Annual Report of the Idaho Geological Survey

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Fiscal Year 2012

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Cover photo: View north from approach ridge to Borah Peak, Lost River Range. Paleozoic sedimentary rocks form the ridge in foreground and Double Springs Pass is in the background. Custer Co. Photo by R.M. Breckenridge.

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INTRODUCTION

The funding and collegial support provided through cooperative projects have long been integral components of the agency's operation. The activities highlighted for the 2012 Annual Report represent long-term research, service, outreach, and education 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, refer to the *Partners and Collaborators* section for the many organizations currently involved in Survey projects. This is a tribute to the staff's interest, initiative, and ingenuity in building these relationships. Details of the staff's professional engagement in the agency's agenda are in the *Publications and Activities* section 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 satellite offices in Pocatello at Idaho State University, in Boise at the Idaho Water Center, and also at Boise State University. Staff geologists conduct applied research with a strong emphasis on producing maps and information on Idaho's geologic setting, earth resources, and geologic hazards. Externally funded projects enhance this research.

ADMINISTRATION

The Survey's statewide mission encourages interdisciplinary partnerships and collaboration with many other agencies, organizations, and universities. This broad cooperation ranges from direct grants for individual projects 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

Arizona Geological Survey ~ Idaho Bureau of Homeland Security ~ Idaho Department of Environmental Quality ~ Idaho Department of Lands ~ Idaho Department of Water Resources ~ Idaho State University ~ Idaho Transportation Department ~ Midas Gold, Inc. ~ National Science Foundation ~ Rocky Mountain Section, American Association of Petroleum Geologists ~ Snake River Section, Society for Mining Metallurgy and Exploration ~ U.S. Bureau of Land Management ~ U.S. Department of Energy ~ U.S. Forest Service ~ U.S. Geological Survey ~ U.S. Mine Safety and Health Training Program ~ Washington State University

Collaborators

Ada County Highway District - American Geological Institute - Association of American State Geologists - Belt Association - Brigham Young University-Idaho -Boise State University - Bonner County Museum - City of Boise - Greater Portneuf Water Resource Partnership - Ice Age Floods Institute - Idaho Concrete and Aggregate Producers Association - Idaho Geospatial Council - Idaho Mining Association - Idaho Historical Society - Idaho National Laboratory - Idaho Office of Energy Resources - Idaho Science Teachers Association - Idaho State University - Idaho Strategic Energy Alliance - Idaho Transportation Department - Idaho Water Resources Research Institute - Inside Idaho - Intermountain Forest Tree Nutrition Cooperative - Intermountain Regional Advisory Council, Advanced National Seismic System -Latah County Historical Society - Latah County Library - Lewis-Clark State College - Montana Bureau of Mines and Geology - National Association of Geoscience Teachers- National Science Foundation, Earthscope Program - Natural Resources Conservation Service - Nevada Bureau of Mines and Geology - North Idaho College ~ Northwest Mining Association ~ Oregon Department of Geology and Mineral Industries ~ Pacific Northwest National Laboratory ~ Pocatello Ground Water Task Force ~ Spokane Community College ~ Tobacco Root Geological Society ~ U.S. Geological Survey Minerals Program ~ U.S. Forest Service ~ University of Idaho ~ University of Montana ~ University of Utah ~ University of Wisconsin-Madison ~ Utah Geological Survey ~ Utah State University ~ Washington Division of Geology and Earth Resources ~ Washington State University ~ Western States Seismic Policy Council ~ Wyoming Geological Survey ~ Yellowstone National Park ~ Yellowstone Volcano Observatory

Association of American State Geologists

The Survey is an active participant in the Association of American State Geologists (AASG). The Idaho State Geologist represented Idaho at the AASG Spring Liaison in Washington, D.C. and the Annual Meeting in Austin, Texas. The AASG is a strong advocate for the funding and reauthorization of the U.S. Geological Survey's National Cooperative Geologic Mapping Program (NCGMP), as well as research programs for data preservation, minerals, energy resources, and geologic hazards. Association of American State Geologists is an important partner with the U.S. Geological Survey's National Geologic Map Database and the annual Digital Mapping Techniques Workshops.

FISCAL OVERVIEW

The Survey's state appropriated budget for FY2012 was \$671,800, which was a reduction from \$701,100 in FY 2011. The mandated reductions in the state budget base have impacted the agency's mission in research, public service, outreach and education. In FY12 grants and contracts increased to \$635,580 from \$548,704 in FY11. The FY 2013 state appropriation is \$701,200.

Budget Fiscal Year 2012						
Category	Beginning Balance	Income	Expense	Ending Balance		
Personnel		\$ 625,115.00	\$ 625,115.00	\$ 0.00		
Operarating Expense		22,812.00	22,812.00	0.00		
Capital Outlay		23,873.00	23,873.00	0.00		
Total Appropriation		671,800.00	671,800.00	0.00		
U/I Personnel Funds		0.00	0.00	0.00		
Local Accounts		115,415.51	53,806.35	\$ 61,609.16		
Grants and Contracts		635,580.00	635,580.00	-		
Grand Total		\$1,422,795.51	\$1,361,186.35	\$ 61,609.16		

Sources of Funding



ORGANIZATION AND Personnel

Organization Chart

Idaho Geological Survey



Directory

Moscow Office

Branch Office at Boise

Morrill Hall, Third Floor, Room 303 University of Idaho 875 Perimeter Drive MS 3014 Moscow, ID 83844-3014 208-885-7991 Idaho Water Center, Suite 242B 322 E. Front Street Boise, ID 83702-7359 208-332-4420 Fax 208-332-4400

Branch Office at Pocatello

Physical Science, Room 201B Idaho State University MS 8071 Pocatello, ID 83209-8071 208-282-4254 Fax 208-282-4414

Administrative and Support Staff

Roy M. Breckenridge	Director and State Geologist
Tracy Kanikkeberg	Financial Technician
Sherry E. Pixley	Office Assistant/Sales

Research, Full-Time

Roy M. Breckenridge	Full Research Geologist
Jane S. Freed	Cartographer
Scott R. Furman	Mine Safety Training Specialist
Collette Gantenbein	Cartographer/GIS Assistant
Dean L. Garwood	Senior Geologist
Virginia S. Gillerman	Associate Research Geologist, Boise
John D. Kauffman	Senior Geologist
Reed S. Lewis	Associate Research Geologist
William M. Phillips	Assistant Research Geologist
Loudon R. Stanford	Manager, Digital Map and GIS Lab
John A. Welhan	Full Research Geologist, Pocatello

Research and Support, Part-Time

Mackenze C. Braun	Work Study Student
Russell F. Burmester	Geologist
John S. Byers	Research Support
James R. Cash	Earth Science Instructor
Emily J. Forsberg	Work Study Student
Susan J. Jones	Research Support
Mark D. McFaddan	Geologist
Victoria E. Mitchell	Research Support Scientist
Kurt L. Othberg	Full Research Geologist, Emeritus
Sherry E. Pixley	Non-lab Research
Keegan L. Schmidt	Geologist
Darin M. Schwartz	Research Support
Cody J. Steven	Work Study Student
David E. Stewart	Geologist
Kerrie N. Weppner	Research Support
Jacob Willis	Research Support

Idaho Geological Survey Advisory Board

Mickey Gunter Chair, Department of Geological Sciences, University of Idaho

David Hawk Representing Office of the Governor

Tom Schultz Director, Idaho Department of Lands

Glenn Thackray Chair, Department of Geological Sciences, Idaho State University

David Jackson Idaho Bureau of Homeland Security Karl Languirand/Rich Reed Idaho Association of Professional Geologists

Jack Lyman Executive Director, Idaho Mining Association

David Wilkins Chair, Department of Geosciences, Boise State University

Ex Officio: Roy Breckenridge Director and State Geologist, Idaho Geological Survey

Idaho Geological Mapping Advisory Committee

Bill Capaul – Chairman Idaho Transportation Department

Carl Austin Golden Jubilee Mining Co.

