 31d of this title; and
  - (C) within 210 days after August 5, 1997, submit a report to the Committee on Energy and Natural Resources of the United States Senate and to the Committee on Resources of the House of Representatives identifying -
- (i) how the Survey and the Association will coordinate the development and implementation of the geologic mapping program;
  - (ii) how the Survey and the Association will establish goals, mapping priorities, and target dates for implementation of the geologic mapping program; and
  - (iii) how long-term staffing plans for the various components of the geologic mapping program will lead to successful implementation of the geologic mapping program.
- (2) Responsibilities of the Secretary
 

In addition to paragraph (1), the Secretary, acting through the Director, shall be responsible for developing, as soon as practicable -

  - (A) in cooperation with the Association, other Federal and State agencies, public and private sector organizations and academia, the geologic-map data base; and
  - (B) maps and mapping techniques which achieve the objectives specified in subsection (c) of this section.
- (c) Program objectives
 

The objectives of the geologic mapping program shall include -

  - (1) determining the Nation's geologic framework through systematic development of geologic maps at scales appropriate to the geologic setting and the perceived applications, such maps to be contributed to the national geologic map (FOOTNOTE 1) database;
 

(FOOTNOTE 1) So in original. Probably should be "geologic-map."
  - (2) development of a complementary national geophysical-map data base, geochemical-map data base, and a geochronologic and paleontologic data base that provide value-added descriptive and interpretative information to the geologic-map data base;

(3) application of cost-effective mapping techniques that assemble, produce, translate, and disseminate geologic-map information and that render such information of greater application and benefit to the public; and

(4) development of public awareness of the role and application of geologic-map information to the resolution of national issues of land use management.

(d) Program components

**The geologic mapping program shall include the following components:**

(1) Federal component

A Federal geologic mapping component, whose objective shall be determining the geologic framework of areas determined to be vital to the economic, social, or scientific welfare of the Nation. Mapping priorities shall be based on -

(A) national requirements for geologic-map information in areas of multiple-issue need or areas of compelling single-issue need; and

(B) national requirements for geologic-map information in areas where mapping is required to solve critical earth-science problems.

(2) Support component

A geologic mapping support component, whose objective shall be providing interdisciplinary support for the Federal Geologic Mapping Component. Representative categories of interdisciplinary support shall include -

(A) establishment of a national geologic-map data base, established pursuant to section 31f of this title;

(B) studies that lead to the implementation of cost-effective digital methods for the acquisition, compilation, analysis, cartographic production, and dissemination of geologic-map information;

(C) paleontologic investigations that provide information critical to understanding the age and depositional environment of fossil-bearing geologic-map units, which investigations shall be contributed to a national paleontologic data base;

(D) geochronologic and isotopic investigations that -

(i) provide radiometric age dates for geologic-map units; and

(ii) fingerprint the geothermometry, geobarometry, and alteration history of geologic-map units, which investigations shall be contributed to a national geochronologic data base;

(E) geophysical investigations that assist in delineating and mapping the physical characteristics and three-dimensional distribution of geologic materials and geologic structures, which investigations shall be contributed to a national geophysical-map data base; and

(F) geochemical investigations and analytical operations that characterize the major- and minor-element composition of geologic-map units, and that lead to the recognition of stable and anomalous geochemical signatures for geologic terrains, which investigations shall be contributed to a national geochemical-map data base.

(3) State component

**A State geologic mapping component, whose objective shall be determining the geologic framework of areas that the State geological surveys determine to be vital to the economic, social, or scientific welfare of individual States. Mapping priorities shall be determined by multirepresentational State panels and shall be integrated with national priorities. Federal funding for the State component shall be matched on a one-to-one basis with non-Federal funds.**

(4) Education component

A geologic mapping education component -

(A) the objectives of which shall be -

(i) to develop the academic programs that teach earth-science students the fundamental principles of geologic mapping and field analysis; and

(ii) to provide for broad education in geologic mapping and field analysis through support of field studies;

(B) investigations under which shall be integrated with the other mapping components of the geologic mapping program and shall respond to priorities identified for those components; and

(C) Federal funding for which shall be matched by non-Federal sources on a 1-to-1 basis.

