

Annual Report
of the
Idaho Geological Survey

Fiscal Year 2006

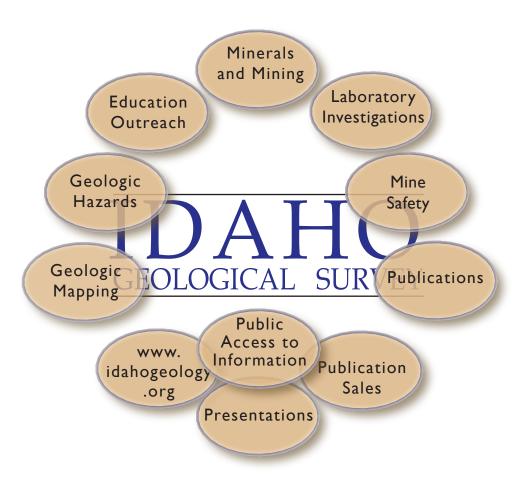
# **Contents**

Highlights	I
Mission Statement	2
Fiscal Overview	5
Sources of Funding	5
Geologic Mapping Projects	7
Publication Sales	13
Customer Downloads	15
Web-Site Visits	15
Most Popular Web Pages	15
Organization and Personnel	
Organization Chart	18
Directory	19
Advisory Board Meeting	
Publications and Activities	

# **Highlights**

The funding and collegial support provided through cooperative projects have long been integral components of the agency's operation. The activities highlighted for the 2006 Annual Report represent long-term research and service programs by the Survey. Over time, the staff has developed wide-ranging interdisciplinary networks in support of its mission. For a one-year snapshot of what has been a very productive synergy, look at the *Partners and Collaborators* section below for the many organizations now currently involved in Survey projects. Moreover, regard this extensive roll call as a solid tribute to a veteran staff's interest, initiative, and ingenuity in building these relationships. To appreciate further the staff's professional engagement in the agency's agenda, review particularly the individual entries in the *Staff Publications and Activities* section provided in detail at the end of this report.

#### **Mission Statement**



The Idaho Geological Survey is the lead agency for collecting and disseminating geologic information and mineral data in the state. In addition to its main office in Moscow at the University of Idaho, the Survey has branch offices in Pocatello at Idaho State University and in Boise at the Idaho Water Center and also Boise State University. Staff geologists conduct applied research with a strong emphasis on producing geologic maps and providing technical and general information about Idaho's geologic setting, earth resources, and geologic hazards. Externally funded projects enhance this research.

#### **Administration**

#### **Partners and Collaborators**

The Survey's statewide mission encourages interdisciplinary partnerships and collaboration with many other agencies, organizations, and universities. This broad cooperation ranges from direct grants to the collegial sharing of expertise and information. On the national level, the Survey is also directly involved in the initiatives of the Association of American State Geologists. These alliances offer many opportunities to engage in projects that enhance the agency's applied research and outreach.

#### **Funding Partners**

Idaho Bureau of Homeland Security ~ Idaho Department of Environmental Quality ~ Idaho Department of Lands ~ Idaho State University ~ Idaho Transportation Department ~ Incorporated Research Institutions for Seismology ~ National Park Service ~ National Science Foundation ~ U.S. Bureau of Land Management ~ U.S. Forest Service ~ U.S. Geological Survey ~ U.S. Mine Safety and Health Training Program ~ University of Idaho Research Office ~ Washington State University

#### Collaborators

Association of American State Geologists ~ Belt Association ~ Boise State University ~ Bonner County Museum ~ Cooperative Ecosystem Studies Units ~ Earthquake Engineering Research Institute ~ Greater Portneuf Water Resource Partnership ~ Ice Age Floods Institute ~ Idaho Conservation League ~ Idaho Earth Science Teachers Association ~ Idaho Mining Association ~ Idaho National Laboratory ~ Idaho Water Resources Research Institute ~ Inside Idaho ~ Intermountain Forest Tree Nutrition Cooperative ~ Intermountain Regional Advisory Council, Advanced National Seismic

System ~ Latah County Historical Society ~ Lewis Clark State
College ~ Montana Bureau of Mines and Geology Earthquake Studies
Office ~ Natural Resources Conservation Service ~ Nez Perce
County ~ North Idaho College ~ Northwest Mining Association ~
Pacific Northwest National Laboratory and Battelle-Pacific
Northwest Division ~ Pocatello Ground Water Task Force ~ Tobacco
Root Geological Society ~ U.S. Department of Agriculture Plant
Materials Center, Agricultural Research, Washington State University ~
University of Utah Seismograph Stations ~ Utah State University ~
Western States Seismic Policy Commission ~ Western North
American Volcanic and Intrusive Rock Database

#### **Association of American State Geologists**

The Survey is an active participant in the Association of American State Geologists (AASG). During FY-06, Roy Breckenridge attended the annual meeting in New Mexico and the spring liaison in Washington, D.C. Roy served the second year of a three-year term as the Western Regional Representative on the U.S. Geological Survey's Peer-Review Panel for the STATEMAP Component of the National Cooperative Geologic Mapping Program (NCGMP). The AASG is a strong advocate for the federal reauthorization of the NCGMP as well as research programs for data preservation, minerals and energy resources, and geologic hazards.

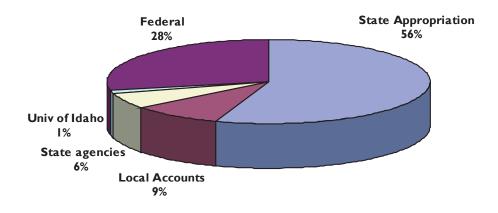
#### **Fiscal Overview**

This year, the State Legislature funded a salary increase and the University instituted an internal increase. Combined, the increases were moderate but represent an important commitment to equity by the University administration. The Survey's operations budget was again funded at base level for FY-06, with no appropriation for capital outlay. The budget cuts and hold-backs of the recent years have reduced the budget base and continue to adversely impact the agency's mission in research, public service, and education.

# Fiscal Overview

	FISCAL YEAR 2006			
Appropriation	Beginning Balance	Income	Expense	Ending Balance
Personnel	\$ 0	\$ 820,600	\$ 820,600	\$ 0
Operating Expense	0	25,700	25,700	0
Capital Outlay	0	0	0	0
Total	0	846,300	846,300	0
U/I Personnel Funds		15,709	15,709	
Local Accounts	113,686	141,722	141,843	113,565
Grants and Contracts	Na	527,697	527,697	Na
TOTAL	\$113,686	\$1,531,428	\$1,531,549	\$113,565

# Sources of Funding



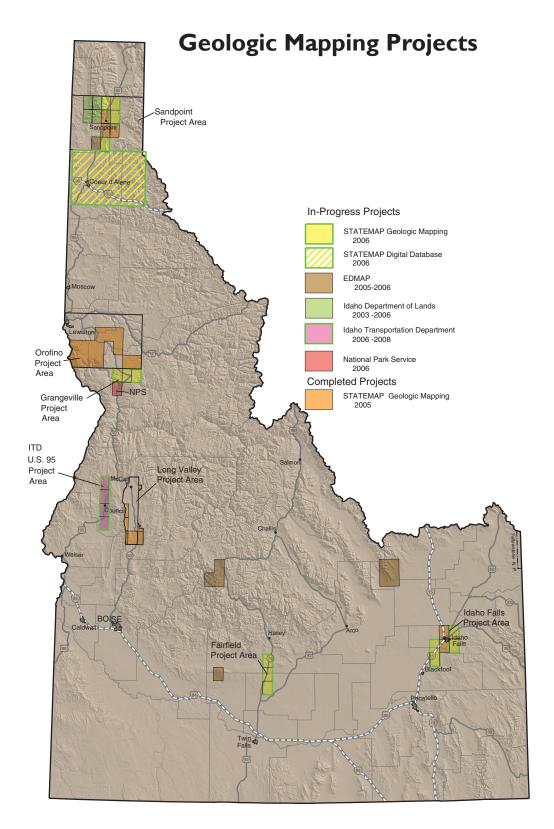
#### Research

# **Geological Mapping and Related Studies**

Central to the Survey's applied research is geologic mapping and topical studies that together form the basic content of digital maps, databases, reports, and publications. Traditionally, mapping in Idaho has been directed at earth resources mainly in rural areas. Since 1985, the Survey has been conducting detailed mapping in selected urban-impact areas on multiple issues. Single issue geologic problems have increased owing to population growth and resource needs.

The Survey is a strong supporter of the National Cooperative Geologic Mapping Program (NCGMP). For more than a decade, the agency has partnered with the STATEMAP component of the NCGMP to deliver digital geologic maps to Idaho users. The Idaho Geologic Mapping Advisory Committee assists the Survey by assessing Idaho's mapping needs and addressing long-term plans for geologic mapping. The committee guides the medium- and short-term mapping plans to take advantage of state partnerships. This year other funding partners include the Idaho Transportation Department, Idaho Department of Lands, and National Park Service. During the year, STATEMAP project geologists mapped seventeen 7.5-minute quadrangles. The Survey also cooperated with Utah State University by publishing quadrangles mapped by students under the EDMAP component of the NCGMP.

Geologic mapping for the Sandpoint project has revealed a large discordance between the Spokane dome mylonite zone and the younger Purcell Trench fault, indicating they are unrelated structures. Mapping south of Lewiston documented previously unrecognized pre-Tertiary right-lateral slip of several kilometers along the Limekiln-Waha structure. A previously unmapped channel fill (Asotin Member, Columbia River basalt) was also discovered South of this structure.



# **Geochronology**

U-Pb dating of 1,450-1,500 Ma detrital zircons in metamorphic rocks west of Sandpoint indicates that the rocks are Belt Supergroup equivalent and the lowermost known Belt rocks in Idaho.