John Russell Russell Surveying

Kenneth C. Reid, PhD. State Archaeologist Idaho State Historic Preservation Office

Mark Stephensen Idaho Bureau of Homeland Security

Nancy Glenn Boise Center Aerospace Laboratory Idaho State University

Paul Gessler Geospatial Laboratory for Environmental Research, University of Idaho Paul Pedone Natural Resource Conservation NRCS State Geologist, Oregon and Idaho

Pete Parsley Thunder Mountain Gold

Scott Van Hoff U. S. Geological Survey Geospatial Liaison

Seth Grigg Idaho Association of Counties

Sylvie White TerraPen Geographics Maps and More

Ted Doughty PRISM Geoscience Consulting LLC

Tom Frost U.S. Geological Survey Minerals Program

IGS Data Preservation Advisory Committee

Chris Dail Exploration Geologist Midas Gold Inc., Spokane, WA

Dave Frank Outreach Coordinator U.S. Geological Survey, Spokane Office Bruce Godfrey GIS Specialist, Inside Idaho University of Idaho, Post Falls, ID

Garth Reese Head of Special Collections University of Idaho Library

RESEARCH

Geological Mapping and Related Studies

The Survey's primary research activity is mapping and publishing the geology of Idaho's 7.5' and 30' x 60' quadrangles. Before 1990, geologic mapping in Idaho was primarily conducted in localized rural areas to facilitate extraction of earth resources. In the last two decades, the Survey has been mapping in areas selected specifically because of development impacts in urban settings, for earth-resource needs, and to advance the science. The Idaho Geologic Mapping Advisory Committee (IGMAC) assists the Survey by assessing Idaho's mapping necessities and addressing long-term plans for geologic mapping. The committee guides the medium- and short-term mapping plans to take advantage of state partnerships. Idaho's geologic map products have been used, for example, to designate landslide hazards; to define mineralization potential; to delineate rock units that form boundaries of aquifers; to show geologic materials for engineering needs; to better predict groundwater resources; to aid in highway design and construction; and to define geologic resources on public lands, which include Idaho's parks, recreation areas, and endowment lands.

Funding of Idaho's geologic mapping program is shared by the STATEMAP component of the National Cooperative Geologic Mapping Program. Since 1993, Idaho has received over \$3.1 million in federal funds and matched an equal amount of state money to complete geologic mapping in Idaho. In 2012, the Idaho Survey was again in the top five in the nation among all STATEMAP proposals. During the year, Survey geologists mapped nine 7.5' quadrangles, and mapped and compiled one 30' x 60' quadrangle under the STATEMAP Program. Forty-four County Geology Maps of Idaho were also released, which show simplified and uniform geologic units within each county.

Hydrogeology

As in the past, cooperation and collaboration characterize the Survey's work on Idaho's ground-water resources. The IGS continues to be a primary source of hydrogeologic information for state and federal water resource agencies, university researchers, out-of-state consultants, and tribal, municipal and citizen water users. The Survey's research activities include analysis of aquifer hydrogeology; groundwater levels, temperatures and geochemical indicators; the sources and impact of ground water contaminants, and the water-bearing potential of aquifers proposed for development. Activities



related to education and outreach also remain a key role, involving ongoing communication with tribes, regulatory agencies, planners and private interests, as well as active participation in graduate teaching and research.

In FY12, the Survey made an important contribution to the classification of land that is unsuitable for septic sewage disposal. The methodology, developed within a Geographic Information System (GIS) utilizing commonly available information on depth to water, soil infiltration, existing septic density and hydrogeologic characteristics, was developed through a fund research project for Idaho's Department of Environmental Quality (IDEQ). The results, published as IGS Staff Report S-12-1, was also made available on IDEQ's Technical Report Series website.

An additional achievement this year was the culmination of the Survey's longstanding efforts to convince IDEQ to apply kriging methods when delineating chronically nitrate-contaminated areas. The statewide Ground Water Monitoring Technical Committee (GWMTC) met to evaluate ordinary and indicator kriging as a method of updating statewide Nitrate Priority Areas in a statistically defensible manner. Further meetings of the GWMTC are planned to consider formal adoption of the methodology.

A highlight of FY12 was the completion of a milestone study of the Mayfield-East Ada area, funded by Idaho's Department of Water Resources (IDWR). Six IGS staff were involved in this geologic mapping and subsurface hydrogeologic evaluation effort, resulting in a 1:36,000 scale map (DWM-144) and a comprehensive hydrogeologic report (S-12-2) that has materially aided IDWR in evaluating the development potential of this geographic area. The work represents a milestone because the mapping was commissioned specifically for the IGS, multiple staff geologists were involved in a geohydrologic investigation, and resulting recommendations are being implemented by IDWR to guide water allocation decisions in the region.

Geologic Hazards

Idaho is prone to earthquakes, flooding, landslides, and volcanic eruptions. The Survey works to support mitigation of these hazards in several ways. Public awareness is addressed through website information and direct contact by e-mail, telephone, and occasional public lectures or field trips. Geological mapping conducted through the STATEMAP program provides baseline information on the location, magnitude, and frequency of hazards. This information is incorporated into planning documents and also serves as the basis for more detailed studies, such as mapping of liquefaction susceptibility and earthquake site classes. The Survey collaborates with volcanic and seismic monitoring of Idaho performed by the U.S. Geological Survey, Montana Bureau of Mines and Geology, University of Utah, University of Idaho, and BYU-Idaho. Finally, the Survey provides expert opinion and advice to state and federal agencies involved with Idaho hazard mitigation.

In FY12, the Survey performed the following hazard mitigation activities at the request of the Idaho Bureau of Homeland Security:

- Participated in meetings of the Idaho Seismic Advisory Committee. This committee provides expert advice on issues related to earthquake hazards and risk reduction strategies.
- Participated in review and revision of the Idaho State Hazard Mitigation Plan. Updating the State Hazard Mitigation Plan qualifies Idaho for all available federal assistance in the event of disasters. It provides a framework to save lives and reduce vulnerability to natural and man-made hazards.
- Provided parameters to the USGS for a ShakeMap simulation of earthquakes on the Squaw Creek fault, the closest known fault to Boise.
- Mapped seismic site class and liquefaction susceptibility in Teton County and the Boise metro area.
- Produced County Hazard maps for all 44 Idaho counties.

Mines and Mining

Active Mining

Since its inception in 1919, the Survey, formerly known as the Idaho Bureau of Mines and Geology, has been providing information for and documentation of the mineral industry of Idaho. The IGS collaborates with the U.S. Geological Survey in production of the Idaho chapter of the Minerals Yearbook, a widely used global compilation of developments and statistics in mining and minerals information. This year's annual presentation to the Northwest Mining Convention in December 2011, shared an upbeat assessment of a vibrant mining industry in Idaho. Employment in the industry increased 11%, resulting in a preliminary value of \$1.2 billion for Idaho's 2011 non-fuel mineral production. This value is a new record for the state and raises Idaho's non-fuel mineral production rank up to 17th in the nation. Precious metal prices continue to rise, and industrial minerals markets are more stable than in previous years.



