Biennial Report of the
Nevada Bureau of Mines and Geology

2000
Scientific Research Staff

**Economic Geology**
Stephen B. Castor, *Research Geologist* - mineral deposits & mineralogy
Joseph V. Tingley, *Research Geologist* - metals & mining history

**Engineering Geology and Geophysics**
John W. Bell, *Research Engineering Geologist* - Quaternary stratigraphy & urban geology
Geoffrey Blewitt, *Research Professor* - geodesy & geodynamics
Craig M. dePolo, *Research Geologist* - earthquake geology & neotectonics
Alan R. Ramelli, *Research Geologist* - neotectonics & Quaternary stratigraphy

**Environmental Geology and Hydrogeology**
P. Kyle House, *Research Geologist* - fluvial geomorphology & paleohydrology
Paul J. Lechler, *Chief Chemist/Geochemist* - analytical geochemistry & precious metals
Lisa Shevenell, *Research Hydrogeologist* - hydrogeology & geothermal resources

**Geologic Mapping and Regional Geology**
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

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

Support Staff

**Administration and Publication Sales**
Terri M. Garside, *Executive Secretary* - finance, contract management, & administration
Cheryl Steed, *Management Assistant* - administration & publication sales backup
Charlotte Stock, *Sales Manager* - publication sales & administrative support

**Analytical Laboratory, Sample Curation, and Geologic Information**
David Davis, *Geologic Information Specialist* - Nevada geology & mining history
Mario Desilets, *Chemist and Quality Assurance Officer* - analytical geochemistry
Bret Pecoraro, *Laboratory Assistant* - technical support on analytical & geodetic equipment

**Cartography, Publication Support, Geographic Information Systems (GIS), and Databases**
Robert Chaney, *Information Systems Specialist* - cartography & GIS
Ron Hess, *Information Systems Specialist & GIS Supervisor* - GIS, remote sensing, & systems administration
Gary Johnson, *Information Systems Specialist* - GIS & systems administration
Richard O. Meeuwig, *Editor* - editing, publication design, & Web-site management
Susan L. Tingley, *Publication Manager & Chief Cartographer* - cartography & publishing
Kris R. Pizarro, *Cartographic Supervisor* - cartography, drafting, & publication design
Jack Hursh, Jr., *Cartographer* - drafting & publication design

For more information about NBMG, please check the Web (www.nbmg.unr.edu)
Biennial Report of the Nevada Bureau of Mines and Geology

2000

Jonathan G. Price
Director/State Geologist

PREPARED FOR

The Board of Regents of the
University and Community College System of Nevada
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Executive Summary

The Nevada Bureau of Mines and Geology (NBMG) is a research and public service unit of the University of Nevada and is the State geological survey. Established by the Nevada Legislature as a department within the public service division of the University and Community College System of Nevada, NBMG is part of the Mackay School of Mines 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 northern and southern Nevada.

NBMG Research Programs Addressing Critical Issues Facing Nevada

Urban Growth - Natural Hazards and Economic Stability

- Earthquakes
- 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

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

The report provides details on the activities of NBMG scientists and support staff during the past two years. As indicated in the lists of publications, research grants, and other professional activity, NBMG has been highly productive, and, according to NRS 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
Director/State Geologist
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, and 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.nbmg.unr.edu).

Major research projects are being conducted throughout Nevada. Geologic maps are being produced to provide better understanding of natural hazards in areas that will be undergoing 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 state in mineral production and the United States the second leading producer of gold in the world.

Research on land subsidence in Las Vegas Valley continues to provide 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 some of the most current technologies to attack this problem—geodetic measurements using the global positioning system (GPS) and interferometry using synthetic aperture radar, a remote-sensing technique. NBMG is beginning to evaluate concerns regarding subsidence and fissures in other desert valleys, where groundwater is being pumped to supply the needs of expanding populations.

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.
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 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 assessments by the Bureau of Land Management, Department of Defense, Department of Energy, and Fish and Wildlife Service. 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 country. 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 a team with broad expertise in the geological sciences and geography. Their efforts are supported by an excellent staff in the areas of cartography, drafting, geographic information systems, editing, publication design, 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 Division of Emergency Management in the Department of Motor Vehicles and Public Safety). 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/State Geologist, 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, particularly in and near urban areas of southern and northern Nevada and in the Humboldt River basin.

An NBMG representative (currently the Director/State Geologist, Jon Price) serves on the State All Hazards Mitigation Advisory 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.

Recognizing the importance of the mining industry to the State's economy, the Nevada Attorney General, Frankie Sue Del Papa, recently formed the Nevada Mining Fraud Task Force to help prevent mining fraud and keep the reputation of the industry from being tarnished. The Task Force includes representatives from the Attorney General's office, the Secretary of State's Securities Division, the Consumer Affairs Division of the Department of Business and Industry, the Division of Minerals, NBMG, the Bureau of Land Management, the Nevada Mining Association, and the American Institute of Professional Geologists. Co-Chairs of the Task Force include the Attorney General, the Administrator of the Nevada Division of Minerals, Alan Coyner, and the NBMG Director/State Geologist, Jon Price. NBMG Special Publication 22 (Gold from Water and Other Mining Scams, by Paul Lechler, NBMG's Chief Geochemist), which is available on the Web, concisely provides the public with information on typical scams.

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 NBMG's Publication Manager and Chief Cartographer, Susan Tingley. The State Board has representation from NBMG, faculty of UNR and UNLV, the State Library and Archives, State Department of Transportation, State Department of Conservation and Natural Resources, Nevada Historical Society, United States Bureau of Land Management, United States Forest Service, and the Inter-Tribal Council of Nevada, Inc. Officially recognized geographic names must be approved by both the State and United States 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 twenty 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. Only 15% 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.

**Nevada 1:24,000-Scale Geologic Maps**

Only about 15% of Nevada is covered with geologic maps at a scale that is detailed enough for most natural hazard, environmental, and resource issues.
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 business 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%. 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.

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 are making efforts to 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 (October) and Earthquake Awareness and Preparedness Week (February), and staff scientists often judge science fairs. NBMG also produces some publications specifically for the general public, such as field guides on the geology and natural history of the Las Vegas, Reno-Carson City-Lake Tahoe regions, and U.S. Highway 50.