The Snake River stream terraces in southeast Idaho form the basis for Idaho's famous potato production, but the ages and stratigraphic relationships of the terraces, loess, and lava flows are poorly known. In 2006, STATEMAP supported new geologic mapping and dating of loess and terrace deposits in the Idaho Falls area. A relatively new dating technique, optically stimulated luminescence (OSL), shows that terrace deposits formed between 12,000 and 19,000 years ago. The OSL laboratory at Utah State University performed the age analyses.

# **Paleomagnetism**

Paleomagnetic studies conducted by the Survey were key in correlating lava flows in the Idaho Falls area. Previous studies by USGS workers established the age and unusual paleomagnetic properties of Shattuck Butte, a vent several miles west of Idaho Falls. As part of STATEMAP geologic mapping of the Idaho Falls North and South quadrangles, the lava flows responsible for producing the series of small cataracts and cascades along the Snake River at Idaho Falls were correlated to the Shattuck Butte vent on the basis of paleomagnetism.

# **Hydrogeology**

The Survey continues to cooperate with other state and federal agencies, university programs, and water-user groups throughout Idaho to better understand the geologic controls on ground-water flow and recharge and the distribution and transport of ground-water contaminants. Results of the research are provided to

end-users for ground-water resource development and protection. To accomplish this, the Survey cooperates with other state and federal agencies, university programs, and water-user groups throughout Idaho. Research applications include modeling the aquifer stratigraphy, analyzing and mapping the ground-water quality, and assessing ground-water vulnerability to septic sewage disposal.

The Survey has developed and applied a new group of spatial-temporal geostatistical tools for analyzing patterns of change in both water quality and ground-water storage. These practical approaches improve the effectiveness of monitoring network sampling designs and are being successfully applied in the analysis of other state ground-water monitoring databases.

A ten-year evaluation of ground-water quality in the lower Portneuf River valley has provided the first strong evidence of the magnitude of ground-water quality impairment due to septic sewage disposal. A novel modeling approach was applied to quantify the cumulative effects of individual septic systems on Pocatello's municipal water supply and to predict impacts of future development.

# **Digital Geologic Maps**

The Survey's digital mapping and GIS laboratory provides services that include digital cartography, spatial data management, database design, network system administration, graphic design and desk-top publishing, and Web site support. The lab continues to compile geology from around the state in a geologic map database in addition to producing new geologic maps. Thirty-four new geologic maps were published this year. Most of these are available as print-on-demand color maps. All are available for free on the Web site, or paper copies can be purchased through the Survey's sales office.

The digital mapping lab incorporated six geologic maps of 30' x 60' tiles into a new statewide geologic map database. The design of this database, or data model, has been revised to fit more closely with

national standards. Work began in May on software tools that will aid in managing new geologic mapping data, compiled in  $30^{\circ} \times 60^{\circ}$  tiles, as they are migrated into the statewide geologic map database. Digital capture of the new geologic map of Idaho, ultimately to be published at 1:750,000, was begun in May.

# **Geologic Hazards**

As the state's population has grown and disaster losses have increased, the Survey is spending more time with geologic hazard mitigation. The agency works formally and informally with the Idaho Bureau of Homeland Security (IBHS) to mitigate, respond to, and recover from the impacts of floods, fires, landslides, and earthquakes, and to provide technical analysis when required under the Idaho State Hazard Mitigation Plan and Executive Order No. 2006-10.

As an active participant in the Western States Seismic Policy Council (WSSPC) and Pacific Northwest and Intermountain regional planning groups of the Advanced National Seismic System (ANSS), the Survey is involved in organizing seismic network operators and planning several hazard mitigation projects. The Survey is leading a state seismic network clearinghouse effort based on the EARTHWORM system in cooperation with the IBHS. Idaho hosted the WSSPC 2005 annual meeting in Boise. The conference's theme, NEHERP's Next Decade: Challenges for Implementation, centered on the challenges facing rural western states. The meeting featured the geology and tectonic setting of Boise and surrounding area.

Idaho's seismic monitoring capabilities are slated to improve as the National Science Foundation funded Earthscope transportable array moves into the state beginning in 2006. The Survey worked with Earthscope contractors to site new seismic stations in northern Idaho. An additional Advanced National Seismic Survey site was also located in 2006 in the McCall area. Together with other western state geological surveys and emergency management agencies, the Survey is

seeking funding to purchase and permanently operate several of the Earthscope sites in Idaho.

FY-06 was a busy time for earthquake research in Idaho. In March, reports were released on the Alpha earthquake swarm near Cascade. This swarm occurred in the September-December period. Hundreds of small earthquakes a day were felt by local residents, with the largest events in the magnitude 3.5-4.0 range. With funding from the Idaho Bureau of Homeland Security, the Survey arranged to place a network of portable seismographs in the area to accurately locate the events and determine their relationship to nearby fault structures. Over 20,000 small earthquakes were recorded by the portable network. Many of the quakes occurred along the southern end of the Long Valley fault.

# Mines and Mining

#### **Active Mining**

The Survey maintains a working knowledge of the geology of all active mines in Idaho. Information and statistics on these mines are collected and published annually. The Survey cooperates with the U.S. Geological Survey in collecting and interpreting mineral statistics and mining data, and presents an overview of the state's exploration and mining at the Northwest Mining Association's annual meeting. Summaries of the year's mining and exploration activity are published in the May issue of *Mining Engineering*, the U.S. Geological Survey's *Minerals Yearbook*, and the Idaho Department of Commerce's *Idaho Facts*.

In 2006, there was a noticeable increase in mining-related inquiries from small-time prospectors and private companies. FY-06 saw a tremendous spike in metal (especially molybdenum and silver) and energy prices and consequently increased exploration activity and mining revenue for companies and the state. For the calendar

year, Idaho's nonfuel mineral production set a record, estimated at \$893 million.

Idaho is also seeing renewed interest in other economically important commodities from energy resources to wine. This year, Idaho experienced a dramatic increase in requests for information on energy resource exploration and development. Particularly active are the oil and gas and geothermal sectors and carbon sequestration research. The Survey prepared an update of the 1982 oil and gas map for Idaho that will be published in geographic information systems (GIS) format. The Survey also worked with the Energy Division of the Idaho Department of Water Resources, public officials of Valley County, and the proposed Intermountain West Geothermal Consortium to promote the use and understanding of geothermal energy. At year's end, the Survey received a grant from the U.S. Geological Survey to study thorium deposits in Lemhi County for FY-07.

#### **Abandoned and Inactive Mines**

The abandoned mine lands (AML) team completed a three-year study of the environmental and physical hazards of selected abandoned and inactive mines in the Salmon and Challis National Forests. Nearly four-hundred sites were inventoried during the course of the three summers. Each site was completely documented, including description, photography, videotape, and GPS coordinates. Unlike previous AML reports, these will be released in digital format on DVD because of the extensive photographs and videotaped records for each property in addition to the written report. An Excel spreadsheet, the key feature in each report, lists the main features of each site and contains hyperlinks to pertinent written material, maps, photographs, and videos. The written reports are also hyperlinked to pertinent files. Two reports have already been released, and three more are being prepared.

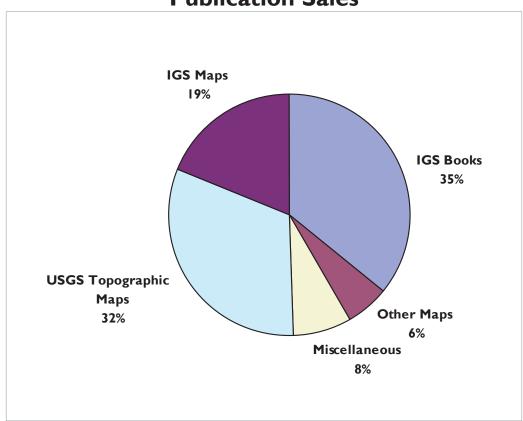
#### **Outreach**

The Survey disseminates geologic and mineral data on Idaho primarily through its publications, Web site, in-house collections, and efforts by the staff in educating the public in the earth sciences.

#### **Publications**

Since 2000, the Survey has released nearly 200 publications that include books, maps, reports, databases, posters, and fact sheets. The rate of output now averages about 25 publications a year. Geologic maps and Staff Reports represent most of the increase (see Staff Publications and Activities).

#### **Publication Sales**



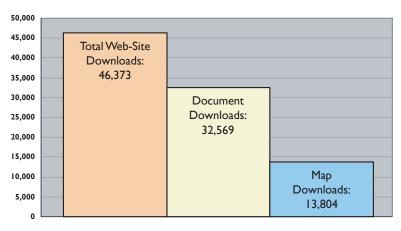
The substantial output in the Survey's geologic mapping in recent years can be traced back to the late 1970s when the agency broadened its published research to include topical and geologic maps designed to stand alone as finished products. Along the way, the Survey developed a solid mapping capability. Sensible investments in digital technology and computer-aided cartography greatly expanded the potential of this small research agency to create very accurate maps using state-of-the-art methods. In 1993, the nation's state surveys joined in support of the National Cooperative Geologic Mapping Act. Since then, Idaho has competed successfully in the program and received nearly \$2 million to map 130 quadrangles. The Survey has expanded output by adding two new publication series, Digital Geologic Maps and Digital Web Maps, that already account for over sixty titles in just five years. Since 1990, twenty-four more titles have been added to the Geologic Map series, and the Surficial Geology Map series, started in 1991, now has fourteen.

Since the late 1970s, the Survey has released more than 460 publications. Of these, over 160 are stand-alone maps, practically all of them geologic. These numbers represent a strong research output, especially in mapping the state's geology.