EXPLORATION 2012

Highlights of Idaho's mining industry for 2011 include two new mines in construction, a major expansion project, and multiple exploration projects. In the Coeur d'Alene District of Shoshone County, Hecla Mining is extending an internal shaft from the 4,900-foot level to the 8,800-foot level to access the Lucky Friday expansion ores. The \$200 million project will extend mine life and increase silver production. However, two fatalilities occurred in 2011; and MSHA ordered a temporary shutdown for safety improvements and maintenance of the Silver Shaft. The U.S. Silver Corporation mined at the Galena mine and also had an active exploration drilling program. Exploration projects in the Silver Valley were ongoing at the Star-Morning mine by Hecla, the Sunshine mine by Sunshine Silver Mines Corporation, the Golden Chest mine by a New Jersey Mining/Marathon joint venture, and the Crescent mine by United Silver. In Custer County, the Thompson Creek mine produced over 20 million pounds of molybdenum. Additionally, Formation Capital Corporation is constructing a cobalt-coppergold underground mine in Lemhi County.

In the Phosphate District of southeast Idaho, Monsanto received final approval for the Blackfoot Bridge mine and began construction. Agrium and J.R. Simplot Company also were in full production at their mines and plants, and a new phosphate exploration project was underway in the Paris Hills area near Bloomington.

Minerals Related Research

Two multi-year funded minerals research projects were underway during FY12. A study with the Idaho Department of Transportation examined aggregate quality, lithology, and its susceptibility to alkali-silica reactivity (ASR). Sampling of material source pits in southwestern Idaho was largely done in 2011, with more statewide sampling underway in the spring and summer of 2012. The second study is a cooperative effort with Midas Gold, Inc., that started at the end of FY12. This project involves research on ore deposits and geologic mapping of the Stibnite quadrangle in central Idaho, one of the state's largest exploration areas.

Energy

Geothermal

The Survey completed work on the second year of a major three-year Department of Energy (DOE)/Association of American State Geologists (AASG) funded contract to identify and digitally compile relevant geotechnical information to stimulate geothermal energy exploration within the state. The project is administered by the Arizona State Geological Survey. Data on 394 oil and gas wells, their temperature logs and bottomhole temperatures, and the state's Quaternary and younger faults were published to the IGS website in FY12. Currently being prepared for publication on the IGS website are data on 55 permitted geothermal wells and 165 low-temperature wells, 404 thermal springs, and 1106 analyses of radioactive (heat-generating) elements in volcanic and igneous rocks in the Challis and Hailey quadrangles; a bibliography of references on Idaho-specific geothermal literature; and a summary of Idaho-specific regulatory and permitting procedures, including contact information and agencies responsible for geothermal development in the state.

All data compiled in FY12 have been submitted to, and are currently cataloged in, the National Geothermal Data System (NGDS) and will eventually be accessible via a national online browser interface to point users to the IGS's server for Idaho-specific data. As part of the third and final year of the NGDS data project, work continues on seven additional data sets, including converting the new statewide geologic map and database to the GeoSciml standard, cataloging additional radioactive whole-rock analyses, including bibliographic references for the Quaternary fault database, and cataloging all well logs and drill stem tests in the oil and gas well holdings.

The IGS is one of four state surveys (including Oregon, Nevada and Utah) to be funded by DOE's NGDS program to acquire new heat flow measurement in the Great Basin. Currently, the IGS is drilling and installing several thermal gradient wells in the Gem Valley of southeast Idaho, which includes the Blackfoot Volcanic Field. Once thermal profiling and thermal conductivity measurements on the wells are completed in late FY13, the drilling and heat flow data will be published to the NGDS via the IGS's web server together with a comprehensive report documenting the geothermal potential of this area.

As in past years, the Survey's research work has been closely integrated with its public outreach and graduate teaching activities. During FY12, the Pocatello office co-developed and co-taught the first geothermal exploration course in Idaho State University's Geoscience Department, arranged a Vulcan 3D geologic modeling software workshop for ISU students and faculty to develop expertise in this research tool, and was instrumental in co-leading four ISU graduate and undergraduate students to first place in DOE's National Geothermal Student Competition (NGSC). These successful students topped runners-up Boise State and Southern Methodist teams, largely because of the use of Vulcan software to visualize subsurface structures, in addition to the choice of study area suggested by the Survey's staff. The NGSC's focus on novel approaches in exploring and developing the Snake River Plain's geothermal resources, and the students' success, brought considerable media attention to the Survey's role in geothermal energy exploration in Idaho.

Oil and Gas

The Idaho Geological Survey maintains files on about two-hundred oil and gas exploration wells in the state. These files include the reports and logs provided by companies to the Oil and Gas Commission from 1903-1988. The files contain drilling correspondence, permits and applications, reports, maps, and geophysical logs. Many are unique historic documents, and in fragile condition.

Information on historical oil and gas exploration wells in Idaho was transferred to the Idaho Geological Survey in 2009 from the Idaho Department of Lands. Recent geothermal and oil and gas exploration in Idaho has greatly increased the number of requests for these logs. The Survey's goal to make them available on the website led to an emphasis to develop a well database and a Google search application to deliver the historical statewide oil and gas well logs, and records collection, on our website.

One project of particular note is the Bridge Resources in Payette County, which drilled for oil and gas in 2010 with the subsequent announcement of a potentially commercial gas discovery. The discovery prompted the 2011 revision of Idaho's regulations on oil and gas drilling to include hydraulic fracturing (fracking) of the host rocks to stimulate gas flow.

Carbon Sequestration

In FY12, the Survey finished compiling geologic data relevant to the U.S. Geological Survey's CO_2 Sequestration Assessment Program. Much of the funding was used to supplement other funding sources to help organize, check, and scan oil and gas well files, to compile a list of selected geologic references, and to post the data on the Survey's website.

Survey staff attended the Rocky Mountain Section meeting of the American Association of Petroleum Geologists in Cheyenne, Wyoming and participated in the Carbon Sequestration Theme Session. A Survey geologist met with the USGS CO_2 Sequestration Assessment Team to plan, initiate, and complete the state project.

OUTREACH

The Survey disseminates geologic and mineral data on Idaho primarily through IGS publications, the website, in-house collections, and efforts by the staff to educate the public in the earth sciences.



Website—www.idahogeology.org

The website provides customers easy access to its publications and data. Nearly all of IGS publications are now available free for download in PDF format. Finding information on the Website has been simplified. Publications can be located via search engines on the site. Geologic data are available there as well, including GIS geologic map data sets and geochemical analyses. This year IGS added a new Google Mapsdriven search tool for finding and retrieving information about Idaho oil and gas wells. In FY12, 540,000 visits were logged on the website and users downloaded 202,000 products. Twenty-four new survey publications were posted on the website this year.

The Digital Mapping and GIS Laboratory

The Survey's digital mapping and GIS laboratory provides services that include digital cartography, spatial data management, database management and design, network system administration, graphic design and desk-top publishing, and website support. The lab continues to compile geology from around the state in a geologic map database, in addition to producing geologic maps. Seventeen geologic maps were published this year. All are available as print-on-demand maps and can be viewed free on the web.

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. Interactive data available on the Survey's website include sets of information on earthquake epicenters, mines and prospects, and geologic faults. The mines and prospects database is available for download. This year IGS added a new Google Maps-driven search tool for finding and retrieving information about Idaho oil and gas wells.