-SOURCE- (Pub. L. 102-285, Sec. 4, May 18, 1992, 106 Stat. 167; Pub. L. 103-437, Sec. 16(a)(1), Nov. 2, 1994, 108 Stat. 4594; Pub. L. 105-36, Sec. 3(b), Aug. 5, 1997, 111 Stat. 1108.)

## APPENDIX C

### Customer Service Questionnaire

Dear patron of the Nevada Bureau of Mines and Geology (NBMG),

We've been asked by the University of Nevada, Reno's administration, for reporting to the Nevada Legislature, to provide performance measures on our products and service. In order to provide quantitative results, we've designed the following questionnaire. Please take a couple of seconds to answer the first question only or a few minutes to complete most or all of the form. Your participation will also allow us to serve you better by addressing any suggestions or concerns you may have. Thank you for your help.

Jon Price  
State Geologist and Director

Please return the survey to:

Terri Garside  
Executive Assistant  
Nevada Bureau of Mines and Geology  
University of Nevada, Reno/MS 178  
Reno, NV 89557

or submit it by email to [tgarside@unr.edu](mailto:tgarside@unr.edu),  
or fill out the questionnaire on the Web ([www.nbmjg.unr.edu](http://www.nbmjg.unr.edu)).

Please rate the following items on a scale of A through F: A = outstanding, B = commendable, C = satisfactory, D = poor, and F = terrible. N/A = not applicable or don't know.

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#### Overall Performance of the Nevada Bureau of Mines and Geology

How well is the Nevada Bureau of Mines and Geology serving you?    **A   B   C   D   F   N/A**

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**NBMG Publications and Information Office** (Please see [www.nbmjg.unr.edu/sales/pbs.htm](http://www.nbmjg.unr.edu/sales/pbs.htm) for a list of publications, [www.nbmjg.unr.edu/dox/dox.htm](http://www.nbmjg.unr.edu/dox/dox.htm) for free, on-line publications, and [www.nbmjg.unr.edu/infof.htm](http://www.nbmjg.unr.edu/infof.htm) for other free information on the Web.)

Quality of NBMG publications:                    **A   B   C   D   F   N/A**

Usefulness of the publications:                    **A   B   C   D   F   N/A**

Number and variety of publications:                    **A   B   C   D   F   N/A**

Quality of NBMG geologic maps:                    **A   B   C   D   F   N/A**

Detail of NBMG geologic maps:                    **A   B   C   D   F   N/A**

Current coverage of geologic maps:                    **A   B   C   D   F   N/A**

Free publications on the Web:                    **A   B   C   D   F   N/A**

Cost of publications for sale:                    **A   B   C   D   F   N/A**

Customer service for sales:                    **A   B   C   D   F   N/A**



paper – printed with customized GIS layers added; free on the Web – print your own; CD-ROM version)?  
What other types of information and databases would you like to see in digital format free on the Web?  
In what specific formats would you like digital information placed on the Web (e.g., pdf files, shapefiles, Access databases, spreadsheets)?  
How would you prefer to see digital data organized on the NBMG Website?  
If we were able to extend or change our office hours for the Publication Sales and Information Office, during which hours would you most likely visit or call?  
Other suggestions or concerns?

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Thank you.