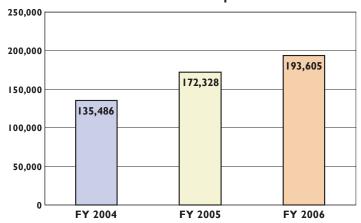
# The Web Site—www.idahogeology.org

The Survey's Web site provides electronic access to its publications and data from an ever-increasing number of customers. The Web site has become the main avenue to a wide-range of information. Online documents available free for download in PDF format include 105 maps and more than 115 additional documents. Publications can be located via search engines on the site. Geologic data are available online including GIS geologic map data sets (Digital Geologic Map series) and two sets of geochemical analyses via a new publication series: Digital Analytical Data. The entire database of mines and prospects is now also available for download as a Digital Database. Work began in June on a new way for customers to visualize geologic fault data. Using Google Earth as

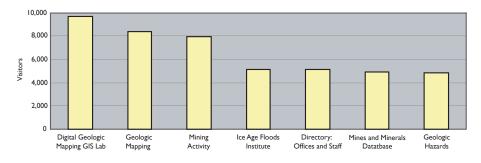
# Customer Downloads of Documents and Maps



# Web-Site Customer Visits Three-Year Comparison



# Most Popular Web Pages



the spatial backdrop, the Survey is overlaying the fault database via a downloadable file. Fault information from the database is then shown for each fault.

#### **Databases and Archives**

The Survey stores and maintains several databases. Many of these data portray spatial information and include additional data tables all stored in relational databases. The newly developed statewide geologic map data are designed around a model that lays out the kinds of information stored in the database and their relationships. For example, a polygon of granite in the database (GIS in this case) is related to the lithologies, minerals, age, and reference or sources for that polygon. Because the Survey no longer prints large press runs of geologic maps, this statewide geologic map database becomes an archive of all the mapping done by the Survey. Interactive data available on the Survey's Web site include sets of information on epicenters, mines and prospects, and Miocene and younger faults. Mines and prospects and geochemistry are both available for download in either database or spreadsheet format.

# **Mine Safety Training**

The U.S. Department of Labor's Mine Safety and Health Training Program in Idaho is administered by the Survey. During FY-06, this program trained and certified over 1,300 miners and industry supervisors in the state and region. A mine safety module and associated classroom materials were popular at the Survey's annual summer field workshop for teachers.

#### **Earth Science Education**

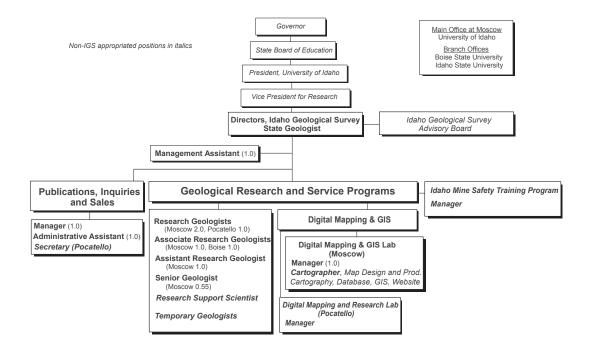
The Survey staff supports a variety of formal and informal education efforts throughout the state, the region, and the nation. Through close working relationships with the geology departments

at the three state universities, Survey geologists make their expertise available by participating in seminars, field trips, and workshops, by teaching selected upper-division courses, and by directing graduate student research. The Survey is primarily engaged in promoting earth science education with the state's teachers through its Web site, through the Idaho Earth Science Teachers Association, and through field workshops conducted around the state so that teachers can observe the methods and science of geology in Idaho's own outdoor laboratory.

The summer of 2005 marked the twenty-sixth teacher workshop the Survey has conducted since 1986. The workshop was held July 10-15 near Borah Peak, the site of Idaho's largest historic earthquake. Twenty-six earth science educators from around the state attended event. The purpose of the workshop was (1) to review earth science techniques and concepts, (2) to gain exposure to new earth science theories and technologies, and (3) to understand natural hazards and their mitigation, particularly in response to those associated with earthquakes. Participants also examined the 1983 fault scarps, mapped glacial features in the Lost River Range, and studied fossils exposed in impressive sections of Paleozoic strata. After instruction in various field techniques, participants devised and implemented their own short research projects. Many focused on creating lesson plans and activities that illustrated the area's geology and natural hazards for their classrooms back home.

# **Organization and Personnel**

# **Organization Chart**



# **Directory**

#### Main Office-Moscow

Morrill Hall, Third Floor University of Idaho PO Box 443014 Moscow, ID 83844-3014 208-885-7991 Fax 208-885-5826

#### **Branch Office-Boise**

Idaho Water Center, Suite 201 322 E. Front Street Boise, ID 83702-7359 208-332-4420 Fax 208-332-4400

#### **Branch Office-Pocatello**

Physical Science, Room 235 Idaho State University MS 8072 Pocatello, ID 83209-8072 208-282-4254 Fax 208-282-4414

#### **Administrative and Support Staff**

Roy M. Breckenridge	Director Manager, Publications and Communications Management Assistant Administrative Assistant		
Research, Full Time	Office Specialist II, Pocatello		
•	Full Bassauch Coologies		
Roy M. Breckenridge	· · · · · · · · · · · · · · · · · · ·		
,	0 1		
Dean L. Garwood			
John D. Kauffman			
Reed S. Lewis			
Victoria E. Mitchell	•		
Kurt L. Othberg	·		
•			
Michael J. Weaver			
	Full Research Geologist, Pocatello		
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Research and Support, Part-Time			
Jennifer M. Bellamy	Work Study		
Jesse S. Bird			
Krista E. Brand	Work Study		
James L. Browne	Geologist		
Russell F. Burmester	Geologist		
James R. Cash	Earth Science Instructor		
Ted W. Erdman	Geologist		
Patrick J. Hickey	Geologist		
Jessica L. Hoke	Work Study		
Mark D. McFaddan	Geologist		
Sherry E. Pixley	Office Assistant/Sales		
Keegan L. Schmidt	Geologist		
Kenneth F. Sprenke	Geologist		
David E. Stewart	3		
Daniel J. Sturgis	Geologic Assistant		

# Twenty-First Annual Advisory Board Meeting May 10, 2006

#### Introduction

The twenty-first annual Advisory Board meeting of the Idaho Geological Survey was held on May 10, 2006, at the Idaho Water Center in Boise. Kurt Othberg and Roy Breckenridge offered their welcome and appreciation to the board members, guests, and staff.

The following Advisory Board members or their representatives were present: **David Farnsworth** (representing Jack Lyman, Executive Director, Idaho Mining Association); **Dennis Geist** (Chair, Department of Geological Services, University of Idaho); **Scott Hughes** (Chair, Department of Geosciences, Idaho State University); **Starr Johnson** (Idaho Association of Professional Geologists); **C.J. Northrup** (Chair, Department of Geosciences, Boise State University); **Stephen Weiser** (Assistant Deputy Director of Mitigation, Idaho Bureau of Homeland Security).

The following guests were present: **Charles Hatch** (Vice President for Research, University of Idaho); **David Jackson** (Idaho Bureau of Homeland Security); **Gene Merrell** (Assistant Vice President of Research, University of Idaho); **Steve Moore** (U.S. Bureau of Land Management); **Ken Neely** (Idaho Department of Water Resources); **Keith Nottingham** (Idaho Department of Transportation); **Kathy Peter** and **Tracy Fuller** (U.S. Geological Survey).

The following staff were present: **Roy Breckenridge**, Charlotte Fullerton, Virginia Gillerman, Kurt Othberg, Loudon Stanford, and John Welhan.

# Strategic Action Plan-2006-2010

Charles Hatch explained how the University of Idaho (UI) has evolved under the new administration. Shortly after his arrival, President Tim White introduced his "Vision and Resources" task force to examine the needs and future direction of the UI. He also drafted his "Plan for Renewal of People, Programs, and Place," which will be implemented July 1, 2006. Provost Douglas Baker transformed these reports into the Strategic Plan. This new Strategic Plan included several components, with the focus area of "Science and Creative Activity" as one of the most important to the scientific community.

President White allocated \$1 million of UI resources to implement the plan. A call was issued to the campus community to submit research proposals based on interdisciplinary studies. From forty proposals, three were awarded grants of \$350,000 for five years and two got smaller amounts for five years. The grants were awarded in these areas: Water Research (social and technical issues; twenty faculty, four different colleges, partnered with IWRRI, etc.); Nanotechnology (cell biology, biomed research-funded at \$5 million a year; \$50 million so far); Sustainable Communities (urban development, geologic opportunities such as mapping); Sustainable Campus; and Ethics in Science.

The research in these areas will capture discretionary resources for the future. Problem solving, collaboration, and interdisciplinary research are encouraged. As an example, the Idaho National Laboratory is currently involved in a consortium of the three state universities, UI, ISU, and BSU, to study ground water and subsurface science, alternative energy, and material science to support the mission of the INL in energy and national security.

# Application to IGS

Research opportunities for IGS include spatial analysis, data analysis, mapping, gas and oil development, natural hazards, risk assessment and other community development issues, carbon sequestration, and geothermal research. The IGS is well placed to collaborate with many diverse groups in interdisciplinary research.

# **Budget Report**

Since 2001, the state appropriations have seen no increase in operating expenditures, forcing the IGS to rely more on external funding to keep operations going. Since 2003, the IGS has received only 3 percent of the total budget annually for operating expense (OE) and no appropriation for capital outlay (CO) to upgrade computers and acquire necessary research equipment. General administrative costs continue to rise, and personnel have seen few pay increases. Over the past three years, the state's OE appropriation has financed the IGS's legislatively authorized state mission for less than six months of each year. Since actual annual costs average nearly \$35,000 but the state appropriation has only been \$26,000, the IGS has had to overcome at least a \$9,000 deficit each year. State appropriations provide for the main office in Moscow, two branch offices, and 10.55 FTEs. The current appropriation is inadequate for the agency to meet its mandated mission as outlined in the Enabling Act.