Mine Safety Training

The U.S. Department of Labor's Mine Safety and Health Administration distributes federal grants to 49 states and the Navajo Nation. Grant funds are used to support health and safety training courses and programs designed to reduce mining accidents, injuries, and illnesses.

The University of Idaho and the Idaho Geological Survey remain committed to providing expert health and safety training and retraining that meets the requirements for 30 CFR parts 46 and 48 New Miner Training and Annual Refresher Training. In addition, the Survey offers MSHA approved classes on such varied subjects as fall protections, powered haulage, accident prevention, electrical hazards, silicosis prevention, respiratory protection, prevention of hearing loss, substance abuse, hand and forearm safety, miner's rights and responsibilities, water hazards, job safety analysis, mine gases, and hazard communications. Training is conducted on-site when feasible and is designed to be as site specific as possible. Before training, the instructor conducts an inspection of the property with the mine manager or safety supervisor. The program is then adapted to address their findings. Mine Rescue Training consists of mock rescues underground, the use of hands-on training, classroom instruction and mine rescue competitions. Surface mine rescue training includes rope rescue training, confined space rescue training, knowledge and control of hazardous materials (HAZMAT).

Earth Science Education

In October, the Survey distributed Earth Science Education Week packets to teachers at the Idaho Science Teachers Association meeting in Idaho Falls. The meeting was attended by teachers from across the state. The American Geological Institute sponsors Earth Science Education Week in cooperation with its member societies on behalf of the geoscience community. Each year, local groups, educators, and interested individuals organize celebratory events. Earth Science Education Week offers opportunities to discover the earth sciences and engage in responsible stewardship of the earth. The program is actively supported by the U.S. Geological Survey, National Aeronautics and Space Administration, the National Park Service, the American Association of Petroleum Geologists Foundation, ExxonMobil, Environmental Systems Research Institute, and other geoscience groups. Due to continued funding cuts, the Idaho Geological Survey's field workshop for teachers was not offered in FY 2012.

PUBLICATIONS AND ACTIVITIES

Publications

- A Case for Post-100 Ma Fault Block Tilting of a Cretaceous Laccolith, Bonner County, Idaho, by Russell F. Burmester and Reed S. Lewis: Northwest Geology, v. 40, p. 27-36, 2011.
- Annual Report of the Idaho Geological Survey, Fiscal Year 2011, Idaho Geological Survey website, 2011.
- Below the Belt: a Road Log of Archean and Paleoproterozoic Rocks in the Eastern Clearwater Complex, Idaho, by Reed S. Lewis, Rachel A. Brewer, Andrew C. Jansen, Victor E. Guevara, Jeffrey D. Vervoort, and Julia A. Baldwin: Northwest Geology, v. 40, p. 143-157, 2011.
- *Building Tribal Economic Diversity Through Geothermal R & D*, by John A. Welhan, Michael O. McCurry, Doyle D. Anderson, Jason S. Walker, Lawrence H. Beaty, and Chikashi Sato: Geothermal Resources Council Transactions, v. 35, p. 81-82, 2011.
- Conceptual Subsurface Model of the Blackfoot Volcanic Field, Southeast Idaho: A Potential Hidden Geothermal Resource, by Kathleen Durk Autenrieth, Michael O. McCurry, John A. Welhan, and Sean Polun: Geothermal Resources Council Transactions, v. 35, 695-697, 2011.
- County Geology and Hazard Maps of Idaho, by William M. Phillips: Idaho Geological Survey Digital Database 4, 2011.
- Geologic Map of the Badger Spring Gulch Quadrangle, Lemhi County, Idaho, by Russell
 F. Burmester, Reed S. Lewis, Kurt L. Othberg, Jeffrey D. Lonn, Loudon R.
 Stanford, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 132, scale 1:24,000, 2011.
- *Geologic Map of the Baker Quadrangle, Lemhi County, Idaho*, by Kurt L. Othberg, Reed S. Lewis, Loudon R. Stanford, Russell F. Burmester, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 141, scale 1:24,000, 2011.

- *Geologic Map of the Big Creek Quadrangle, Lemhi County, Idaho*, by Reed S. Lewis, David E. Stewart, and Eric D. Stewart: Idaho Geological Survey Digital Web Map 143, scale 1:24,000, 2012.
- Geologic Map of the Copeland Quadrangle, Boundary County, Idaho, by Roy M. Breckenridge, Russell F. Burmester, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 139, scale 1:24,000, 2011.
- *Geologic Map of the Corral Quadrangle, Camas County, Idaho*, by John D. Kauffman and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 130, scale 1:24,000, 2011.
- Geologic Map of the Dairy Mountain Quadrangle, Idaho County, Idaho, by John D. Kauffman, Reed S. Lewis, Keegan L. Schmidt, David E. Stewart, Dean L. Garwood, and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 129, scale 1:24,000, 2011.
- *Geologic Map of the Eastport Quadrangle, Boundary County, Idaho*, by Russell F. Burmester, Roy M. Breckenridge, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 140, scale 1:24,000, 2011.
- Geologic Map of the Goldstone Mountain Quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana, by Reed S. Lewis, Kurt L. Othberg, Loudon R. Stanford, Russell F. Burmester, Jeffrey D. Lonn, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 134, scale 1:24,000, 2011.
- Geologic Map of the Hall Mountain Quadrangle, Boundary County, Idaho, by RussellF. Burmester, Roy M. Breckenridge, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 138, scale 1:24,000, 2011.
- Geologic Map of the John Day Mountain Quadrangle, Idaho County, Idaho, by Reed
 S. Lewis, Keegan L. Schmidt, David E. Stewart, Kurt L.Othberg, John D.
 Kauffman, and Eric D. Stewart: Idaho Geological Survey Digital Web Map 128, scale 1:24,000, 2011.
- Geologic Map of the Lewisville Quadrangle, Jefferson and Bonneville Counties, Idaho, by William M. Phillips and John A. Welhan: Idaho Geological Survey Digital Web Map 135, scale 1:24,000, 2011.
- Geologic Map of the Linderman Dam Quadrangle, Fremont, Madison, and Teton Counties, Idaho, by Glenn F. Embree and William M. Phillips: Idaho Geological Survey Digital Web Map 133, scale 1:24,000, 2011.