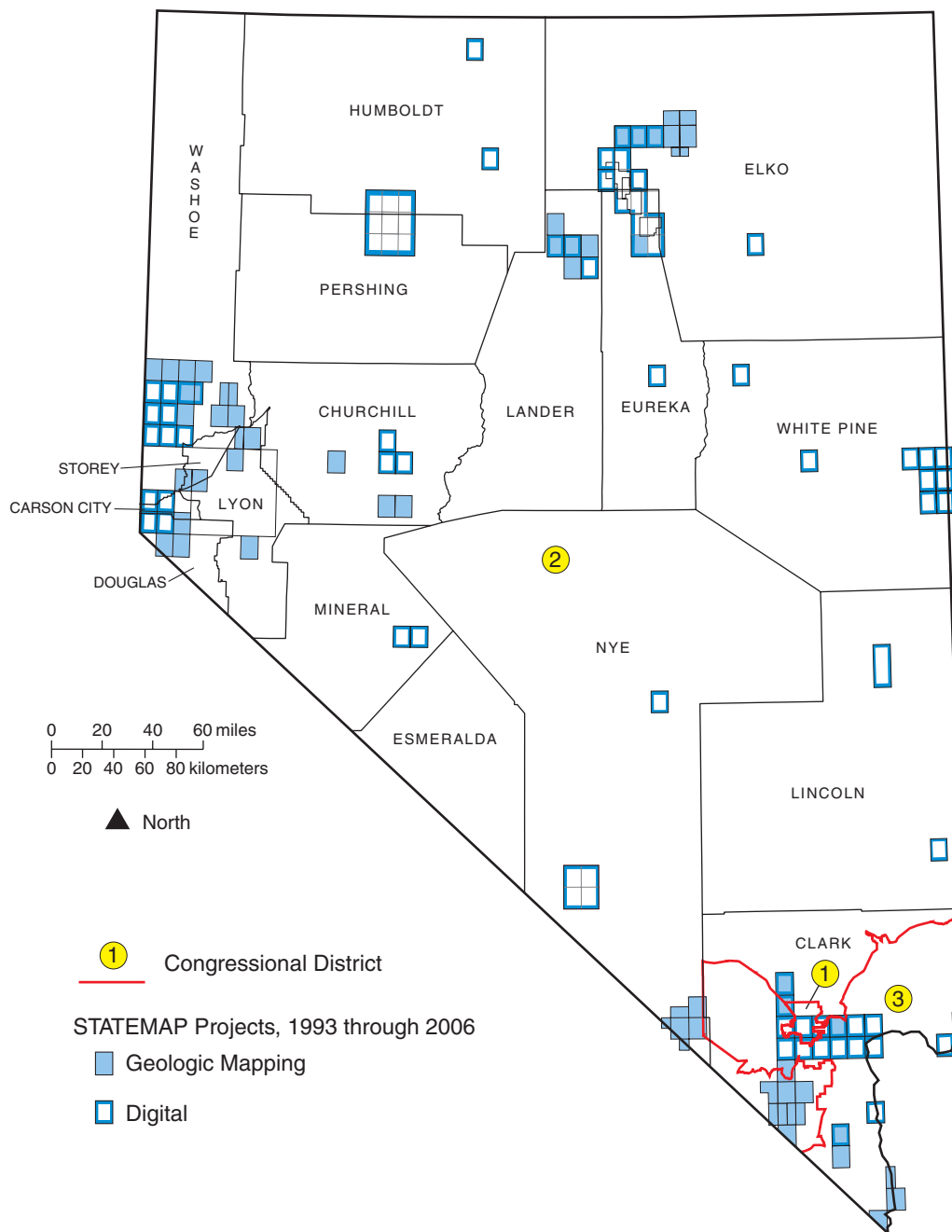
ASSOCIATION OF AMERICAN  
STATE GEOLOGISTS

UNITED STATES  
GEOLOGICAL SURVEY



# National Cooperative Geologic Mapping Program

## NEVADA



### Contact information

#### Nevada Bureau of Mines and Geology

State Geologist: Jonathan G. Price (775/784-6691 ext.126)

STATEMAP Contact: Christopher D. Henry (775/784-6691 ext.128)

<http://www.nbmj.unr.edu>

#### USGS Geologic Mapping Program Office

Program Coordinator: Peter T. Lytle (703/648-6943)