As part of its mandate, the IGS is also involved in its own outreach program providing geologic information, earth science education (K-12), and digital GIS lab (internet-website access) to the state's citizens. The agency continues its outreach and research as best it can under these difficult fiscal circumstances.

# **Multidisciplinary Opportunities**

Beyond the chronic budget problem, the IGS continues to be well placed to interact successfully with the University of Idaho research community, other state universities, and government agencies in providing a solid research environment and opportunities for multidisciplinary collaboration. Over the past few years, the IGS has earned a sizeable amount of external funding, the most prominent being that from the USGS mapping program. This has provided returned overhead on grants and contracts, allowing the IGS to pay for administrative operations as a result of the state appropriation shortfall. The establishment of service centers such as the motor pool, GIS lab at Moscow, geosciences analyses, publication sales, and the Mine Safety Training program funded by the Mine Safety Health Administration have contributed to the level of research the agency has accomplished. Chuck Hatch emphasized that grant and contract activities need to pay their share of using the service centers, which need to balance income and expenditures.

# In Summary

In summary, the Survey's state appropriation underfunds the basic operating requirements of its state mission, and the Survey's activities are driven by grants and contracts that cannot fully support the mission. To most effectively meet the enacted mission, it is vital the IGS state appropriation be increased.

# **FY-08 Enhancement Request**

An enhancement request to increase the agency's fiscal year 2008 appropriation was presented and unanimously approved by the Advisory Board. Dennis Geist moved that IGS formally pass a budgetary request that meets its needs with well-articulated justification.

# **Advisory Board Members**

#### Roy Breckenridge

Chair, ex officio
Director, Idaho Geological Survey
Main Office at Moscow
Morrill Hall, Third Floor
University of Idaho
PO Box 443014
Moscow, ID 83844-3014

#### **Dennis Geist**

Chair, Department of Geological Sciences PO Box 443022 University of Idaho Moscow, ID 83844-3022

#### **David Hawk**

(Representing Office of the Governor)
Director, Energy & Natural Resources
Division
J.R. Simplot Company
PO Box 27, One-Capital Center
Boise, ID 83707

#### Scott Hughes

Chair, Department of Geosciences Physical Science, Room 325 Idaho State University Pocatello, ID 83209

#### Starr Marea Johnson

(Representing Idaho Association of Professional Geologists) 5328 Hill Road Boise, ID 83703

#### Jack Lyman

Executive Director Idaho Mining Association 802 West Bannock, Suite 301 Boise, ID 83702

#### M. Jerome Mapp

(Member-at-Large)
Western Planner Resources
Boise City and County Planning
1855 Danmore Drive
Boise, ID 83712

#### C.J. Northrup

Chair, Department of Geosciences Boise State University 1910 University Drive Bosie, ID 83725

#### **Kurt Othberg**

Chair, ex officio Director, Idaho Geological Survey Main Office at Moscow Morrill Hall, Third Floor University of Idaho PO Box 443014 Moscow, ID 83844-3014

# Stephen Weiser

(Member-at-Large)
Assistant Deputy Director, Mitigation Idaho Bureau of Homeland Security 4040 Guard Street
Boise, ID 83705-5004

# Winston Wiggins

Director, Idaho Department of Lands 954 W. Jefferson Boise, ID 83720

# **Publications and Activities**

#### **Publications**

- Basaltic Volcanism of the Central and Western Snake River Plain: A Guide to Field Relations Between Twin Falls and Mountain Home, Idaho, by John W. Shervais, John D. Kauffman, Virginia S. Gillerman, Kurt L. Othberg, Scott K. Vetter, V. Ruth Hobson, Megan Zarnetske, Matthew F. Cooke, Scott H. Matthews, and Barry B. Hanan, in J. Pederson and C.M. Dehler, eds., Interior Western United States: Geological Society of America, Field Guide 6, p. 27-52, 2005.
- Boundary Effects on the Onset of Nonlinear Flow in Porous Domains, by H. Basagaoglu, P. Meakin, S. Succi, and J. Welhan: Europhysics Letters, v. 73, no. 6, p. 1-6.
- Cosmogenic <sup>10</sup>Be and <sup>26</sup>Al Exposure Ages of Tors and Erratics, Cairngorm Mountains, Scotland: Timescales for the Development of a Classic Landscape of Selective Linear Glacial Erosion, by William M. Phillips, Adrian M. Hall, Ruth Mottram, L. Keith Fifield, and David E. Sugden: Geomorphology v. 73, p. 222-245, 2006.
- Database of the Mines and Prospects of Idaho, by Victoria E. Mitchell, Ruth E. Vance, Earl H. Bennett, and B. Benjamin E. Studer: Idaho Geological Survey Digital Database 1.
- Fault and Earthquake Maps of Idaho, by Roy M. Breckenridge and Loudon R. Stanford, in W.R. Lund ed., Proceedings Volume Basin and Range Province Seismic Hazards Summit II, Western States Seismic Policy Council: Utah Geological Survey Miscellaneous Publication 05-2, CD, 2005.
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- Geologic Map of the Deadwood River 30 x 60 Minute Quadrangle, Idaho, by Thor H. Kiilsgaard, Loudon R. Stanford, and Reed S. Lewis: Idaho Geological Survey Geologic Map 45, scale 1:100,000, 2006.
- Geologic Map of the Derr Point Quadrangle, Bonner and Shoshone Counties, Idaho, compiled and mapped by Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, and Reed S. Lewis: Idaho Geological Survey Digital Web Map 59, scale 1:24,000, 2006.
- Geologic Map of the Falls City Quadrangle, Jerome County, Idaho, by John D. Kauffman and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 46, scale 1:24,000, 2005.
- Geologic Map of the Hagerman Quadrangle, Gooding and Twin Falls
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  John D. Kauffman: Idaho Geological Survey Digital Web Map 50,
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- Geologic Map of the Jerome Quadrangle, Jerome and Twin Falls Counties, Idaho, by Virginia S. Gillerman, Kurt L. Othberg, and John D. Kauffman: Idaho Geological Survey Digital Web Map 48, scale 1:24,000, 2005.
- Geologic Map of the Kamiah Quadrangle, Lewis and Idaho Counties, Idaho, by John D. Kauffman, Reed S. Lewis, and Paul E. Myers: Idaho Geological Survey Geologic Map 42, scale 1:24,000, 2006.
- Geologic Map of the Kooskia Quadrangle, Idaho County, Idaho, by John D. Kauffman, Reed S. Lewis, and Paul E. Myers: Idaho Geological Survey Digital Web Map 61, scale 1:24,000, 2006.

- Geologic Map of the Lapwai Quadrangle, Nez Perce County, Idaho, by John H. Bush, Dean L. Garwood, and John D. Kauffman: Idaho Geological Survey Digital Web Map 41, scale 1:24,000, 2005.
- Geologic Map of the Lewiston Orchards North Quadrangle and Part of the Clarkston Quadrangle, Nez Perce County, Idaho, compiled and mapped by Dean L. Garwood and John H. Bush: Idaho Geological Survey Digital Web Map 40, scale 1:24,000, 2005.
- Geologic Map of the Niagara Springs Quadrangle, Gooding and Twin Falls Counties, Idaho, by Virginia S. Gillerman, Kurt L. Othberg, and John D. Kauffman: Idaho Geological Survey Digital Web Map 47, scale 1:24,000, 2005.
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- Geologic Map of the Shoshone Quadrangle, Lincoln County, Idaho, by John D. Kauffman, Kurt L. Othberg, John W. Shervais, and Matthew F. Cooke: Idaho Geological Survey Digital Web Map 44, scale 1:24,000, 2005.
- Geologic Map of the Shoshone SW Quadrangle, Jerome and Lincoln Counties, Idaho, by John D. Kauffman and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 45, scale 1:24,000, 2005.
- Geologic Map of the Sixmile Creek Quadrangle, Clearwater, Idaho, and Lewis Counties, Idaho, by Reed S. Lewis, John D. Kauffman, Keegan L. Schmidt, and Russel F. Burmester: Idaho Geological Survey Geologic Map 43, scale 1:24,000, 2006.
- Geologic Map of the Thousand Springs Quadrangle, Gooding and Twin Falls Counties, Idaho, by Virginia S. Gillerman, John D. Kauffman, and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 49, scale 1:24,000, 2005.

- Geologic Map of the Trout Peak Quadrangle, Bonner County, Idaho, compiled and mapped by Reed S. Lewis, Roy M. Breckenridge, Mark D. McFaddan, and Russell F. Burmester: Idaho Geological Survey Digital Web Map 58, scale 1:24,000, 2006.
- Geologic Map of the Tuttle Quadrangle, Gooding and Twin Falls Counties, Idaho, by John D. Kauffman, Kurt L. Othberg, and Virginia S. Gillerman: Idaho Geological Survey Digital Web Map 51, scale 1:24,000, 2005.
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- Geologic Map of the Twin Falls Quadrangle, Jerome and Twin Falls Counties, Idaho, by Kurt L. Othberg, John D. Kauffman, and Virginia S. Gillerman: Idaho Geological Survey Digital Web Map 52, scale 1:24,000, 2005.
- Geologic Map of the Woodland Quadrangle, Clearwater, Idaho, and Lewis Counties, Idaho, by Reed S. Lewis, John D. Kauffman, Keegan L. Schmidt, and Paul E. Myers: Idaho Geological Survey Geologic Map 44, scale 1:24,000, 2006.
- Idaho Mining and Exploration, 2005, by Virginia S. Gillerman, Michael J. Weaver, and Earl H. Bennett: Mining Engineering, v. 58, no. 5, p. 80-85; also posted with permission from Mining Engineering at www.idahogeology.org, 2006.
- Idaho State Report, 2005, by Roy M. Breckenridge: Association of American State Geologists, The State Geologists Journal LVII, p. 39-42.
- List of Publications, 2006, by Roger C. Stewart: Idaho Geological Survey booklet, 56 p., 2006.