- Geologic Map of the Lucile Quadrangle, Idaho County, Idaho, by Reed S. Lewis, Keegan L. Schmidt, Kurt L. Othberg, David E. Stewart, and John D.Kauffman: Idaho Geological Survey Digital Web Map 126, scale 1:24,000, 2011.
- Geologic Map of the McKinzie Creek Quadrangle, Idaho County, Idaho, by John D. Kauffman, Keegan L. Schmidt, Reed S. Lewis, David E. Stewart, Kurt L. Othberg, and Dean L. Garwood: Idaho Geological Survey Digital Web Map 127, scale 1:24,000, 2011.
- Geologic Map of the Menan Buttes Quadrangle, Jefferson and Madison Counties, Idaho, by William M. Phillips and John A. Welhan: Idaho Geological Survey Digital Web Map 137, scale 1:24,000, 2011.
- *Geologic Map of the Picabo Quadrangle, Blaine County, Idaho*, by Dean L. Garwood, John D. Kauffman and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 131, scale 1:24,000, 2011.
- Geologic Map of the Rigby Quadrangle, Jefferson and Bonneville Counties, Idaho, by William M. Phillips and John A. Welhan: Idaho Geological Survey Digital Web Map 136, scale 1:24,000, 2011.
- Geothermal Potential of the Blackfoot Reservoir-Soda Springs Volcanic Field: A Hidden Geothermal Resource and Natural Laboratory in SE Idaho, by Michael O. McCurry, John A. Welhan, Sean Polun and Kathleen D. Autenrieth: Geothermal Resources Council Transactions, v. 35, 917-924, 2011.
- *Idaho Mining and Exploration, 2010*, by Virginia S. Gillerman and Earl H. Bennett: Idaho Geological Survey Staff Report 11-1, 30 p., 2011.
- *Idaho's Geothermal Prospects and Development Potential*, by John A. Welhan, Kenneth W. Neely, and Chad F. Hersley: Geothermal Resources Council Transactions, v. 35, 1595-1597, 2011.
- Isotopic Evolution of the Idaho Batholith and Challis Intrusive Province, Northern U.S. Cordillera, by Richard M. Gaschnig, Jeffrey D. Vervoort, Reed S. Lewis, and Basil Tikoff: Journal of Petrology, v. 52, no. 12, p. 2397-2429, 2011.
- NEHRP Site Class and Liquefaction Susceptibility Maps for the Boise Metro Area, Idaho, by William M. Phillips and John A. Welhan: Idaho Geological Survey Digital Database 5, 2011.

- NEHRP Site Class and Liquefaction Susceptibility Maps for Teton County, Idaho, by William M. Phillips: Idaho Geological Survey Digital Database 6, 2011.
- *Oil and Gas Map of Idaho*, by Dean L. Garwood, Reed S. Lewis, Rachel G. Daly, and Roy M. Breckenridge: 2011 Revision, Idaho Geological Survey Digital Web Map 142, scale 1:750,000, 2011.
- The Idaho Geological Survey's Activities in the National Geothermal Data Program: Data Compilation and Heat-Flow Drilling, by John A. Welhan, Roy M. Breckenridge, Dean L. Garwood, John D. Kauffman, Reed S. Lewis, and Virginia S. Gillerman: Geothermal Resource Council Transactions, v. 35, p. 1589-1593, 2011.
- *The Mineral Industry of Idaho, 2008*, by Virginia S. Gillerman and USGS staff: U.S. Geological Survey Minerals Yearbook, v. 2, p. 14.0-14.6, 2011.
- Uranium and additional Whole-Rock Data From the 1976-1980 Challis and Hailey NURE Projects, Central Idaho, compiled by Reed S. Lewis and Madison L. Myers: Idaho Geological Survey Digital Analytical Data 7, 2012.

Abstracts

- *Late Wisconsin Glaciation in Northern Idaho*, by Roy M. Breckenridge and Dean L. Garwood: Annual Meeting of the Pacific Northwest Section of the National Association of Geoscience Teachers, Spokane, Washington, June.
- Neodymium-enriched Rare Earth and Thorium Deposits, Lemhi Pass District, Idaho
 A Paleozoic Story, by Virginia S. Gillerman, Mark D. Schmitz, Michael J.
 Jercinovic, and Rich Reed: Society for Mining, Metallurgy, and Exploration,
 Inc., Preliminary Program with Abstracts 2012 Annual Meeting, p. 43, 2012.
- Precambrian Basement Rocks of the Clearwater Metamorphic Core Complex: a New Piercing Point Along the Western Laurentian Margin, by Andrew C. Jansen, Jeff D. Vervoort, and Reed S. Lewis: Geological Society of America Abstracts with Programs, vol. 43, no. 5, p. 491, 2011.
- Shear Wave Velocity-Depth from IMASW Measurements in Teton County, Idaho: Updated NEHRP Site-Response Classification and Seismic Amplification Maps, by Jamey P. Turner, William M. Phillips, Mark S. Zellman, and Daniel R.H. O'Connell, Seismological Research Letters vol. 83, no. 2, p. 378-379, 2012.

- Structure, Intrusive History, and Location of the Eastern Margin of the Wallowa Terrane,
 Western Idaho, by Reed S. Lewis, Keegan L. Schmidt, and Darin M. Schwartz:
 Geological Society of America Abstracts with Programs, v. 43, no. 5, p. 646, 2011.
- *Tectonic and Magmatic Evolution of Central Idaho: Preliminary Results of the IDOR Project*, by Basil Tikoff, Nicole Braudy, Richard M.Gaschnig, Jeff Vervoort, Reed S. Lewis, Raymond M.Russo, John A. Hole, Kathy Davenport, and Victor Mocanu: Geological Society of America Abstracts with Programs, v. 43, no. 5, p. 362, 2011.
- *The Many (and Sometimes Lost) Arcs of Idaho*, by Richard Gaschnig, Jeff Vervoort, Basil Tikoff, and Reed S. Lewis, Geological Society of America Abstracts with Programs, v. 43, no. 5, p. 647, 2011.
- U-Pb Geochronology of Pre-Belt Supergroup Rocks in the Clearwater Complex, Idaho: Implications for Precambrian Basement Provinces and Stratigraphy of the Northern Rockies, by Victor Guevara, Julia Baldwin, James L. Crowley, Reed S. Lewis, and David A. Foster, Geological Society of America Abstracts with Programs, v. 44, no. 6, p. 9, 2012.

Reports

- *Below the Belt: Archean and Paleoproterozoic Rocks in the Eastern Clearwater Complex, Idaho*, by Reed S. Lewis: Tobacco Root Geological Society Annual Field Conference, Superior, Montana, August.
- Compilation of Whole-Rock Geochemical Data from the Files of Earl Bennett and Wayne Hall, by Reed S. Lewis: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Digital Record of 1983 Borah Peak Earthquake Slides*, by Roy M. Breckenridge, Dean L. Garwood, and Sherry Pixley: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Earthquake Hazard Reference Database*, by William M. Phillips: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Final Technical Report, U.S. Geological Survey Data Preservation Program*, by Reed S. Lewis: Idaho Geological Survey final report to U.S. Geological Survey, November.

- *First Quarterly Progress Report*, by John A. Welhan: Idaho Geological Survey report to the Arizona Geological Survey Geothermal Data Project Year 2, ARRA/AASG, October.
- Geologic Map of the Canuck Peak Quadrangle, Boundary County, Idaho, and Lincoln County, Montana, by Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, and Reed S. Lewis: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- Geologic Map of the Curley Creek Quadrangle, Boundary County, Idaho, and Lincoln County, Montana, by Roy M. Breckenridge, Russell F. Burmester, Reed S. Lewis, Mark D. McFaddan, and Jeffrey D. Lonn: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- *Geologic Map of the Big Creek Quadrangle, Idaho and Valley Counties, Idaho*, by Reed S. Lewis, David E. Stewart, and Eric D. Stewart: Idaho Geological Survey Deliverable to U.S. Forest Service, scale 1:24,000, August.
- Geologic Map of the Bird Creek Quadrangle, Lemhi County, Idaho, by Russell F.
 Burmester, Reed S. Lewis, Kurt L. Othberg, Loudon R. Stanford, Mark D.
 McFaddan, and Jeffrey D. Lonn: Idaho Geological Survey report to the U.S.
 Geological Survey for STATEMAP, scale 1:24,000, May.
- Geologic Map of the Idaho Part of the Grangeville 30 x 60 Minute Quadrangle, and Adjoining Areas of Washington and Oregon, by John D. Kauffman, Keegan L. Schmidt, Reed S. Lewis, David E. Stewart, Kurt L. Othberg, and Dean L. Garwood: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:100,000, May.
- Geologic Map of the Leonia Quadrangle, Bonner and Boundary Counties, Idaho, and Lincoln County, Montana, by Russell F. Burmester, Mark D. McFaddan, Roy
 M. Breckenridge, Reed S. Lewis, and Jeffrey D. Lonn: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- Geologic Map of the Line Point Quadrangle, Boundary County, Idaho, and Lincoln County, Montana, by Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, Reed S. Lewis, and Jeffrey D. Lonn: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- Geologic Map of the Mayfield Area, Ada and Elmore Counties, Idaho, by William M.
 Phillips, Reed S. Lewis, Virginia S. Gillerman, Dean L. Garwood, and David E.
 Stewart: Idaho Geological Survey deliverable product to Idaho Department of
 Water Resources for contract CON00827, scale 1:36,000, December.