<http://ncgmp.usgs.gov/>

# SUMMARY OF STATEMAP GEOLOGIC MAPPING PROGRAM IN NEVADA

## Las Vegas Area

### New geologic maps of 7.5-minute quadrangles at 1:24,000 scale

Bird Spring (2004)	Hidden Valley (2004)	W <sup>1</sup> / <sub>2</sub> Mount Manchester (2003)	W <sup>1</sup> / <sub>2</sub> of Spirit Mtn SE (2004)
Corn Creek Springs (1997)	Horse Springs (2000)	Nelson SW (1998)	Sixmile Spring (2000)
Davis Dam (1999)	Iceberg Canyon (2001)	NE <sup>1</sup> / <sub>4</sub> Nopah Peak (2002)	E <sup>1</sup> / <sub>2</sub> of State Line Pass (2002)
NV part of Desert (2003)	Jean (2002)	Pahrump (1998)	NE <sup>1</sup> / <sub>4</sub> Stewart Valley (2002)
Frenchman Mountain (1994)	S <sup>1</sup> / <sub>2</sub> of Last Chance Range (2001)	Roach (2003)	Tule Springs Park (1996)
Goodsprings (2004)	W <sup>1</sup> / <sub>2</sub> McCullough Pass (2003)	Searchlight (2005)	

### Digital versions of previously published 7.5-minute geologic quadrangle maps

Blue Diamond NE (2001)	Fire Mountain (2006)	Hoover Dam (2000)	Mount Davis (2002)
Blue Diamond SE (2001)	Frenchman Mountain (2002)	Las Vegas NE (2000)	Nelson SW (2006)
Boulder Beach (2000)	Government Wash (2006)	Las Vegas NW (2000)	Tule Springs Park (2001)
Callville Bay (2006)	Henderson (2000)	Las Vegas SE (2000)	
Corn Creek Springs (2001)	Hiller Mountains (2006)	Las Vegas SW (2000)	

## Reno Area

### New geologic maps of 7.5-minute quadrangles at 1:24,000 scale

Dogskin Mountain (2000)	Fraser Flat (1998)	McTarnahan Hill (1997)	Olinghouse (1993)	Sutcliffe (2001)
Fernley East (2004)	Gardnerville (1999)	Minden (2001)	E <sup>1</sup> / <sub>2</sub> Pah Rah Mtn (2003)	Tule Peak (1999)
W <sup>1</sup> / <sub>2</sub> of Fernley West (2005)	Griffith Canyon (1996)	W <sup>1</sup> / <sub>2</sub> of Moses Rock (1998)	Seven Lakes Mtn (2005)	Virginia City (2000)
Flowery Peak (2005)	Lahontan Mountains (2006)	W <sup>1</sup> / <sub>2</sub> of Nixon (2002)	Stockton Flat Well (2006)	Wadsworth (1993)
				Yerington (2000)

### Digital versions of previously published 7.5-minute geologic quadrangle maps

Bedell Flat (2001)	Genoa (2001)	Marlette Lake (2001)	Reno (2000)	Verdi (2000)
Carson City (2001)	Glenbrook (2001)	New Empire (2006)	Reno NE (2000)	Vista (2000)
Fraser Flat (2006)	Granite Peak (2001)	W <sup>1</sup> / <sub>2</sub> of Moses Rock (2006)	Reno NW (2000)	

### Digital versions of previously published 30x60-minute geologic quadrangle maps

Carson City (2001), 1:100,000 scale

## Humboldt River Basin

### New geologic maps of 7.5-minute quadrangles at 1:24,000 scale

Argenta (1999)	Emigrant Pass (1998)	NW <sup>1</sup> / <sub>4</sub> of Reed Station (2005)	Toe Jam Mountain (1997)
Bateman Spring (1999)	S <sup>2</sup> / <sub>3</sub> of Jacks Peak (2005)	Russells (2002)	Tuscarora (1997)
Battle Mountain (1997)	Mahala Creek West (2005)	NE <sup>1</sup> / <sub>4</sub> of Stampede Ranch (2005)	Water Pipe Canyon (2005)
S <sup>2</sup> / <sub>3</sub> of California Mountain (2005)	Mount Blitzen (1996)	Stony Point (1998)	

### Digital versions of previously published 7.5-minute geologic quadrangle maps

Battle Mountain (2002)	Mount Blitzen (2001)	Toe Jam Mountain (2002)	Willow Creek Reservoir (2006)
Beaver Peak (2006)	Mule Canyon (2006)	Tuscarora (2001)	Willow Creek Reservoir SE (2006)
Big Bald Mountain (2006)	Stony Point (2002)		