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- Simulation of Snow Shielding Corrections for Cosmogenic Nuclide Surface Exposure Studies, by T.F. Schildgen, W.M. Phillips, and R.S. Purves: Geomorphology v. 64, p. 67-85, 2005.
- Site Inspection Report for the Abandoned and Inactive Mines in Idaho on and Near U.S. Forest Service Lands (Region IV): U.S. Bureau of Land Management Properties, Mineral Hill and Camas Mining Districts, Hailey-Bellevue Area, Blaine County, Idaho, by Victoria E. Mitchell and Earl H. Bennett: Idaho Geological Survey Staff Report 05-12, 152 p., 2005.
- Site Inspection Report for the Abandoned and Inactive Mines in the Salmon-Challis National Forest: Beaverhead Range-Lost River Range Area, Lemhi, Butte, and Clark Counties, Idaho, by Earl H. Bennett and Victoria E. Mitchell: Idaho Geological Survey Staff Report 06-1, DVD, 2006.
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- Surficial Geologic Map of the Harrison Quadrangle, Kootenai and Benewah Counties, Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 42, scale 1:24,000, 2005.
- Surficial Geologic Map of the Sun Valley Quadrangle, Blaine County, Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 56, scale 1:24,000, 2006.
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- Using Pyroxene Microphenocrysts to Determine Cosmogenic <sup>3</sup>He Concentrations in Old Volcanic Rocks: An Example of Landscape Development in Central Gran Canaria, by A.J. Williams, F.M. Stuart, S.J. Day, and W.M. Phillips: Quaternary Science Reviews v. 24, p. 211-222, 2005.
- Weathering Pits as Indicators of the Relative Age of Granite Surfaces in the Cairngorm Mountains, Scotland, by A.D. Hall and W.M. Phillips: Geografiska Annaler, v. 88A, no. 2, p. 135-150, 2006.

# **Abstracts**

The 2005 Earthquake Swarm, Cascade, Idaho, by J.L. Peterson, J.E. Zollweg, W.M. Phillips, R.M. Breckenridge, Stephen Weiser, and K.F. Sprenke: 48th Annual Idaho Academy of Science Meeting and Symposium, Abstract P21, Moscow, March.

- Detrital Zircon Constraints on Neoproterozoic Sediment Distribution and Tectonic Elements Near the Clearwater River, Idaho, by Reed S. Lewis, Russell F. Burmester, Peter Oswald, and Jeff D. Vervoort: Geological Society of America Abstracts with Programs, v. 37, no. 7, p. 218, 2005.
- Intercalated Sediments in a Heterogeneous Basalt Aquifer, Eastern Snake River Plain, Idaho: Geostatistical Analysis and Spatial Modeling, by J.A. Welhan, R. Farabaugh, J.P. Rousseau, G. Rattray, and D.J. Ackerman: Geological Society of America Annual Meeting, Abstracts with Program, Salt Lake City, Paper 238-5.
- Late Cretaceous and Tertiary Structure of the Western Idaho and Orofino Shear Zones, West-Central Idaho, by Nell Mark, Jack Grow, Matt Sanchez, Cody Pink, Jesse Bird, Brian Tillquist, John Oldow, and Bill McClelland: Geological Society of America Abstracts with Programs, v. 37, no. 7, p. 72, 2005.
- Quantifying the Impact of Septic Effluent on Groundwater Quality by Chemical Mass Balance Modeling, by J. Welhan and C. Meehan: Intermountain Conference on the Environment, Program Abstracts, Pocatello, p. 1.
- Styles and Rates of Knickpoint Migration From Cosmogenic Be-10 in an Extensional Landscape, by D.C. Commins, S. Gupta, W. Phillips, and J. Schaefer: American Geophysical Union, Eos Tranactions, v. 86, no. 52, Fall Meeting Supplement, Abstract H31A-1269.
- The Tectonic Evolution of the Northern Columbia River Flood-Basalt Province, by Stephen P. Reidel, John Bush, Dean Garwood, John Kauffman, and Bart S. Martin: Geological Society of America Abstracts with Programs, v. 37, no. 7, October.

# Reports

Aguifer Pumping Capacity, Historical Trends, and Alternative Supplies: White Paper Report, by John A. Welhan: Mayor's Scientific Advisory Panel, Pocatello, May.

- Faults and Seismicity of Southwestern Idaho, by William M. Phillips,
  Dean L. Garwood, and Roy M. Breckenridge: Idaho Bureau of
  Homeland Security report, CD.
- Geologic Map of the Idaho Falls North Quadrangle, Bonneville County, Idaho, by William M. Phillips and John A. Welhan: Idaho Geological Survey map, scale 1:24,000, May.
- Geologic Map of the Idaho Falls South Quadrangle, Bonneville County, Idaho, William M. Phillips and John A. Welhan: Idaho Geological Survey map, scale 1:24,000, May.
- Geologic Map of the Orofino 30'x 60' Quadrangle, Idaho, by John D. Kauffman, Dean L. Garwood, Keegan L. Schmidt, Reed S. Lewis, Kurt L. Othberg, and William M. Phillips: Idaho Geological Survey map, scale 1:100,000, April.
- Geologic Map of the Sagle Quadrangle, Bonner County, Idaho, by Reed S. Lewis, Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, Fred K. Miller, and David M. Miller: Idaho Geological Survey map, scale 1:24,000.
- Geologic Map of the Sandpoint Quadrangle, Bonner County, Idaho, by Reed S. Lewis, Russell F. Burmester, Roy M. Breckenridge, Stephen E. Box, and Mark D. McFaddan: Idaho Geological Survey map, scale 1:24,000.
- Geologic Map of the Talache Quadrangle, Bonner County, Idaho, by Russell F. Burmester, Mark D. McFaddan, Roy M. Breckenridge, and Reed S. Lewis: Idaho Geological Survey map, scale 1:24,000.
- Historical Summary and Recommendations: East Center Street Slope Failure, Pocatello, by John A. Welhan: Pocatello's Public Works Department, April.
- Idaho Annual Report 2005, by William M. Phillips, Roy M. Breckenridge, and Stephen Weiser: Western States Seismic Policy Council, January.

- Idaho's Geologic Maps, by Kurt L. Othberg, Roy M. Breckenridge, Loudon R. Stanford, and Reed S. Lewis: Idaho Geological Survey information sheet, 2 p., May.
- Idaho's Ground Water, by John A. Welhan, Roy M. Breckenridge, and Kurt L. Othberg: Idaho Geological Survey information sheet, 2 p., May.
- Oil and Gas Potential of Northern Idaho: Summary Report and GIS Project (ArcMap9), by Virginia S. Gillerman with GIS work by Charlla Adams and Ellen Wray-Macombe: Idaho Geological Survey report to Bureau of Land Management, Coeur d'Alene District, 18 p. with CD, September.
- Septic Impacts on Lower Portneuf River Valley Ground Water, by John A. Welhan: Bannock County Office of Planning and Development, Pocatello, September.
- Site Inspection Report for Abandoned and Inactive Mines on Lands Administered by the U.S. Bureau of Land Management in the Boise Resource Area: Idaho Almaden Mine, Washington County, Idaho, by Dave E. Leppert and Virginia S. Gillerman: Idaho Geological Survey report to U.S. Bureau of Land Management, 23 p., 2005.
- Site Inspection Report for the Abandoned and Inactive Mines in the Salmon-Challis National Forest: Beaverhead Range-Lost River Range Area, Lemhi, Butte, and Clark Counties, Idaho, by Earl H. Bennett and Victoria E. Mitchell: Idaho Geological Survey report to U.S. Bureau of Land Management, CD and DVD, 2005.
- Site Inspection Report for the Abandoned and Inactive Mines in the Salmon-Challis National Forest: Middle Fork-Yankee Fork Area, Custer County, Idaho, by Victoria E. Mitchell and Earl H. Bennett: Idaho Geological Survey report to U.S. Bureau of Land Management, CD and DVD, 2006.
- Site Inspection Report for the Abandoned and Inactive Mines in the Salmon-Challis National Forest: Salmon and Challis Areas, Lemhi and Custer Counties, Idaho, by Ted Erdman and Victoria E.

- Mitchell: Idaho Geological Survey report to U.S. Bureau of Land Management, CD and DVD, 2005.
- Site Inspection Report for the Abandoned and Inactive Mines in the Salmon-Challis National Forest: Salmon and Vicinity, Lemhi County, Idaho, by Ted Erdman and Victoria E. Mitchell: Idaho Geological Survey report to U.S. Bureau of Land Management, CD and DVD, 2006.
- Student Presentations From 2005 Field Workshop for Teachers, compiled by William M. Phillips: Idaho Geological Survey report to Idaho Bureau of Homeland Security, September, CD.
- Summary of STATEMAP Geologic Mapping Program in Idaho, by Kurt L. Othberg, Roy M. Breckenridge, and Loudon R. Stanford: National Cooperative Geologic Mapping Program, STATEMAP Project Information Sheets, <a href="http://ncgmp.usgs.gov/cgmpabout/statemap/statemapfs/ID.pdf">http://ncgmp.usgs.gov/cgmpabout/statemap/statemapfs/ID.pdf</a>, 2006.
- Surficial Geologic Map Compilation of the Coeur d'Alene Lake Area, by Roy M. Breckenridge and Loudon R. Stanford: Bureau of Homeland Security map, scale 1:50,000, CD.
- Surficial Geologic Map of the Cascade Quadrangle, Valley County Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey map, scale 1:24,000, April.
- Surficial Geologic Map of the Donnelly Quadrangle, Valley County Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey map, scale 1:24,000, April.
- Surficial Geologic Map of the Meadows Quadrangle, Valley County Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey map, scale 1:24,000, April.
- Surficial Geologic Map of the No Business Mountain Quadrangle, Valley County Idaho, by Roy M. Breckenridge and Kurt L. Othberg: Idaho Geological Survey map, scale 1:24,000, April.