- *Geologic Map of the Rose Quadrangle, Bingham County, Idaho*, by William M. Phillips: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- *Geologic Map of the Salmon Quadrangle, Lemhi County, Idaho*, by Reed S. Lewis, Kurt L. Othberg, Russell F. Burmester, Loudon R. Stanford, Mark D. McFaddan, and Jeffrey D. Lonn: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- Geologic Map of the St. Anthony Quadrangle, Fremont and Madison Counties, Idaho, by William M. Phillips: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- *Geologic Map of the Thorn Creek SW Quadrangle, Gooding County, Idaho*, by John D. Kauffman: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, May.
- Geophysical Well Log Collection Data for Historical Oil and Gas Wells in Idaho, by Dean L. Garwood and James R. Cash: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Geothermal Permitting in Idaho*, by Virginia S. Gillerman: Idaho Geological Survey report to the Arizona Geological Survey Geothermal Data Project Year 2, ARRA/AASG, March.
- *Historical Oil and Gas Well Data for Idaho*, by Dean L. Garwood and James R. Cash: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Idaho Active Faults*, by John A. Welhan and Diana Boyack: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, 2012.
- *Idaho Geothermal Borehole Temperatures*, by John A. Welhan and Diana Boyack: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, 2012.
- *Idaho Geothermal Well Headers,* by John A. Welhan and Diana Boyack: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, 2011.

- *Idaho Geothermal Well Log Compilation Data*, by John A. Welhan and Diana Boyack: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, 2012.
- *Idaho Oil and Gas Borehole Temperatures*, by Dean L. Garwood and James R. Cash: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, April.
- *Idaho Oil and Gas Well Headers*, by Dean L. Garwood and James R. Cash: Idaho Geological Survey report to the Arizona Geological Survey ARRA/AASG Geothermal data for USGIN Document Repository, March.
- *Idaho Oil and Gas Well Log Compilation Data*, by Dean L. Garwood and James R. Cash: Idaho Geological Survey report to the Arizona Geological Survey ARRA/ AASG Geothermal data for USGIN Document Repository, March.
- *Index of Sunshine Mining Company Exploration Files*, by Victoria E. Mitchell: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- NEHRP Site Class and Liquefaction Susceptibility Maps for Teton County, Idaho, by William M. Phillips: Idaho Geological Survey Final report and deliverable products for Task Order No. 001-FY-2011, Idaho Military Division, December.
- Preliminary Hydrogeologic Analysis of the Mayfield Area, Ada and Elmore Counties, Idaho, by John A. Welhan: Idaho Geological Survey Fi006Eal contract report to Idaho Department of Water Resources, December.
- Second Quarterly Progress Report, by John A. Welhan: Idaho Geological Survey report to the Arizona Geological Survey Geothermal Data Project Year 2, ARRA/ AASG, December.
- Summary and Cover Letter for East Ada Project, by Virginia S. Gillerman: Idaho Geological Survey project report to Idaho Department of Water Resources, East Ada contract, December.
- *Summary of ICAAR 2012 Conference*, by Virginia S. Gillerman: Idaho Geological Survey project deliverable to Idaho Transportation Department, 5 p. with CD, June.
- Supporting Information for the Idaho Geological Survey's Notice of Intent to Conduct Geothermal Exploration Operations in Southeastern Idaho, by John A. Welhan: Idaho Geological Survey Notice of Intent and supporting documentation to submitted to the Bureau of Land Management, April.

- Supporting Information for the Idaho Geological Survey's Notice of Intent to Conduct Geothermal Exploration Operations in Southeastern Idaho, by John A. Welhan: Idaho Geological Survey environmental checklist and associated permitting documents submitted to the Department of Energy, June.
- *Third Quarterly Progress Report*, by John A. Welhan: Idaho Geological Survey report to the Arizona Geological Survey Geothermal Data Project Year 2, ARRA/AASG, April.
- *Update of Idaho Geological Survey Geologic Map Database*, by Loudon R. Stanford and Dean L. Garwood: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.
- *Update of Idaho Geological Survey Mines and Prospects Database*, by Victoria E. Mitchell and Loudon R. Stanford: Idaho Geological Survey deliverable to the U.S. Geological Survey Data Preservation Program, September.

Presentations

- *Dialog for Kids Program, Question and Answer Session*, by Reed S. Lewis: Idaho Public TV, Moscow-Boise, January.
- *Geologic Map of the Wood River Area, Idaho*, by Roy M. Breckenridge: Most Significant Outcomes, NCGMP 20 Years and Counting, 104th Annual Association of American State Geologists Meeting, Austin, June.
- Geology and Geologic Hazards Framework Layers: an Update, by Loudon R. Stanford: Idaho Geospatial Forum, Boise, April.
- Geology and Geologic Hazards Framework Layers: an Update, by Loudon R. Stanford: Idaho Geospatial Forum, Boise, October.
- Geology of Lemhi Pass District, Idaho and Montana, by Virginia S. Gillerman: University of California, Berkeley, Field Camp, Wise River, Montana, July.
- Geologic Mapping in the Clearwater Embayment for Tim Petty (Deputy Legislative Director for Senator Risch), by Dean L. Garwood, Reed S. Lewis, and Roy M. Breckenridge, North Central Idaho, August.
- *Geothermal Setting of Stanley's Thermal Waters*, by John A. Welhan: Technical presentation to Stanley City Council members, Stanley, September.
- Idaho Mining and Exploration, 2011, by Virginia S. Gillerman: Northwest Mining Association, Reno, Nevada, December.