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 the State Fair, home shows, 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.

<table>
<thead>
<tr>
<th></th>
<th>Publication Sales</th>
<th>Analytical Services</th>
<th>Information Office Customers</th>
<th>Customers Served by Scientists</th>
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<tbody>
<tr>
<td></td>
<td>Walk-in</td>
<td>Telephone</td>
<td>Walk-in</td>
<td>Telephone</td>
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<tr>
<td>1991</td>
<td>$106,427</td>
<td>$6,715</td>
<td>1,116</td>
<td>1,418</td>
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<tr>
<td>1992</td>
<td>108,293</td>
<td>7,587</td>
<td>1,080</td>
<td>1,440</td>
</tr>
<tr>
<td>1993</td>
<td>98,842</td>
<td>10,866</td>
<td>921</td>
<td>1,228</td>
</tr>
<tr>
<td>1994</td>
<td>98,717</td>
<td>6,070</td>
<td>908</td>
<td>1,211</td>
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<tr>
<td>1995</td>
<td>100,225</td>
<td>7,712</td>
<td>837</td>
<td>1,116</td>
</tr>
<tr>
<td>1996</td>
<td>112,800</td>
<td>6,973</td>
<td>1,070</td>
<td>1,427</td>
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<tr>
<td>1997</td>
<td>110,315</td>
<td>17,164</td>
<td>1,035</td>
<td>1,380</td>
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<tr>
<td>1998</td>
<td>102,319</td>
<td>18,624</td>
<td>1,119</td>
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<td>1999</td>
<td>126,397</td>
<td>9,552</td>
<td>1,170</td>
<td>1,560</td>
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</table>

1 Accurate count of walk-in customers is kept; telephone inquiries are estimated to be about four for every three walk-in customers.

2 Records of numbers of informational inquiries directed to individual scientists are not kept; these are estimated to be approximately 50 per State-funded scientist per year. The Director/State Geologist was on assignment at the National Research Council during 1993 and 1994.

NBMG has developed a user-friendly site for sale of publications on the Web (at www.nbmg.unr.edu/sales.htm) and considerable amounts of Web information for teachers, the general public, and technical professionals. Several publications are available in their entirety 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.

**Budget**

The majority of the funds expended by NBMG come from the Legislature as part of the Statewide Program funding for UNR. The bulk of these funds cover salaries and fringe benefits for NBMG employees. The State does not provide a substantial amount of operating funds (only $39,402 per year), and the ever-increasing amount of money required to be returned for mandated salary savings is now $44,983 for the current fiscal year. This results in a net deficit of nearly $6,000 at the beginning of any fiscal year, unless, as is rarely the case, 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 does, however, consume a large amount of the time of the Director and of many of the senior staff.

<table>
<thead>
<tr>
<th>State-funded budget item</th>
<th>Fiscal year 1999-2000 budget</th>
</tr>
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<tbody>
<tr>
<td>Professional</td>
<td>$909,344</td>
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<tr>
<td>Classified</td>
<td>339,453</td>
</tr>
<tr>
<td>Graduate Assistants</td>
<td>19,000</td>
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<tr>
<td>Fringe Benefits</td>
<td>257,903</td>
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<tr>
<td>Operating</td>
<td>39,402</td>
</tr>
<tr>
<td>Subtotal</td>
<td>1,565,102</td>
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<tr>
<td>- Mandated Salary Savings</td>
<td>-44,983</td>
</tr>
<tr>
<td>Total</td>
<td>1,520,119</td>
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</table>
**Staffing Levels**

NBMG has 12.35 faculty FTE, 8.47 classified staff FTE, and two half-time graduate research assistants funded by the State. An additional 2.94 faculty FTE and 3.53 classified staff FTE and generally between 5 and 15 undergraduate and graduate student assistants are 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.

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.

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

**Scientific Research Staff**

**Economic Geology**
- Stephen B. Castor, *Research Geologist* - mineral deposits & mineralogy (1.0 FTE)
- Joseph V. Tingley, *Research Geologist* - metals & mining history (1.0 FTE)

**Engineering Geology and Geophysics**
- John W. Bell, *Research Engineering Geologist* - Quaternary stratigraphy & urban geology (1.0 FTE)
- Geoffrey Blewitt, *Research Professor* - geodesy & geodynamics (0.75 FTE)
- Craig M. dePolo, *Research Geologist* - earthquake geology & neotectonics (0 FTE)
- Alan R. Ramelli, *Research Geologist* - neotectonics & Quaternary stratigraphy (0 FTE)

**Environmental Geology and Hydrogeology**
- P. Kyle House, *Research Geologist* - fluvial geomorphology & paleohydrology (1.0 FTE)
- Paul J. Lechler, *Chief Chemist/Geochemist* - analytical geochemistry & precious metals (1.0 FTE)
- Lisa Shevenell, *Research Hydrogeologist* - hydrogeology & geothermal resources (1.0 FTE)

**Geologic Mapping and Regional Geology**
- 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)

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

**Support Staff**

**Administration and Publication Sales**
- Terri M. Garside, *Executive Secretary* - finance, contract management, & administration (0.92 FTE)
- Cheryl Steed, *Management Assistant* - administration & publication sales backup (1.0 FTE)
- Charlotte Stock, *Sales Manager* - publication sales & administrative support (0.49 FTE)

**Analytical Laboratory, Sample Curation, Geologic Information**
- David Davis, *Geologic Information Specialist* - Nevada geology & mining history (1.0 FTE)
- Mario Desilets, *Chemist and Quality Assurance Officer* - analytical geochemistry (1.0 FTE)
- Bret Pecoraro, *Laboratory Assistant* - technical support on analytical & geodetic equipment (0 FTE)