Water Availability and Water Quality in the Lower Portneuf River Valley Aquifer, by John A. Welhan: Pocatello Community Development Commission, September.

#### **Presentations**

- Applications of Using Digital Physiographic Images for Geologic Research, by Dean L. Garwood: Idaho Geological Survey luncheon presentation, January.
- Basaltic Volcanism of the Central and Western Snake River Plain: A Guide to Field Relations Between Twin Falls and Mountain Home, Idaho, by John W. Shervais, John D. Kauffman, Virginia S. Gillerman, and Kurt L. Othberg: Geological Society of America Field Trip 6, Hagerman, October.
- The Big Faults in Northern Idaho and What We Know About Them, Idaho, by Reed S. Lewis and Russell F. Burmester: EARTHSCOPE meeting, Bozeman, Montana, September.
- Chemical Mass Balance Modeling to Quantify Septic Effluent Impact, by John A. Welhan: University of Idaho hydrology seminar series, Pocatello (telecast to Idaho Falls, Boise and Moscow), September.
- Deep Time in the Sawtooths: 2 Million Years of Climate Change, by William M. Phillips and Loudon R. Stanford: Wild Idaho Conservation Conference field trip, Sawtooth Valley, May.
- Earthquakes in Idaho, by Virginia S. Gillerman: Gem State Kiwanis Club, Boise, January.
- Faults and Seismicity of Southwestern Idaho, by William M. Phillips, Dean L. Garwood, and Roy M. Breckenridge: Western States Seismic Policy Council annual meeting, poster presentation, Boise, October.

- Geologic History of the Lower Portneuf River Valley, by John A. Welhan: Interpretive walking tour, Valley Pride Portneuf River Celebration Day, Pocatello, October.
- Geologic Mapping in Geothermal Exploration, by Virginia S. Gillerman:

  Valley County and City of Cascade geothermal working group,

  Cascade, November.
- Geology and Mining, by Michael J. Weaver: Lakes Middle School Career Days, Coeur d'Alene, March.
- Geology of the Big Creek Area, Idaho, by Reed S. Lewis: University of Idaho College of Natural Resources, Big Creek Symposium, April.
- Geostatistical Analysis and Modeling of Aquifer Properties, by John A. Welhan: Department of Geosciences colloquium, University of Utah, Salt Lake City, Utah, November.
- Geostatistical Modeling of Sediment Abundance in a Heterogeneous Basalt Aquifer, Idaho National Laboratory, by John A. Welhan: Friends of the Pleistocene, Craters of the Moon National Monument, September.
- Geostatistics in Natural Resource and Ecological Research, by John A. Welhan: Biology 651, GIS applications in ecology, Idaho State University, September 28.
- Ground-Water "Fast Paths" in the Snake River Plain Aquifer: A Critique of Radiogenic Isotope Ratios as Natural Ground-Water Tracers, by John A. Welhan: Environmental geochemistry graduate class, Idaho State University, April.
- <sup>3</sup>He Surface Exposure Dating of Snake River Lava Flows, by William M. Phillips: Idaho Geological Survey luncheon presentation, January.
- Heterogeneity, Anisotropy and Ground-Water Flow in the Eastern Snake River Plain Aquifer, by John A. Welhan: Introductory hydrogeology, Idaho State University, February.

- Idaho Geology, by Virginia S. Gillerman: Idaho Ground-Water Association annual meeting, Boise, January; Mountain West Outdoor Club, Boise, February.
- Idaho Minerals and Mining, by Virginia S. Gillerman: Treasure Valley Math and Science Center, Riverglen School, Boise, September.
- Idaho Mining and Exploration, 2005, by Virginia S. Gillerman: Northwest Mining Association Convention, Spokane, Washington, December.
- Identifying and Modeling the Impact of Septic Effluent on Ground Water in the Lower Portneuf River Valley, by John A. Welhan: Idaho Department of Environmental Quality, Twin Falls Regional Office, Twin Falls, September.
- Intercalated Sediments in a Heterogeneous Basalt Aquifer, Eastern Snake River Plain, Idaho: Geostatistical Analysis and Spatial Modeling, by John A. Welhan: Geological Society of America annual meeting, Salt Lake City, Utah, October.
- In the Wake of the Deluge: Following the Lake Missoula Floodpath Through Paintings 1810-1860, by Jack Nisbet and Roy Breckenridge: Ice Age Floods Institute, Coeur du Deluge Chapter, and Bonner County Historical Society, Sandpoint, November.
- Map Production and Data Distribution the Idaho Way, by Jane S. Freed and Loudon R. Stanford, Association of Earth Science Editors annual meeting, Shepherdstown, West Virginia, September.
- Mine Safety, by Michael J. Weaver: Field Workshop for Teachers, Borah Peak area, Mackay, July.
- Miocene Geologic History of Moscow-Pullman Area and Its Use in Understanding Present Day Ground-Water Movement, by John H. Bush and Dean L. Garwood: Lewis-Clark State College, Division of Natural Sciences Speaker Series, 2006.

- Modeling Septic Impacts on Ground-Water Quality in a Flow System Context, by John A. Welhan: Ground Water Monitoring Technical Committee meeting, Boise, April.
- Natural Hazards of the Boise Area, by William M. Phillips: Western States Seismic Policy Council Annual Meeting, Field Trip Guide, Boise, October.
- Paleomagnetic Field Measurements and Core Drilling, by John D. Kauffman and Dean L. Garwood: Idaho Geological Survey luncheon presentation, April.
- Pre-Miocene Magmatism in the Northern Rocky Mountains, by Reed S. Lewis and Arthur A. Bookstrom: EARTHSCOPE meeting, Bozeman, Montana, September.
- Quantifying the Impact of Septic Effluent on Ground-Water Quality by Chemical Mass Balance Modeling, by John A. Welhan: Intermountain Conference on the Environment, Pocatello. September.
- Septic Impacts on Ground Water in the Lower Portneuf River Valley, by John A. Welhan: Pocatello City Council, planning and engineering staff, Pocatello, August; Bannock County Planning and Development Council rezoning committee, Pocatello, August.
- Septic Impacts on Lower Portneuf River Valley Ground Water, by John A. Welhan: Bannock County Planning and Development Council sewer task force, Pocatello, September.
- Volcanoes of Southern Idaho, by Virginia S. Gillerman: Sherman Elementary School, Gifted and Talented Program, Nampa, May.
- Water Availability and Water Quality in the Lower Portneuf River Valley Aguifer, by John A. Welhan: Pocatello Community Development Commission, September.

- Water Balance and Future Capacity of the Lower Portneuf River Vallley Aguifer, by John A. Welhan: Introductory geology class, Idaho State University, April.
- Well Drilling and Data Collection: Understanding the Subsurface, by John A. Welhan: United University contractor seminar, Idaho Falls, March.
- Where's the Water? Pocatello's Hidden Resource: I. Ground-Water Supply, by John A. Welhan: New Knowledge Adventures, Idaho State University Continuing Education, Pocatello, October.
- Where's the Water? Pocatello's Hidden Resource: II. Ground-Water Protection, by John A. Welhan: New Knowledge Adventures, Idaho State University Continuing Education, Pocatello, November.
- Where's the Water? Pocatello's Hidden Resource: III. The Future of Water in the West, by John A. Welhan: New Knowledge Adventures, Idaho State University Continuing Education, Pocatello, February.

# **Professional Activities**

- Advisory board meeting, Idaho Geological Survey, May (R.M. Breckenridge, K.L. Othberg, L.R. Stanford).
- American Geophysical Union, fall meeting, San Francisco, California, December (W.M. Phillips).
- Association of American State Geologists, annual meeting, Santa Fe, New Mexico, June (R.M. Breckenridge).
- Association of American State Geologists, liaison meeting, Washington, D.C., March (R.M. Breckenridge).
- Association of American State Geologists, midyear meeting, Salt Lake City, Utah, October (R.M. Breckenridge).
- Cascade Geothermal, steering committee meeting, Cascade, June (V.S. Gillerman).

- Chief judge, Annual Central Mine Rescue Competition, Osburn, May (M.J. Weaver).
- Co-convener, Big Creek symposium, April (R.S. Lewis).
- Co-leader, session 1: Quantifying the hazard: Challenges, NEHERP's next decade: Challenges for implementation, Western States Seismic Policy Council, annual conference, Boise, September (R.M. Breckenridge).
- Co-leaders, Geological Society of America Field Trip 6, "Basaltic Volcanism of the Central and Western Snake River Plain," Hagerman, October (J.D. Kauffman, K.L. Othberg).
- CRONUS (Cosmic-Ray Produced Nuclide Systematics on Earth Project) 2nd Annual Meeting, Berkeley, California, December (W.M. Phillips).
- Delegate (Idaho), Basin and Range Province earthquake working group, Salt Lake City, Utah, March (W.M. Phillips).
- Delegate, Geoscience, Western States Seismic Policy Council (W.M. Phillips).
- Digital Mapping Techniques Workshop, Columbus, Ohio, June (J.S. Freed, L.R. Stanford).
- Field meeting with U.S. Geological Survey, Blackbird mining district, Lemhi County, Salmon, September (V.S. Gillerman).
- Field trip, Association of American State Geologists, Santa Fe, New Mexico, June (R.M. Breckenridge).
- Field trip, Belt Association, August (R.S. Lewis).
- Field trip, natural hazards of the Boise area, Western States Seismic Policy Council annual meeting, Boise, October (R.M. Breckenridge).
- Field trip and lecture, Hagerman Fossil Fish Workshop, Caldwell, May (V.S. Gillerman).