### Digital versions of Carlin trend maps

North Carlin trend (2003), 1:24,000 scale    Maggie Creek district (2003), 1:18,000 scale    North trend (2003), 1:6,000 scale

## Other Areas

### New geologic maps of 7.5-minute quadrangles at 1:24,000 scale

Bell Canyon, Churchill County (1995)    Bell Mountain, Churchill County (1995)

### Digital versions of previously published 7.5-minute geologic quadrangle maps

Bettles Well (2001)	Lamoille (2002)	Mount Moriah (2006)	Spring Mountain (2001)
Buckskin Mountain (2001)	Lime Mountain (2002)	Old Mans Canyon (2006)	The Cove (2006)
Delvada Spring (2001)	Little Horse Canyon (2006)	Pirouette Mountain (2001)	Third Butte East (2006)
Frazier Creek (2001)	Mina (2001)	Reveille (2001)	Wonder Mountain (2001)
Job Peak (2001)	Mormon Jack Pass (2006)	Robinson Summit (2001)	

### Digital versions of other previously published 1:24,000-scale geologic maps

Bullfrog Hills (2002)    Eugene Mountains (2002)    Fairview Range (2002)    Grassy Mountain (2002)

The STATEMAP part of the National Cooperative Geologic Mapping Program has helped Nevadans by significantly increasing the geographic coverage of detailed maps produced by the Nevada Bureau of Mines and Geology. Geologic mapping in the Las Vegas and Reno urban areas is focused primarily on issues related to growth and land management, including earthquake and flood hazards, land subsidence due to ground-water withdrawal, collapsing and expanding soils, landslides, ground-water protection, air quality, and raw materials for construction. Mapping of the Humboldt River basin provides key information on the origin of its precious metal deposits, which make Nevada the leading gold and silver producer in the U.S., and on the environmental and economic impacts of mining and climatic change. Planners, scientists, engineers, managers, policy makers, teachers, students, and members of the general public who are interested in the world around them use geologic maps. Only about 20% of Nevada's 1,980 7.5-minute quadrangles are adequately mapped with the detail that is needed for most applications.

## STATEMAP FUNDING

Federal Fiscal Year	State Dollars	Federal Dollars	Total Project Dollars
93	20,519	20,000	40,519
94	21,746	20,000	41,746
95	15,113	10,000	25,113
96	126,444	123,780	250,224
97	261,357	152,410	413,767
98	258,917	139,424	398,341
99	175,175	115,500	290,675
00	135,520	111,210	246,730
01	216,702	196,289	412,991
02	220,825	213,597	434,422
03	184,860	183,231	368,091
04	203,225	171,583	374,808
05	172,489	135,032	307,521
06	234,966	205,172	440,138
	\$2,247,858	\$1,797,228	\$4,045,086



# Nevada Bureau of Mines and Geology



## Advisory Committee Members

Alan Coyner, *Administrator, Nevada Division of Minerals, Chair of the Advisory Committee*  
Kay Brothers, *Deputy General Manager, Engineering/Operations, Southern Nevada Water Authority*  
Russ Fields, *President, Nevada Mining Association*  
Del Fortner, *Summit Engineering Corporation, Reno*  
Shawn Gooch, *Civil Engineer, City of Sparks*  
Lewis Gustafson, *Mineral Exploration Consultant, Reno*  
Gary Johnson, *Deputy State Director, Minerals, U.S. Bureau of Land Management*  
Ron Lynn, *Building Official, Clark County Building Department*  
Debra Struhsacker, *Environmental Consultant, Reno*  
Jim Werle, *Converse Consultants, Las Vegas*

## Emeritus Faculty

Harold F. Bonham, Jr., *Research Geologist - volcanic stratigraphy and metals*  
John W. Erwin, *Geophysicist - gravity & electromagnetic fields*  
Liang-Chi Hsu, *Research Mineralogist - mineralogy & experimental petrology*  
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Susan L. Tingley, *Publications Manager & Chief Cartographer - cartography & geography*

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