**Cartography, Publication Support, Geographic Information Systems (GIS), and Databases**
- Robert Chaney, *Information Systems Specialist* - cartography & GIS (0 FTE)
- Ron Hess, *GIS Supervisor* - GIS, remote sensing, & systems administration (1.0 FTE)
- Gary Johnson, *Information Systems Specialist* - GIS & systems administration (0.53 FTE)
- Richard O. Meeuwig, *Editor* - editing, publication design, & Web-site management (1.0 FTE)
- Susan L. Tingley, *Publication Manager & Chief Cartographer* - cartography & publishing (1.0 FTE)
- Kris R. Pizarro, *Cartographic Supervisor* - cartography, drafting, & publication design (1.0 FTE)
- Jack Hursh, Jr., *Cartographer* - drafting & publication design (0.53 FTE)
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;
- **geologic mapping, with an emphasis on Mesozoic and Paleozoic stratigraphy and structural geology (2 FTE)** - to cover much of southern and northeastern Nevada;
- **geologic mapping, with an emphasis on hydrothermal systems (1 FTE)** - to better assess mineral and geothermal resource potentials;
- **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;
- **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;
- **geographic information systems (1.47 FTE)** - to build and link statewide databases and to assist in NBMG research;
- **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;
- **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;
- **geodesy (1.25 FTE)** - to further build expertise in the exciting area of space geodesy, which has wide applications in geological hazards and weather.
- **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;
- **marketing and publication sales (1.51 FTE)** - to better reach the public with NBMG's useful publications;
- **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;
- **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.

Setting priorities for these 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 21.92 FTE to NBMG's staff; this would about double the number of positions at NBMG. Ideally, many 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/State Geologist directly supervises all of the scientists who are faculty members and most of the classified staff members. A significant expansion in staff would require the delegation of more supervisory responsibility to others.
New Staff at NBMG

We are delighted to have added Kyle House, an expert in fluvial geomorphology and flood hazards, to our team of research geologists. Kyle is expanding upon his research at the Desert Research Institute and his Ph.D. dissertation work at University of Arizona, which focused primarily on problems in Arizona, to address flood hazards in urban and rural areas of Nevada. He is also working closely with Alan Ramelli to study past effects of high water flows in the Humboldt River; their geologic mapping is excellent groundwork for understanding impacts from dewatering of mines.

We are also excited about hiring Geoffrey Blewitt, a world leader in the field of geodesy. Geoff's specialty is in use of the Global Positioning System (GPS) to measure movements of the Earth's surface to within a few millimeters. He comes to us from the Department of Geomatics, University of Newcastle upon Tyne, England, where he was awarded a professorship in space geodesy. With a Ph.D. in physics form the California Institute of Technology, Geoff worked on the early development of geodetic applications of GPS at NASA's Jet Propulsion Lab. His research is helping us understand crustal deformation and earthquake hazards in Nevada. He holds a joint appointment as Research Professor in the Nevada Seismological Laboratory.

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) and through the National Cooperative Geologic Mapping Program (see 43 USC Sec. 31c).

NBMG also works closely with the Nevada Division of Minerals. The Division of Mineral 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). This relationship works well, because NBMG has facilities and staff to assist interested individuals with examination of these materials. Nonetheless, the ever-increasing volume of material that is delivered to us has caused problems regarding adequate storage space on the UNR campus and at off-campus storage facilities owned by UNR. Because space is not available, NBMG currently is filled to capacity. We continue to accept the well sample and records as required by NAC 522 and 534A, but because there isn't enough storage space, we have to reject offers to receive many other materials that have long-term value in research, resource assessment and discovery, hazard identification, and environmental protection.

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 All Hazards Mitigation Advisory 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 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 Mines to further the collection of geological and mineralogical specimens and with the Mines and Engineering Library to improve the collection of published and unpublished information on the geology and mineral resources of the State (see NRS 514.040). As with the problem with space for storage of records and samples from oil, gas, and geothermal wells, neither the Museum nor NBMG have adequate storage space for these materials.

Performance Measures for NBMG

Reports, maps, and special publications produced by the Nevada Bureau of Mines and Geology, 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.

**NBMG Publications Produced**

<table>
<thead>
<tr>
<th>Year</th>
<th>Maps</th>
<th>Totals</th>
<th>Average (of past three years)</th>
<th>Number of scientists</th>
<th>Number of publications produced per State-funded scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>0</td>
<td>15</td>
<td>11</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>2</td>
<td>20</td>
<td>11</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>7</td>
<td>16</td>
<td>17</td>
<td>11</td>
<td>1.5</td>
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<tr>
<td>1994</td>
<td>4</td>
<td>12</td>
<td>16</td>
<td>11</td>
<td>1.1</td>
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<tr>
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<td>15</td>
<td>11</td>
<td>1.6</td>
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<td>16</td>
<td>15</td>
<td>11</td>
<td>1.5</td>
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<tr>
<td>1997</td>
<td>4</td>
<td>14</td>
<td>16</td>
<td>11</td>
<td>1.3</td>
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<td>5</td>
<td>26</td>
<td>19</td>
<td>11</td>
<td>2.4</td>
</tr>
<tr>
<td>1999</td>
<td>11</td>
<td>40</td>
<td>27</td>
<td>11</td>
<td>3.6</td>
</tr>
</tbody>
</table>

1 Numbers of NBMG publications, including geologic maps, produced during that year.
2 NBMG has had three to four additional scientists supported on grants and contracts each year. In recent years the number of State-funded scientists has been steady at eleven.

**External Publications Produced by NBMG Scientists**

<table>
<thead>
<tr>
<th>Year</th>
<th>Yearly Totals</th>
<th>Average (of past three years)</th>
<th>Number of scientists</th>
<th>Number of publications produced per State-funded scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>52</td>
<td>11</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>1992</td>
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<tr>
<td>1993</td>
<td>49</td>
<td>51</td>
<td>11</td>
<td>4.5</td>
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<tr>
<td>1994</td>
<td>72</td>
<td>58</td>
<td>11</td>
<td>6.5</td>
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<td>1995</td>
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<td>1997</td>
<td>76</td>
<td>65</td>
<td>11</td>
<td>6.9</td>
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<tr>
<td>1998</td>
<td>91</td>
<td>78</td>
<td>11</td>
<td>8.3</td>
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<tr>
<td>1999</td>
<td>75</td>
<td>81</td>
<td>11</td>
<td>6.8</td>
</tr>
</tbody>
</table>
Overall Productivity (Total number of publications per State-funded scientist)