- Field trip co-coordinator and co-leader, Inland Northwest Research Alliance subsurface science graduate program (I.A. Welhan).
- Field trip co-leader, Geological Society of America field trip, Hagerman, October (V.S. Gillerman).
- Field trip leader, "Ice Age Floods Trail in Idaho," Board of Idaho Department of Transportation, Sandpoint, July (R.M. Breckenridge).
- Field trip leader, "Ice Age Floods National Geologic Trail (S.B. 206) in Idaho," National Park Service and Congressional staff, July (R.M. Breckenridge).
- Field Workshop for Idaho Earth Science Teachers, Borah Peak area, July (R.M. Breckenridge, W.M. Phillips, K.L. Othberg, M.J. Weaver, G.A. Worthington).
- Geological Society of America annual meeting, Salt Lake City, Utah, October (V.S. Gillerman).
- Geothermal Heating Assessment Group, Mountain Home Air Force Base, November (V.S. Gillerman).
- Great Rift Science Symposium, Idaho State University, Pocatello, October (W.M. Phillips).
- Guest lecturer, Engineering seminar 651, Ecology GIS seminar B651, Geology seminar G599, and Introduction to hydrogeology G430, Idaho State University (I.A. Welhan).
- Host, Idaho Earth Science Teachers winter meeting, Moscow, February (W.M. Phillips).
- Idaho Association of Professional Geologists meetings, Boise (V.S. Gillerman).
- Idaho Bureau of Homeland Security, State Agency Emergency Coordination working group meetings, Boise, monthly (V.S. Gillerman).

- Idaho Division of Environmental Quality, ground water advisory meeting, Boise, April (V.S. Gillerman).
- Idaho Earth Science Teachers Association, business meeting, Pocatello, October (W. M. Phillips).
- Idaho Earth Science Teachers Association, business meeting, Idaho State University Lost River Field Camp, July (R.M. Breckenridge, K.L. Othberg).
- Idaho Environmental Forum meetings, Boise (V.S. Gillerman).
- Idaho Geologic Mapping advisory committee (IGMAC), teleconference, Boise and Moscow, June and September (R.M. Breckenridge, K.L. Othberg).
- Idaho Geologic Mapping Mapping Advisory Committee (IGMAC), meeting, Boise, May (R.M. Breckenridge, V.S. Gillerman, K.L. Othberg, L.R. Stanford, J.A. Welhan).
- Idaho Geospacial Committee meeting, Boise, September, January, and April (L.R. Stanford).
- Idaho Geospacial Users meeting, Boise, November (L.R. Stanford).
- Intermountain West Geothermal Consortium, organizing meetings, Boise and Salt Lake City, fall (V.S. Gillerman).
- Instructor, Geology 404 and 504, "Geology and Geologic Hazards of Lost River Area," Department of Geological Sciences, University of Idaho, July (W.M. Phillips).
- Instructor, Geology 404 and 504, glacial geology module of "Geology and Geologic Hazards of Lost River Area," Department of Geological Sciences, University of Idaho, July (R.M. Breckenridge).
- Instructor, Geology 404 and 504, landslide module of "Geology and Geologic Hazards of Lost River Area," Department of Geological Sciences, University of Idaho, July (K.L. Othberg).

- Instructor and Adjunct Professor, Geology 497-2, Ore deposits, Boise State University, fall semester (V.S. Gillerman).
- Instructor, mine safety training sessions, Mine Safety and Health Administration (M.J. Weaver).
- Instructor, two-day statistical methods workshop for management and staff, Idaho Department of Environmental Quality (J.A. Welhan).
- Judge, National Mine Reclamation Awards, U.S. Bureau of Land Management, Boise, July (V.S. Gillerman).
- Judge, Southeast Regional Mine Rescue Competition, New Iberia, Louisiana, May (M.J. Weaver).
- Lead contact, Western States Cluster meetings, Association of American State Geologists (R.M. Breckenridge).
- LIDAR Workshop, sponsored by U.S. Bureau of Reclamation, U.S. Geological Survey, and Idaho Department of Water Resources, Boise, May (L.R. Stanford, V.S. Gillerman).
- Member, advisory committee, Advanced National Seismic System (ANSS), Intermountain West, (R.M. Breckenridge).
- Member, Alpine Club Canada (R.M. Breckenridge).
- Member, American Quaternary Association (R.M. Breckenridge).
- Member, Association of American State Geologists (R.M. Breckenridge).
- Member, audit committee, Association of American State Geologists, June (R.M. Breckenridge).
- Member, Basin and Range committee, Western States Seismic Policy Council (R.M. Breckenridge).
- Member (lifetime), Certified Mine Safety Professional (M.J. Weaver).

- Member, earth science education committee, Association of American State Geologists (R.M. Breckenridge).
- Member (Ex Officio), Board of Directors, Western States Seismic Policy Council (R.M. Breckenridge).
- Member, Geochemical Society (W.M. Phillips).
- Member, Geological Society of Nevada (V.S. Gillerman).
- Member, geologic hazards policy committee, Association of American State Geologists (R.M. Breckenridge).
- Member, Ground-Water Monitoring Technical Committee, Idaho Department of Environmental Quality (J.A. Welhan).
- Member, Idaho Geospacial Committee (L.R. Stanford).
- Member, Independent Oil and Gas Conservation Commission forum, Association of American State Geologists (R.M. Breckenridge).
- Member, Mayor's open-space committee, City of Pocatello (J.A. Welhan).
- Member, Society for Sedimentary Geology (V.E. Mitchell).
- Member, Seismological Society of America (R.M. Breckenridge).
- Member, steering committee, Greater Portneuf Water Resources Partnership (J.A. Welhan).
- Member, steering committee, Idaho Earth Science Teachers Association (R.M. Breckenridge).
- Member, steering committee, North American Digital Geologic Map Data Model (L.R. Stanford).
- Member, U.S. Mine Rescue Association (M.J. Weaver).
- Members, American Geophysical Union (W.M. Phillips, J.A. Welhan).

- Members, Geological Society of America (R.M. Breckenridge, V.S. Gillerman, R.S. Lewis, V.E. Mitchell, K.L. Othberg, W.M. Phillips, J.A. Welhan).
- Members, Idaho Earth Science Teachers Association (R.M. Breckenridge, K.L. Othberg, W.M. Phillips).
- Members, Idaho EDMAP review board, Idaho Geological Survey (R.M. Breckenridge, K.L. Othberg).
- Members, Northwest Mining Association (V.S. Gillerman, R.S. Lewis).
- Members, Society for Mining, Metallurgy, and Exploration, Inc. (V.S. Gillerman, M.J. Weaver).
- Mine Safety and Health Administration, States' grants annual business meeting, Beaver, West Virginia, April (M.J. Weaver).
- National Public Television, Nova series, Mentorn Productions, WGN Boston Public Television, September and October (R.M. Breckenridge).
- Northwest Mining Association 111th Annual Convention, Spokane, Washington, December (V.S. Gillerman, R.S. Lewis, M.J. Weaver).
- Oregon Seismic Monitoring meeting, Portland, Oregon, November (W.M. Phillips).
- Organizer, Society of Economic Geologists, Prospectors & Developers Association of Canada, uranium short course, Toronto, Canada, March (V.S. Gillerman).
- Organizers, 2005 Field Workshop for Teachers, "Geology and Geologic Hazards of the Lost River Area," Cascade, July (R.M. Breckenridge, K.L. Othberg, W.M. Phillips).
- Quaternary Geochronology, editorial board meeting, San Francisco, California, December (W.M. Phillips).
- Participant, Comcast for Info Ed workshop, Office of Sponsored Programs, University of Idaho, March (K.L. Othberg).

- Participant, national steering committee, Intermountain West Needs for Advanced National Seismic System (ANSS), November (R.M. Breckenridge).
- Participant, University Matters Workshop, building successful sponsored research programs, University of Idaho, May (K.L. Othberg).
- Participant, University Matters Workshops, leadership meetings, University of Idaho (R.M. Breckenridge).
- Participant, University Matters Workshop, tenure and promotion, University of Idaho, November (K.L. Othberg).
- Participant, University Matters Workshop, University financial planning—A framework, University of Idaho, April (K.L. Othberg).
- Participants, President's Fireside Chat, University of Idaho, April (R.M. Breckenridge, K.L. Othberg).
- Prospectors and Developers Association of Canada Convention, Toronto, Canada, March (V.S. Gillerman).
- Representative, Association of American State Geologists Western Region, STATEMAP peer review panel, National Cooperative Geologic Mapping Program, 2004-2007 (R.M. Breckenridge).
- Representative, Department of Geosciences, Idaho State University (J.A. Welhan).
- Representative, Governor's carbon sequestration advisory committee (J.A. Welhan).
- Representative, School of Graduate Studies, Idaho State University Graduate Faculty (J.A. Welhan).
- Representative (University of Idaho), Intermountain West Geothermal Consortium, Boise (V.S. Gillerman).
- Reviewer, Earth and Planetary Science Letters (W.M. Phillips).