- *Idaho's Oil and Natural Gas Geology An Overview*, by Virginia S. Gillerman: Idaho Environmental Forum Legislative Forecast, Boise, January.
- *Idaho's Oil and Natural Gas Geology An Overview*, by Virginia S. Gillerman: Idaho Ground Water Association Annual Meeting, Boise, February.
- Lithologic Characterization of Active ITD Aggregate Sources and Implications for Aggregate Quality, by William M. Phillips: Teleconference with Technical Advisory Committee of the Idaho Transportation Department, February.
- Lithologic Characterization of Active ITD Aggregate Sources and Implications for Aggregate Quality – A Progress Report, by Virginia S. Gillerman and Kerrie Weppner: Idaho Department of Transportation Technical Advisory Committee Meeting, Boise, February.
- Mineral Activity in Idaho and Idaho Geological Survey East Ada Project Update, by Virginia S. Gillerman: Idaho Department of Environmental Quality Groundwater Technical Committee, Boise, September.
- NEHRP Site Class and Liquefaction Susceptibility Maps for Teton County, Idaho, by William M. Phillips: Teleconference with Idaho Bureau of Homeland Security, January.
- Neodymium-enriched Rare Earth and Thorium Deposits, Lemhi Pass District, Idaho – A Paleozoic Story, by Virginia S. Gillerman, Mark D. Schmitz, Michael J. Jercinovic, and Rich Reed: Society for Mining, Metallurgy, and Exploration Annual Meeting, Seattle, Washington, February.
- *Results of Geologic Mapping Projects in Idaho*, by Reed S. Lewis: National Association of Geoscience Teachers, Pacific Northwest Section 2012 Conference, Spokane, Washington, June.
- *Results of STATEMAP Projects in Idaho, for USGS STATEMAP TEAM*, by Roy M. Breckenridge, Reed S. Lewis, and Mark D. McFaddan, North Idaho, September.
- *The Boise Basin Gold Discovery and Its Role in Idaho's History*, by Don Adair and Virginia Gillerman: Osher Institute Course, Boise, May.
- The Idaho Geological Survey's Activities in the National Geothermal Data Program: Data Compilation and Heat-Flow Drilling, by John A. Welhan, Roy M. Breckenridge, Dean L. Garwood, John D. Kauffman, Reed S. Lewis, and Virginia S. Gillerman: Geothermal Resource Council Annual Meeting, (presented by John A. Welhan), October.

The Stanley Geothermal Project: An Assessment of Geothermal Resource Development Potential, by John A. Welhan: Idaho State University Geosciences Colloquium, November.

Media Interviews

- *Geologists Prepare for Potential Earthquakes*, KPVI Channel 6, Idaho Falls, July 18, 2011 (W.M. Phillips).
- Geologists Prepare for "The Big One," KIFI Channel 8, Idaho Falls, July 18, 2011 (W.M. Phillips).
- *Geologists Study Earthquake Hazards in Teton County*, KCHQ 102.1 FM, Driggs, July 12, 2011 (W.M. Phillips).
- Geologists Studying Earthquake Risks in Teton, Idaho State Journal, Pocatello, July 20, 2011 (W.M. Phillips).
- Geologists Test Valley for Earthquake Safety, Teton Valley News, Driggs, July 28, 2011 (W.M. Phillips).
- *Geologists to Test Local Area for Earthquake Damage Potential*, Teton Valley News, Driggs, July 14, 2011 (W.M. Phillips).
- Idaho Gas Industry Enters New Phase, by Rocky Barker, Idaho Statesman, May 5-6, 2012 (V.S. Gillerman).
- Study on Quakes Starts in Teton Co., Post Register, Idaho Falls, July 20, 2011 (W.M. Phillips).
- Tapping the Mining Vein, by Joel Mills, Lewiston Tribune, January 29, 2012 (V.S. Gillerman).
- University of Idaho Geologists Take Preventative Measures Before Potential Earthquake, University of Idaho press release, Moscow, July 11, 2011 (W.M. Phillips).

Still Digging, by William L. Spence, Lewiston Tribune, December 16, 2012 (V.S. Gillerman).

Web Products

Idaho Oil and Gas, by Dean L. Garwood: Idaho Geological Survey web page, update.

Search Idaho Oil and Gas Wells, 1903-1988: A Google Maps Search App, by Loudon R. Stanford, Dustin Thomas, and Dean L. Garwood: Idaho Geological Survey web page.

Operational Improvements

- Arranging and participating in a custom training workshop for students and faculty at Idaho State University on "Introduction to Vulcan" 3D geologic modeling software, June 19-22 (J.A. Welhan).
- Develop Idaho Geological Survey funding source and salary tracking worksheet (Grant Track): Idaho Geological Survey planning worksheet (D.L. Garwood, T. Kanikkeberg, and R.M. Breckenridge).
- Implemented Idaho Geological Survey Funding source and salary tracking worksheet (Grant Track): January (D.L. Garwood and T. Kanikkeberg).
- Improvements to Mines and Prospects Web Search Tool: A Google Maps Search App: Idaho Geological Survey web page (L.R. Stanford, D. Thomas, R.S. Lewis).
- Migration of Idaho Geological Survey Point of Sale data to new POS software, January, (L.R. Stanford).
- Trainer, Idaho Geological Survey funding source and salary tracking worksheet (Grant Track): Idaho Geological Survey planning worksheet, onsite training sessions, Moscow, Boise, and Pocatello, January (D.L. Garwood).

Professional Activities

Adjunct Graduate Faculty, Boise State University (V.S. Gillerman).

- Association of American State Geologists, Annual Meeting, Austin, Texas, June (R.M. Breckenridge).
- Association of American State Geologists, Liaison meetings, Washington DC, March (R.M. Breckenridge).
- Belt Association Meeting and Field Trip, Wallace, September (V.S. Gillerman, M.D. McFaddan, R.S. Lewis).
- Chair, Geology and Geologic Hazards Idaho Framework Layers, Technical Working Group, (L.R. Stanford).
- Co-advisor, Idaho State University student team, Department of Energy, National Geothermal Student Competition, Spring/Summer semester (J.A. Welhan).
- Co-developer and co-teacher, Geology 5599 Geothermal Exploration, Idaho State University, Fall semester 2011 (J.A. Welhan and M.O. McCurry).

- Co-instructor, The Boise Basin Gold Discovery and Its Role in Idaho's History, Osher Institute for Lifelong Learning, Boise, May (V.S. Gillerman).
- Colorado School of Mines, Rare Earths Short Course, Golden, CO, August (V.S. Gillerman).
- Contributor, Model Earthquake Parameters and Metro Boise NEHRP Site Class Map for Squaw Creek Fault Shakemap Earthquake Scenario, U.S. Geological Survey, http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/Squaw_ Creek_7.0_se/, October-December (W.M. Phillips).
- Coordinator, Annual Belt Association meeting, Wallace, Idaho, September (R.S. Lewis).

Digital Mapping Techniques 2012 Workshop, Urbana-Champaign, May (L.R. Stanford).

- Fellow, Society of Economic Geologists (V.S. Gillerman).
- Field Trip Leader, Boise Basin Gold District, Osher Institute for Lifelong Learning, Boise, May (V.S. Gillerman).
- Field Trip Leader, Lemhi Pass and North Fork Districts, Idaho, for University of California, Berkeley, Field Camp and WSU faculty and graduate student, July (V.S. Gillerman).
- Field Trip Leaders, Geologic tour of STATEMAP results for the Clearwater Embayment for Tim Petty (Deputy Legislative Director for Senator Risch), August (D.L. Garwood, R.S. Lewis, R.M. Breckenridge).
- Field Trip Leaders, Results of STATEMAP for Coeur d'Alene, Sandpoint, and Bonners Ferry Projects, USGS STATEMAP Team field check by D. Howard and L. Quintana, September (R.M. Breckenridge, M.D. McFaddan, R.S. Lewis).
- Geological Society of America Annual Meeting, Minneapolis, Minnesota, October (R.S. Lewis).
- Geology Community of Use, USTOPO telephone conferences, January, February, March, and April, (L.R. Stanford).
- Geology of the Continental Margin of Ancestral North America: Laurentia in Northeastern Washington, Pacific Northwest Section of the National Association of Geoscience Teachers Field Trip, northeastern Washington, June (R.M. Breckenridge, D.L. Garwood).
- Handling difficult conversations at work, Department of Education, University of Idaho, November, 2011 (T. Kanikkeberg).