<table>
<thead>
<tr>
<th>Year</th>
<th>Totals</th>
<th>Number of publications (including NBMG publications and others) produced per State-funded scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>67</td>
<td>6.1</td>
</tr>
<tr>
<td>1992</td>
<td>72</td>
<td>6.5</td>
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<tr>
<td>1993</td>
<td>65</td>
<td>5.9</td>
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<tr>
<td>1994</td>
<td>84</td>
<td>7.6</td>
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<tr>
<td>1995</td>
<td>72</td>
<td>6.5</td>
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<tr>
<td>1996</td>
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<td>7.5</td>
</tr>
<tr>
<td>1997</td>
<td>90</td>
<td>8.2</td>
</tr>
<tr>
<td>1998</td>
<td>117</td>
<td>10.6</td>
</tr>
<tr>
<td>1999</td>
<td>115</td>
<td>10.5</td>
</tr>
</tbody>
</table>

With only 14 full-time scientists on the NBMG staff (only 11 of whom are funded by State appropriations and three of whom are funded by grants and contracts), NBMG has been highly productive. Measured on a per person basis, publication productivity is outstanding.
Research and Non-Research Grants and Contracts Awarded

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Grants and Contracts</th>
<th>Total Awards</th>
<th>Average (of past three years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>4</td>
<td>$182,389</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>3</td>
<td>37,970</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>3</td>
<td>32,790</td>
<td>$84,383</td>
</tr>
<tr>
<td>1987</td>
<td>3</td>
<td>74,450</td>
<td>48,403</td>
</tr>
<tr>
<td>1988</td>
<td>1</td>
<td>7,186</td>
<td>38,142</td>
</tr>
<tr>
<td>1989</td>
<td>7</td>
<td>337,658</td>
<td>139,765</td>
</tr>
<tr>
<td>1990</td>
<td>15</td>
<td>1,009,440</td>
<td>451,428</td>
</tr>
<tr>
<td>1991</td>
<td>4</td>
<td>351,298</td>
<td>566,132</td>
</tr>
<tr>
<td>1992</td>
<td>15</td>
<td>650,801</td>
<td>670,513</td>
</tr>
<tr>
<td>1993</td>
<td>23</td>
<td>944,687</td>
<td>648,929</td>
</tr>
<tr>
<td>1994</td>
<td>14</td>
<td>932,270</td>
<td>842,586</td>
</tr>
<tr>
<td>1995</td>
<td>32</td>
<td>1,529,343</td>
<td>1,135,433</td>
</tr>
<tr>
<td>1996</td>
<td>14</td>
<td>615,509</td>
<td>1,025,707</td>
</tr>
<tr>
<td>1997</td>
<td>17</td>
<td>1,215,298</td>
<td>1,120,050</td>
</tr>
<tr>
<td>1998</td>
<td>29</td>
<td>708,603</td>
<td>846,470</td>
</tr>
<tr>
<td>1999</td>
<td>32</td>
<td>2,873,711</td>
<td>1,599,204</td>
</tr>
</tbody>
</table>

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 UNR Foundation to pay geologists outside UNR 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.
APPENDIX A

Activities of NBMG in 1998 and 1999

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 1998 and 1999.

Publications - 1998


Publications - 1999


dePolo, C.M., and Ramelli, A.R., 1999, Earthquakes in the Reno/Carson City area, unpublished guidebook for an Earthquake Awareness Field Trip, Feb. 27.


Ramelli, A., Bell, J., Caskey, S., dePolo, C., Guerrieri, L., and Yount, J., 2000, Belt-like behavior of surface-rupturing earthquakes in the western Basin and Range province, USA: accepted for presentation at the 31st International Geological Congress.


Active Research Grants - 1998 and 1999


Clark County Department of Building, Expansive soils in Las Vegas Valley, funding beginning 7/99, $11,308 initial funding with $5,000 per year for following 4 years, J.W. Bell.

Desert Research Institute, Review and mineral management plan development, Nellis Test and Training Range, 10/99–9/00, $10,002, J.V. Tingley (Minerals Specialist, working with DRI staff).

European Space Agency, Earth Observation Program, Detection of preseismic and coseismic fault slip with interferometric data, 6/99–6/00 (continuation), No fixed dollar amount; awarded 18 satellite data images valued at $9000, J.W. Bell, and F. Amelung.

European Space Agency, Earth Observation Program, Detection of preseismic and coseismic fault slip with interferometric data, 6/98–6/99, No fixed dollar amount; awarded 16 satellite data images valued at $8,000, J.W. Bell and F. Amelung.


Federal Geographic Data Committee, Conduct metadata workshops, 1999, $15,000.00, G.L. Johnson.

Federal Geographic Data Committee, Create a FGDC compliant metadata clearinghouse, 1999, $40,000.00, G.L. Johnson.


Indiana University and Purdue University at Indianapolis, Travel Support to conduct environmental research in Bolivia, 1998, $1,500, P.J. Lechler.

Las Vegas Valley Water District, Subsidence in Las Valley, 1/99–1/00, $165,000, J.W. Bell.

Las Vegas Valley Water District, Subsidence studies in Las Vegas with InSAR, 6/99–5/00, $70,000, J.W. Bell.


NASA, NSF, and JPL in collaboration with other research institutions including UNAVCO, JPL, and State University of New York, Space geodesy and its application to geophysical science and environmental concerns, 1999-2000, $200,000, G. Blewitt.

National Park Service, Geomorphological and archeological evaluation of the east fork of the Virgin River, in Parunuweap Canyon, Zion National Park, Utah, 5/99–6/00, $14,000, P. Buck (DRI) and P.K. House.

National Science Foundation, Research experiences in the field with mentors from State Geological Surveys, Grant Number EAR-9908618 to the Association of American State Geologists, 6/1/99 to 5/31/00, $80,000 plus additional $23,875 from the U.S. Geological Survey, J.G. Price; Mentoring project at NBMG, $2,500, J. Faulds.

National Science Foundation, Acquisition of a stable isotope facility to study earth and environmental systems and processes, 6/99 to 5/02, $240,000, G. Arehart, S. Poulson, L. Shevenell, R. Karlin, and R. Tempel.

National Science Foundation, Evolution of the Sierra Nevada-Basin and Range boundary—the record in Neogene basin deposits, 1/99–12/00, $175,350, P. Cashman, J. Trexler, and C. Henry.

National Science Foundation, Hydrological Sciences Program, Comparison of regional flood frequency responses to climatic variability in the western United States during the Late Holocene using modern, historical, and prehistorical information, 1/98–12/00, $156,281, P.K. House, and L.L. Ely.