- Reviewer, grant proposal, National Science Foundation, August (W.M. Phillips).
- Reviewer, manuscript, Geological Society of America Bulletin, July (W.M. Phillips).
- Reviewer, manuscript, Geomorphology journal, October (W.M. Phillips).
- Reviewer, Quaternary Geochronology (W.M. Phillips).
- Secretary, Belt Association Board of Directors (R.S. Lewis).
- Short course on uranium, Northwest Mining Association 111th Annual Convention, Spokane, Washington, December (V.S. Gillerman).
- Society of Economic Geologists, council and program committee meetings, Toronto, Canada, March, and Salt Lake City, Utah, October (V.S. Gillerman).
- Society of Economic Geologists, Fellow, and Past Vice-President, and Program Committee Chair (V.S. Gillerman).
- Software reviewer, National Geologic Map Database data entry tool (Beta), May (L.R. Stanford).
- Steering committee, North American Digital Geologic Map Data Model meeting, Columbus, Ohio, June (L.R. Stanford).
- Supervisor, Work Study student, Jessica Hoke, preparation of mineral separates for cosmogenic nuclide surface exposure dating, January—April (W.M. Phillips).
- Technical advisor, Bannock County Planning and Zoning Department (J.A. Welhan).
- Technical advisor, Bannock County sewer task force (I.A. Welhan).
- Technical advisor, Mayor's scientific advisory panel, City of Pocatello (J.A. Welhan).

- Technical advisor, Shoshone-Bannock Tribes' Water Resources Department (J.A. Welhan).
- Technical advisor, statistical methods in ground-water monitoring, Idaho Department of Environmental Quality (J.A.Welhan).
- Tobacco Root Geological Society annual meeting, August (R.S. Lewis).
- University of Idaho Innovative Teaching Workshop, "The serious business of teaching out of the box," Moscow, February (W.M. Phillips).
- U.S. Geological Survey STATEMAP review panel meetings, Reston, Virginia, December (R.M. Breckenridge).
- Western States Seismic Policy Council annual meeting, Boise, October (W.M. Phillips).

#### **Media Interviews**

- Earth Predictions Don't Shake Local Expert, by Lynn Berk: Coeur d' Alene Press, June 30 (W.M. Phillips).
- Geologist: Aquifer Being Depleted Faster Than Replenished, by Jimmy Hancock: Idaho State Journal, September 15 (J.A. Welhan).
- Geologists Report Quake Cluster in Idaho, by Anne Wallace Allen: Associated Press, September 28 (W.M. Phillips).
- Hot Summer May Erase Aquifer Progress, by Elizabeth Ziegler: Idaho State Journal, April 12 (J.A. Welhan).
- Idaho Needs to Set Up Monitoring to Gauge Quake Risks: Idaho Statesman editorial, local section p. 6, October 4 (R.M. Breckenridge).
- Oil and Gas Exploration in Idaho: Television Interview, KCBI Channel 2, Boise, June (V.S. Gillerman.

- Protecting Vital Resource: Steps Aim to Preserve Area Aquifers, by John O'Connell: Idaho State Journal, October 31 (J.A. Welhan).
- Seismologist Installs Measuring Instruments at Earthquake Cluster Site by Anne Wallace Allen: Seattle Post-Intelligencer, October 2 (W.M. Phillips).
- Water Supply Threatened? Study Shows Degradation of Aquifers, by John O'Connell: Idaho State Journal, October 30 (J.A. Welhan).

### **Graduate Thesis Committees**

- Nicholas Atiemo, M.S., Environmental Engineering, Idaho State University (J.A. Welhan).
- Chris Jenkins, Ph.D., Biological Sciences, Idaho State University (J.A. Welhan).
- Helen R. Margerison, Ph.D., Geography, University of Edinburgh (W.M. Phillips).
- Tiisetso Masiane, M.S. Environmental Engineering, Idaho State University (J.A. Welhan).
- John Mazurek, M.S., Geosciences, Idaho State University (J.A. Welhan).
- Chris Meehan, M.S., Geosciences, Idaho State University (J.A. Welhan).
- Alex Zirakparvar, M.S., Geology, Washington State University (R.S. Lewis).

## **Grants and Contracts**

- Abandoned and Inactive Mine Inventory: R.S. Lewis (U.S. Forest Service, Region I, September 2001-September 2006, \$97,593).
- Belt-Purcell Basement Domains: R.S. Lewis (U.S. Geological Survey Mineral Resources External Research Program, September 2004-September 2005, \$15,000).

- The Bunker Hill Mine, 1885-1895: Mine Development, Milling Technology, and Environmental Impacts: V.E. Mitchell (John Calhoun Smith Memorial Fund, May 2006-June 2007, \$8,002).
- Compilation and Geologic Mapping in the Sandpoint 30'x 60' Quadrangle: R.S. Lewis (U.S. Geological Survey STATEMAP Program, May 2005-April 2006, \$41,977).
- Compilation and Geologic Mapping in the Sandpoint 30'x 60' Quadrangle: R.S. Lewis (U.S. Geological Survey STATEMAP Program, May 2006-April 2007, \$53,391).
- Digital Geology of Idaho: R.S. Lewis (National Science Foundation, subcontract with Idaho State University, June 2004-May 2007, \$20,000).
- Geochronology of Iron Oxide-Copper-Thorium-REE Mineralization in Proterozoic Rocks at Lemhi Pass, Idaho, and a Comparison to Copper-Cobalt Ores, Blackbird Mining District, Idaho: V.S. Gillerman, (U.S. Geological Survey, Mineral Resources External Research Program, July 2006-June 2007, \$61,372).
- Geologic Mapping in the Orofino, Long Valley, Sandpoint, and Idaho Falls Project Areas: K.L. Othberg, R.M. Breckenridge, R.S. Lewis, J.D. Kauffman, and W.M. Phillips (U.S. Geological Survey STATEMAP Project, May 2005-April 2006, \$191,188). Geologic Mapping in the Sandpoint, Idaho Falls, Fairfield, and Grangeville Project Areas, and a Digital Geologic Database Project: K.L. Othberg, R.M. Breckenridge, R.S. Lewis, J.D. Kauffman, W.M. Phillips, and L.R. Stanford (U.S. Geological Survey STATEMAP Program, May 2006-April 2007, \$226,513).
- Geologic Map of the WhiteBird Quadrangle: R.M. Breckenridge (National Park Service, June 2006-December 2007, \$20,000).
- Geologic Mapping in the Mount Casey 7.5' Quadrangle: R.S. Lewis (Idaho Department of Lands, May 2005-April 2006, \$6,000).

- Geologic Mapping in the Orofino, Long Valley, Sandpoint, and Idaho Falls Project Areas: K.L. Othberg, R.M. Breckenridge, R.S. Lewis, J.D. Kauffman, and W.M. Phillips (U.S. Geological Survey STATEMAP Program, May 2005-April 2006, \$191,188).
- Geologic Mapping in the Sandpoint, Idaho Falls, Fairfield, and Grangeville Project Areas, and a Digital Geologic Database Project: K.L. Othberg, R.M. Breckenridge, R.S. Lewis, J.D. Kauffman, W.M. Phillips, and L.R. Stanford (U.S. Geological Survey STATEMAP Program, May 2006-April 2007, \$226,513).
- Geologic Mapping, U.S. 95, Tamarack to Indian Valley: K.L. Othberg and V.S. Gillerman (Idaho Department of Transportation, May 2006-September 2008, \$60,000).
- Hydrostratigraphy and Nitrate Distribution in Shallow Ground Water of Pleasant Valley: J.A. Welhan (Idaho Department of Environmental Quality, May 2006-June 2007, \$49,080).
- Idaho BLM Abandoned Mine Lands Program: V.S. Gillerman (U.S. Bureau of Land Management, July 2003-December 2005, \$40,000).
- Idaho BLM Abandoned Mine Lands Program of Inventory and Remediation of Inactive and Abandoned Mine Sites on or near BLM Lands in Idaho: V.S. Gillerman (U.S. Bureau of Land Management, September 2005-December 2008, \$20,000).
- Idaho BLM Abandoned Mine Lands Program—FY-2006 Modification: V.S. Gillerman (U.S. Bureau of Land Management, September 2006-September 2010, \$20,000).
- Idaho Earthquake Education and Mitigation: W.M. Phillips and R.M. Breckenridge (Idaho Bureau of Homeland Security, March-September 2006, \$30,000).
- Idaho Mine Safety Training Program: M.J. Weaver (Mine Safety and Health Administration, October 2004-September 2005, \$89,007).
- Idaho Mine Safety Training Program: M.J. Weaver (Mine Safety and Health Administration, October 2005-September 2006, \$88,074).

- Minesite Database: R.S. Lewis (U.S. Forest Service, Region 4, June 2003-December 2007, \$360,000).
- Mitigation of Idaho Geologic Hazards, Earthquake Education Workshop: R.M. Breckenridge, K.L. Othberg, and W.M. Phillips (Idaho Bureau of Homeland Security, March-October 2005, \$45,000).
- Mitigation of Idaho Geologic Hazards, Earthquake Education Workshop: R.M. Breckenridge and W.M. Phillips (Idaho Bureau of Homeland Security, March-October 2006, \$30,000).
- Monitor and Assess 2005 Long Valley Earthquake Swarm: R.M. Breckenridge and W.M. Phillips (Idaho Bureau of Homeland Security September 2005-January 2006, \$15,000).
- Statistical Methods Training and Interpretive Guidance for Ground-Water Quality Data Analysis: J.A. Welhan (Idaho Department of Environmental Quality, December 2005–December 2006, \$14,600).
- Terrestrial Cosmogenic Nuclide Sample Preparation Laboratory: W.M. Phillips (University of Idaho, July 2005-June 2006, \$9,000).
- USArray, Incorporated Research Institutions for Seismology: K.F. Sprenke and R.M. Breckenridge (National Science Foundation, May 2006-April 2007, \$33,879).