North Atlantic Treaty Organization, PGEs in chromitites in Turkey, 8/97–8/98, $9,000, P.J. Lechler.


P.K. House.


Geologic maps of the Fraser Flat and Moses Rock (west half) Quadrangles, 5/98–4/99, $28,952, L. Garside, S. Castor, C. dePolo, and J. Rigby.


Geologic map of the Nelson SW Quadrangle, 8/99–9/00, $20,326, J. Faulds and J.W. Bell.

Geologic map of the Pahrump Quadrangle, 8/98–9/99, $34,746, and C.M. dePolo, A.R. Ramelli, and J.W. Bell.

Geologic map of the Sixmile Spring quadrangle, 8/99–9/00, $28,635, C.M. dePolo, A.R. Ramelli, J.W. Bell, and J. Faulds.


Geologic map of the south half of the Tule Peak Quadrangle, 5/99–4/00, $12,394, L. Garside, J. Faulds, C. dePolo, and C.D. Henry.


University of Nevada, Reno International Studies Travel Grant to develop environmental mercury project in Guyana, 7/97–6/98, $1,500, P.J. Lechler.

University of Nevada, Reno International Travel Support to attend International Platinum Symposium, Rustenburg, South Africa, 1998, $750, P.J. Lechler.

University of Nevada, Reno Junior Faculty Research Award Program, Timing of metal mobility and deposition from actively degassing magmas, 2/97–8/98, $2,000, L. Shevenell.

Other Professional Activities - 1998

Bell, J.W.
Chair, Geoscience Committee, Nevada Earthquake Safety Council.
Co-leader, Field trip on Quaternary geology of the Yucca Mountain area, annual meeting of the Friends of the Pleistocene.

Castor, S.B.
Chair, Education Committee, Geological Society of Nevada, Reno, Nevada.
Teacher, rock and mineral identification classes, Libby Booth Elementary School.
Judge, Regional Science Fair.
dePolo, C.M.
Chair, Basin and Range Province Committee, Western States Seismic Policy Council.
Member, Geosciences Committee, Nevada Earthquake Safety Council.
Presenter, The activity of faults in Nevada, Southwestern Section of the Association of Engineering Geologists in Las Vegas.
Presenter, The western Nevada earthquake planning scenario, joint meeting between the U.S. Environmental Protection Agency and the State of Nevada on disaster response in Nevada.
Presenter, The western Nevada earthquake planning scenario, Truckee Meadows Community College System emergency response class.
Presenter, The western Nevada earthquake planning scenario, Southern California Earthquake Center.

Desilets, M.
Co-teacher, laboratory for Mining and Exploration Geochemistry, University of Nevada, Reno, Fall, 1998.
Co-teacher, laboratory for Analytical Methods and Instrumentation, University of Nevada, Reno, Fall, 1998.
Judge, Western Regional Science Fair, Reno, Nevada.
Judge, Desert Height Elementary School Science Fair, Reno, Nevada.
Chair, Membership Committee, Geological Society of Nevada.
Co-chair, Facilities and Social committee, Geology and Ore Deposits: The Great Basin and Beyond, 2000 Symposium, Geological Society of Nevada.

Faulds, J.E.
Presenter, hazard mapping in the Laughlin area, Clark County, Nevada: Nevada Earthquake Council Meeting, Reno, Nevada.
Presenter, assessment of natural hazards in the Laughlin-Bullhead City area, Laughlin Administrators.
Presenter, research in Frenchman Mountain and Meadview North areas, Nevada and Arizona, Lake Mead Field Conference.
Co-leader, Geological Society of America field trip, Rocky Mountain Section Meeting, Flagstaff, Arizona.
Editor, Geological Society of America Special Paper 323.

Garside, L.J.
Member, Scholarship Committee, Nevada Petroleum Society.
Member, Potential Gas Committee, Institute for Energy Resource Studies, Colorado School of Mines.

Henry, C.D.
Co-leader, field trip to Tuscarora, Nevada, U.S. Geological Survey.
Member, Technical Program Committee, 2000 Symposium, Geological Society of Nevada.
Featured in American Geological Institute video “Careers for Geoscientists.”

Hursh, J.P.
Contestant, Give it your best shot, Volcanic Dike Wall print: Shooting of the West X photography symposium, Winnemucca, Nevada.
Presenter, Photographic tour of the State of Nevada: Elder College Christmas dinner slide show, sponsored by the Division of Continuing Education, University of Nevada.

House, P.K.
Teacher, Quaternary Geology and Techniques of Surficial Geologic Mapping, University of Nevada, Reno, Summer Term, 1998.
Leader, field trip in Arizona, Utah, and Nevada for the U.S. Bureau of Reclamation Seismotectonic and Paleohydrology Research Group.
Leader, field trip for visiting geomorphologists from Hebrew University, Israel, and Lancaster University, U. K.
Co-organizer, field trip and ground-penetrating-radar research project for undergraduates from University of Wisconsin, Eau Claire.
Interviewed by the Associated Press regarding the flood history of the Truckee River.
Featured in American Geological Institute Video “Careers for Geoscientists.”
Johnson, G.L.
Instructor, Introduction to GIS, University of Nevada, Reno, Spring 1998.

LaPointe, D.D.
Presenter, minerals education workshops, semiannual teacher workshops of the Nevada Mining Association and Nevada Division of Minerals, Las Vegas, Nevada.
Presenter, USGS State Earth Science Information Center (ESIC) coordinators meeting, implementation of ESIC materials in earth science educational outreach projects in Nevada.
Member, Education Committee, Nevada Mining Association.
Co-chairman, Education Committee, Geological Society of Nevada.
Member, Nevada Earthquake Education and Awareness Committee.
Chair, Scholarship/Loan Committee, Nevada-Reno Section of the Women’s Auxiliary of the American Institute of Mining, Metallurgical, and Petroleum Engineers.
Assistant to Partners in Science Program between University of Nevada, Reno Medical School and local at-risk third grade classes.
Teacher, Washoe County Gifted and Talented Program for students at Hidden Valley gifted and talented teaching center.
Teacher, Washoe County School District Teacher In-Service Program.
Leader of University Child and Family Research Center field trips to Coeur Rochester Mine, Hazen diatomite pit, and Grimes Point Nevada Wonderstone locality.
Teacher, Great Basin National Park Teachers’ Workshop.
Curriculum developer for Kids University, an educational summer camp program at the University of Nevada, Reno.
Speaker on careers, rocks, minerals, geology, mineral resources, and maps to Nevada public and private school classes at Hug, Reno, Manogue, Galena, Valley, Clark, Bonanza, and Wooster High Schools, and Lemmon Valley and Hunsberger elementary schools.
Resource for Earth Science educational materials for teachers.

Lechler, P.J.
Member, Technical Program Committee, 2000 Symposium, Geological Society of Nevada.
Co-teacher, Mining and Exploration Geochemistry, Fall 1998.
Co-teacher, Analytical Methods and Instrumentation, Fall 1998.
Consultant for U.S. Environmental Protection Agency on geochemistry of water-rock interactions at Sulfur Bank Mercury Mine, Clear Lake, California.

Price, J.G.
Chair, Board of Directors, Western States Seismic Policy Council.
Vice President, Association of American State Geologists.
Treasurer, Association of American State Geologists.
Secretary, Nevada Earthquake Safety Council.
Chair, Research Council, Society for Mining, Metallurgy, and Exploration.
Chair, State Mapping Advisory Committee.
Chair, Nominating Committee, American Institute of Professional Geologists.
Field Trip Leader, Earth Science Week.
Instructor, Nevada Mining Association Teachers Conferences, Las Vegas and Ely.
Judge, Lois Allen Elementary School Science Fair.
Administrator, Mining Cooperative Fund, State of Nevada.
Member, Committee on Earth Resources, National Research Council.
Member, Task Force to Review the Federal-State Cooperative Water Program of the U.S. Geological Survey.
Member, Science Standards Task Force, Nevada Department of Education.
Member, Organizing Committee, Conference on Meeting Societal Resource and Environmental Requirements for the 21st Century, American Association of Petroleum Geologists, Taos, New Mexico.
Member, Nevada All Hazard Mitigation Committee.
Member, Higher Education Geoscience Advisory Board, American Geological Institute.
Member, Fiftieth Anniversary Committee, American Geological Institute.
Member, Mineral and Energy Resources Section, National Association of State Universities and Land Grant Colleges.
Member, Economic Geology Publishing Company.
Member, Editorial Board, Ore Geology Reviews.
Member, Liaison Committee, Executive Committee, and Energy and Minerals Policy Committee, Association of American State Geologists.
Representative to the Member Society Council of the American Geological Institute for the Association of American State Geologists.
Trustee, Society of Economic Geologists Foundation.
Speaker on Reno television station, CBS Channel 2, Face the State, an extended interview on mining issues.

Ramelli, A.R.
Leader, field trip on Quaternary Geology of the Yucca Mountain Area, Southern Nevada: Friends of the Pleistocene Pacific Cell.
Leader, field trip visit to the C-Hill trench across the Carson City fault, University of Wisconsin Eau Claire.
Member, Southern Chapter of the Nevada Association of Land Surveyors GPS Subcommittee, provided input on a proposed CORS site at Mt. Arden.
Expert-panel member, Yucca Mountain Seismic Source and Fault Displacement Characterization Project.
Presenter, GPS results from Yucca Mt. and GPS activities to the Nevada Earthquake Safety Council.

Shevenell, L.
Consultant to the Bureau of Mining Regulation and Reclamation (NDEP) regarding reporting requirements on pit lake data and analyses.
Co-organizer/convener of the Nevada Pit Lake working group. Subcommittee chair of the Nevada Pit Lake working group (Data reporting and quality).
Judge, 1998 Regional Science Fair, Reno, Nevada.
Judge, student oral presentations at the 1998 Spring American Geophysical Union Meeting, Boston, Massachusetts.

Tingley, J.V.
Reviewer, Nevada State Clearinghouse documents for comment on mineral issues.
Member, Special Nevada Report Team.
Executive Secretary, Nevada State Board of Geographic Names.

Tingley, S.L.
Chair, Nevada State Board on Geographic Names.

Other Professional Activities - 1999

Bell, J.W.
Advisor, GES Consultants in Las Vegas with seismic code; Stantech Consultants in Reno with seismic hazard in the Pyramid Lake area; Lincoln County Emergency Management with seismic hazards and design for schools in the Caliente area; Placer Dome Mining with seismic design for tailings pond at Getchell; Washoe County School District with seismic hazard information for proposed school site; Nye County Commissioners with subsidence hazard information; Las Vegas Valley Water District with assistance on developing the Las Vegas Springs Preserve; U.S. Bureau of Reclamation with assistance in assessing the seismic hazards of the Lake Tahoe area.
Blewitt, G.
Governing Board Member, International GPS Service, and the International Association of Geodesy Special Commission VI.
Chair, International Association of Geodesy Special Study Group, Advanced GPS Analysis for Precise Positioning.
Electee, University NAVSTAR Consortium (UNAVCO).
Liaison, University of Newcastle, California Institute of Technology (Wernicke), Harvard Smithsonian Center for Astrophysics (Davis), State University of New York, Stonybrook (Holt), UNAVCO (Stein), JPL’s Thinking Systems Section (Stolorz and Donnellan), JPL’s Tracking Systems Section (Bar Sever and Zumberge).

Castor, S.B.
Member, Education Committee, Geological Society of Nevada.
Judge group leader, Regional Science Fair.
Co-instructor and field trip leader, Geology 417/617, Instrumental Methods of Determinative Mineralogy.

dePolo, C.M.
Chair, Basin and Range Province Committee of the Western States Seismic Policy Council.
Chair, Earthquake Risk Mitigation Committee of the Nevada Earthquake Safety Council.
Member, Geosciences Committee, and the Strategic Planning Committee of the Nevada Earthquake Safety Council.
Presenter, Douglas County School Board, local earthquake hazards in Douglas County and the seismic safety of schools.
Leader, field trip during Nevada Earthquake Awareness Week, Earthquakes in the Reno/Carson City area.
Leader, field trip during Earth Science Week, What’s Shakin’ in the Neighborhood?
Interviewee, four-page long article on earthquake hazards in Las Vegas for the April 11, Sunday edition of the Las Vegas Review-Journal, including half of the front page, with headlines.

Faulds, J.E.
Leader and organizer, Nevada Petroleum Society field trip.
Speaker, Nevada Petroleum Society meeting and All Hazards Committee Meeting.
Co-chair, two technical sessions, Geological Society of Nevada 2000 meeting.

Garside, L.J.
Co-Chairman, Geology of Nevada Session, Geological Society of Nevada 2000 meeting.
Member, Technical Program Committee, Geological Society of Nevada 2000 meeting.
Leader, Truckee Canyon field trip for K–12 teachers and students.
Assistant, Nevada Division of Minerals booth at the Reno Geothermal Resources Council meeting.
Member, Nevada Petroleum Society Scholarship Committee.
Member, Potential Gas Committee, Institute for Energy Resource Studies, Colorado School of Mines.

Henry, C.D.
Member, Technical Program Committee, Geological Society of Nevada 2000.

Hess, R.H.
State of Nevada representative, Western Governors’ Association Geographic Information Council.
State of Nevada representative, National States Geographic Information Council.
Member, National States Geographic Information Council NASA project group.

House, P.K.
Instructor, University of Nevada-Reno Department of Geological Sciences Summer Field Camp.
Convener, The Second International Paleoflood Conference.
Feature, Gardnerville Record-Courier and the Nevada Appeal.

Johnson, G.L.
Instructor, Introduction to GIS, and Advanced GIS, University of Nevada, Reno.
Instructor, Arcview and GIS, Truckee Meadows Community College.
Instructor, Workshop on metadata creation, Reno, Nevada.
LaPointe, D.D.
Assistant, Science Partners program, UNR Medical School students, devising earth science curricula for the Partners in Science outreach program.
Board of Directors, Geological Society of Nevada Foundation.
Chair, Literature Committee, Regional National Science Teachers Association.
Chair, Mackay School of Mines Scholarship Committee.
Chair, Nevada Earthquake Education and Awareness Committee.
Chair, organizer, lecturer, and field trip leader, Winnemucca School to Careers Workshop, Winnemucca.
Chair, Scholarship-loan committee, Nevada Reno Section of the Women’s Auxiliary of the American Institute of Mining, Metallurgical, and Petroleum Engineers.
Co-Chair, Geological Society of Nevada Education Committee.
Co-Chair, Sample Acquisition Committee, National Science Teachers Association.
Coordinator, Geological Society of Nevada Earth Science Field Trip Grant program.
Coordinator, Presenter, and Field Trip Leader, Minerals Education Workshops, semiannual teacher workshops of the Nevada Mining Association and Nevada Division of Minerals in Las Vegas in March and in Winnemucca in July.
Developer, curriculum and activity schedule for week-long sessions of Kids University.
Chair, Nevada Earthquake Education and Awareness Committee.
Member, Education Committee, Nevada Mining Association (NMA) which was awarded the National Minerals Education Foundation 1999 Award for Excellence in Minerals Education.
Member, the Advisory Board for McCaw School of Mines in Henderson, NV.
Organizer and Field Trips Leader, University Child and Family Research Center.
Organizer, Western Nevada Regional Science Fair judges.
Planner and Coordinator, Nevada Earth Science Week activities.
Presenter, educational talks on minerals, maps, earthquakes, careers, and geology to K-12 teachers and classes for the following schools: Hug, Reno, Manogue, Valley high schools, Mendive and Incline middle schools, Bernice Martin Matthews, Verdi, Agnes Risley, and Hunsberger elementary schools.
Presenter, Field Trip Leader, National Minerals Education Foundation annual meeting, Elko.
Presenter, locally and nationally available resources in mapping skills and land-use planning, Kid City–Harrah’s Automobile Museum, Reno.
Presenter, Nevada State Fair, Mackay-NBMG booth, answering questions from the public and distributing free mineral samples, public field trip notices, and information.
Presenter, Reno Home Show, NMA-NDOM-NBMG booth, answering questions from the public and distributing free mineral samples, public field trip notices, and information.
Recruitment Coordinator for the Mackay School of Mines.

Lechler, P.J.
Co-taught Analytical Methods and Instrumentation, University of Nevada, Reno.

Price, J.G.
President-Elect, Association of American State Geologists.
Chair, Research Council, Society for Mining, Metallurgy, and Exploration.
Chair, Board of Directors, Western States Seismic Policy Council.
Chair, State Mapping Advisory Committee.
Chair, Government Affairs Committee, Nevada Section, American Institute of Professional Geologists.
Chair, Government Affairs, Mineral and Energy Resources Section, National Association of State Universities and Land Grant Colleges.
Secretary, Nevada Earthquake Safety Council.
Administrator, Mining Cooperative Fund, State of Nevada.
Member, Nevada All Hazard Mitigation Committee, State of Nevada.
Member, Executive Committee, Board on Earth Sciences and Resources, National Research Council.
Member, Committee on Earth Resources, National Research Council.
Member, Committee on Hardrock Mining on Federal Lands, National Research Council.
Member, Task Force to Review the Federal-State Cooperative Water Program of the U.S. Geological Survey.
Co-chair, Technical Program Committee for the 2000 Symposium, Geological Society of Nevada.
Judge, Lois Allen Elementary School Science Fair.
Judge, Northern Nevada Regional Science Fair.
Co-Leader, two all-day Earth Science Week field trips.
Instructor, Nevada Mining Association Teachers Conference, Winnemucca.
Member, Mineral and Energy Resources Section, National Association of State Universities and Land Grant Colleges.
Member, Ad Hoc Committee on Professional Ethics, Society of Economic Geologists.
Member, Economic Geology Publishing Company.
Member, Editorial Board, Ore Geology Reviews.
Member, Liaison Committee, Executive Committee, and Energy and Minerals Policy Committee, Association of American State Geologists.
Representative to the Member Society Council of the American Geological Institute for the Association of American State Geologists.
Trustee, Society of Economic Geologists Foundation.
Member, Nominating Committee, American Institute of Professional Geologists.
Co-convener, Topical session on geoscience ethics guidelines, sponsored by the American Institute of Professional Geologists, Geological Society of America annual meeting.
Session chair, Area Reports, Northwest Mining Association annual meeting.

Ramelli, A.R.
Leader, Field trip on Earthquakes in the Reno/Carson City area, Earthquake Awareness Week.
Representative, All-Hazards Mitigation Committee.
Assistant to Scott Mensing (UNR Dept. of Geography) in establishing procedures and control for their GPS pathfinder system.

Shevenell, L.
Member, Steering committee for the Western States Pit Lake Conference, April 4–6, 2000.
Member, Interagency Abandoned Mine Lands Environmental Task Force.

Tingley, J.V.
Reviewer, Nevada State Clearinghouse documents for comment on mineral issues.
Executive Secretary, Nevada State Board on Geographic Names.

Tingley, S.L.
Chair, Nevada State Board on Geographic Names.
Reviewer, Statewide Class Concept Study for the Cartographic Technician Series.

Invited Papers and Presentations - 1998


Faulds, J.E., Searchlight pluton, Eldorado Mountains, Nevada: Massive pluton emplacement at the onset of continental extension: American Geophysical Union Spring Meeting, Boston, Massachusetts.

Faulds, J.E., Societal and economic significance of regional segmentation structures in extended terranes: Homestake Mining Company, Reno, Nevada.

Faulds, J.E., Stratigraphic and structural framework of Yucca Mountain, Nevada: Implications for the proposed high-level nuclear waste repository: Idaho State University, Pocatello.

Faulds, J.E., The role and significance of regional segmentation structures in extended terranes: Idaho State University, Pocatello.

Henry, C.D., 40Ar/39Ar dating applied to ore deposits: Geochronology class, New Mexico Institute of Technology.


Price, J.G., A scenario for a major earthquake in western Nevada, Sparks Rotary Club.


Price, J.G., Employment opportunities with geological surveys, University of Nevada, Las Vegas.
Price, J.G., Key issues in earth science, Reno High School.
Price, J.G., Perspectives on meeting societal resource and environmental requirements for the 21st century, American Association of Petroleum Geologists, Division of Environmental Geosciences Conference in Taos, New Mexico.
Shevenell, L., Chemical characteristics of 16 past or existing pit lakes at precious metal mines in Nevada: Mine Design, Operation and Closure Conference, Polson, Montana.
Shevenell, L., Formation of lakes in open pit mines that extend below the water table: Water quality of 16 pit lakes in Nevada: 1998 Spring American Geophysical Union meeting, Boston, Massachusetts.
Shevenell, L., Overview of the Getchell pit lake project: Mackay School of Mines Advisory Board Meeting, Washoe Valley, Nevada.

Invited Papers and Presentations - 1999


dePolo, C.M., 1999. Strike-slip faulting in the southern Walker Lane belt and earthquake mechanics of the Walker Lane Belt: Cenozoic Tectonics of the Walker Lane belt seminar, University of Nevada, Reno.


Faulds, J.E., 1999. Building mountains from the bottom up: Reconciling pluton emplacement, volcanism, and extension of the continental lithosphere in the Eldorado Mountains of southern Nevada (Miller, Faulds, and others): GSA annual meeting, Denver, Colorado.


House, P.K., 1999. Using geologic information to evaluate the influence of hydrological change on the channel morphology of the middle Humboldt River: Nevada Legislative Committee on Public Lands, Lovelock, Nevada.


Price, J.G., Geology to the Rescue, National Science Teachers Association, Reno.

Price, J.G., Hardrock Mining on Federal Lands, twelve separate presentations made to the Nevada State Land Use Planning Advisory Council (Reno), University of Nevada, Reno, National Research Council (Washington, D.C.), Nevada Division of Environmental Protection (Carson City), U.S. Forest Service and Bureau of Land Management (Reno), Nevada Mining Association (Reno), California Mining Association (Sacramento), Northwest Mining Association (Spokane), and Geological Society of America (Denver).


Shevenell, L., Building relationships with program managers, and how to prepare competitive proposals: Nevada State EPSCoR Conference, Las Vegas, Nevada. (Invited)


Shevenell, L., Evaluation of a numerical pit-lake filling model at the Getchell Mine, Nevada: Modeled versus observed filling rates: American Geophysical Union Meeting, Boston, Massachusetts.

Shevenell, L., Hydrogeochemical characteristics of pit lakes at open pit mines in Nevada: Mackay School of Mines Earth Sciences Seminar, Reno, Nevada.

Shevenell, L., Use of well hydrographs to estimate aquifer parameters: DoD program review meeting, Boise State University, Boise, Idaho. (Invited)

Shevenell, L., Water quality in Nevada pit lakes compared to that in natural, terminal lakes in Nevada: Nevada Mining Association, Environmental sub-committee, Elko, Nevada. (Invited)


Honors and Awards - 1998

Bell, J.W.
Research paper: Dating precariously balanced rocks in seismically active parts of California and Nevada, selected for the cover of the June 1998 issue of the journal Geology.
dePolo, C.M.
Completed doctoral studies at the University of Nevada, Reno.

Hess, R.H.
Completed the requirements for master’s degree in Geography at the University of Nevada, Reno.

Price, J.G.
Elected Vice President of the Association of American State Geologists.
Elected Chair of the Board of Directors of the Western States Seismic Policy Council.

Honors and Awards - 1999

Bell, J.W.

Blewitt, G.
Elected Fellow of the International Association of Geodesy.
Awarded the NASA Group Achievement Award for an Earth-rotation measurement system based on GPS.

LaPointe, D.D.
Dean’s award for outstanding recruiter of the year for Mackay School of Mines.

Price, J.G.
Elected President-Elect of the Association of American State Geologists.
John T. Galey, Sr. Memorial Public Service Award, American Institute of Professional Geologists, for outstanding contributions to the public welfare in the highest traditions and ideals of AIPG.
Platinum Award (first place), ThinkQuest for Tomorrow's Teachers, Materials for Use in Teacher Education, award for design of a Web site titled "The Science of the Comstock." Team members included Collette Craig, Elisabeth Price, John Fuetsch, Lindsay Craig, and Jonathan Price.
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.

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.
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.

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.

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.

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.

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.
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.
4. Such other departments as the board of regents may designate.

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.

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.

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.

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

(Amended to NRS by 1989, 1287; A 1991, 201)
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]
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 database; 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.
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.

Advisory Committee Members

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Bill DuBois, DuBois & Company
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