- International Conference on Alkali-Aggregate Reaction, Austin, TX, May, 2012 (V.S. Gillerman).
- Idaho Framework Layers, Super Technical Working Group meeting, Boise, April, (L.R. Stanford).
- Idaho Geologic Mapping Advisory Committee telephone conference, Moscow, September (J.D. Kauffman, R.M. Breckenridge, R.S. Lewis, D.L. Garwood, W.M. Phillips).
- Idaho Geological Survey representative, Department of Geosciences, Boise State University (V.S. Gillerman).
- Idaho Geological Survey representative, Department of Geosciences, Idaho State University (J.A. Welhan).
- Idaho Geological Survey Digital Mapping Lab Tour, for Tim Petty (Deputy Legislative Director to Senator James E. Risch), Moscow, August (L.R. Stanford).
- Idaho Geological Survey Digital Mapping Lab Tour, for William Capaul, P.G. District Geologist, Idaho Transportation Department, Moscow, October (L.R. Stanford).
- Idaho Geological Survey Digital Mapping Lab Tour, for Charles Buck (Associate Vice President and Center Executive Officer for Northern Idaho, University of Idaho), November (L.R. Stanford).
- Idaho Geological Survey representative and disaster coordinator, Bureau of Homeland Security (BHS), State Agency Emergency Coordinator's Working Group (V.S. Gillerman).
- Idaho Geospatial Council Executive Committee Meeting, Boise, February, April, and June (L.R. Stanford).
- Idaho State University Affiliate Faculty and Graduate Faculty representative (J.A. Welhan).
- Instructor, Idaho State Tax Commission summer school, Boise, July (V.S. Gillerman).
- Map Services in the GeoSciML-Portrayal, USGIN/OneGeology Workshop, Golden, May, (L.R. Stanford).
- Mastering PowerPoint, Professional Development and Learning, University of Idaho, Webinar, May 2012 (T. Kanikkeberg).
- Member, Advanced National Seismic System, Intermountain West Regional Advisory Council (R.M. Breckenridge).

Member, American Geophysical Union (W.M. Phillips, J.A. Welhan).

- Member, American Institute of Professional Geologists, (R.M. Breckenridge).
- Member, Association of American State Geologists/U.S. Geological Survey Data Capture Working Group (L.R. Stanford).
- Member, Departmental Grant Administrator Roundtable, Office of Sponsored Programs, University of Idaho (T. Kanikkeberg).
- Member, Financial Information Group, Office of Business Systems and Accounting Services, University of Idaho (T. Kanikkeberg).
- Member, Geological Society of America (R.M. Breckenridge, V.S. Gillerman, R.S. Lewis, W.M. Phillips).
- Member, Geological Society of Nevada (V.S. Gillerman).
- Member, Geology and Geologic Hazards Idaho Framework Layers, Technical Working Group, (L.R. Stanford).
- Member, Geothermal Resources Council (J.A. Welhan).
- Member, Governor's Geothermal Task Force, Idaho Strategic Energy Alliance, (V.S. Gillerman).
- Member, Idaho Ground Water Monitoring Technical Committee (J.A. Welhan).
- Member, Northwest Mining Association (V.S. Gillerman, R.S. Lewis).
- Member, Quaternary Geology and Geomorphology Division, Geological Society of America (R.M. Breckenridge, W.M. Phillips).
- Member, Society for Mining, Metallurgy, and Exploration, Inc. (SME) (V.S. Gillerman).
- Member, State Agency GIS Group, Idaho (L.R. Stanford).
- Member, Western States Seismic Policy Council (R.M. Breckenridge, W.M. Phillips).
- Member, Spokane-Coeur d'Alene Corridor, Water Sustainability, and Climate Research Initiative, University of Idaho-Washington State University Biophysical Work Group, (R.M. Breckenridge).
- Mine and Field Tours, Aggregate Pits of South-Central Idaho; Gold Hill mine and Boise Basin (V.S. Gillerman).
- Mine and Field Tours, Aggregate Pits of Southwestern Idaho, Stibnite District, McCall and Warren areas (V.S. Gillerman).

- Missoula Floods, Glaciers, Early People and Explorers in Northeast Washington, Pacific Northwest Section of the National Association of Geoscience Teachers Field Trip, Pend Oreille River Valley of northeastern Washington, June (R.M. Breckenridge, D.L. Garwood).
- Mine Safety Refresher Training, Mine Safety Health Administration, Boise, (V.S. Gillerman).
- Northwest Mining Association Convention, Reno, Nevada, December (V.S. Gillerman).
- Palouse Basin Water Summit, Pullman, Washington, October (R.M. Breckenridge, D.L. Garwood).
- Participant, Basin and Range Province Earthquake Hazard Working Group II, U.S. Geological Survey and Western States Seismic Policy Council, Salt Lake City, Utah, November (W.M. Phillips).
- Participant, Benefit Focus Group to discuss University of Idaho employees' benefits, knowledge, and communication preferences, December (C.G. Gantenbein).
- Participant, Executive Board Meeting, Idaho State Hazard Mitigation Plan, Idaho Bureau of Homeland Security, September (W.M. Phillips).
- Participant, Idaho State Agency GIS meeting, Boise, December (L.R. Stanford).
- Participant, USGIN/OneGeology Workshop Preparation webinar, April, (L.R. Stanford).
- Phase I and II Space Survey, Office of Sponsored Programs, University of Idaho, March and April, 2012 (T. Kanikkeberg).
- Powerful Listening Skills, Rockhurst University Continuing Education Center seminar on the University of Idaho campus, Office of Sponsored Programs, November, 2011 (T. Kanikkeberg).
- Quarterly EPAF Advisory Group, Office of Human Resource, University of Idaho, December 2011) (T. Kanikkeberg).
- Registered Geologist, Oregon Board of Geologist Examiners, (R.M. Breckenridge).
- Reviewer, Earthquake Education and Awareness in Idaho, Classroom Activities, Idaho Bureau of Homeland Security, December (W.M. Phillips).
- Reviewer, Geological Society of America Geosphere, February (W.M. Phillips).
- Reviewer, Geological Society of America Special Paper, December (W.M. Phillips).
- Search Committee, Research Support Scientist 2, Moscow, October (R.S. Lewis, T. Kanikkeberg, J.D. Kauffman).

Secretary, Belt Association Board of Directors (R.S. Lewis).

- Society of Mining, Metallurgy, and Exploration Convention: Seattle, Washington, February (V.S. Gillerman).
- Space Survey, Office of Sponsored Programs, University of Idaho, May (T. Kanikkeberg).
- Student, Geography 479, GIS Programming Class, University of Idaho (C.G. Gantenbein).
- Student, GIS Programming 101 for ArcGIS 10: Mastering Python, a two day short course, Boise, October (L.R. Stanford).
- Summer Session Electronic Personnel Action Form, Budget Office, University of Idaho, April (T. Kanikkeberg).
- Supervisor, Cody Steven, Work Study student, University of Idaho, August-May (R.S. Lewis).
- Supervisor, Emily Forsberg, Work Study student, University of Idaho, January-May (W.M. Phillips).
- Supervisor, James Cash, Temporary Employee, University of Idaho, January-June (D.L. Garwood).
- Supervisor, Kerrie Weppner, Temporary Employee, University of Idaho, July-June (V.S. Gillerman).
- Supervisor, MacKenzie Braun, Work Study student, University of Idaho, July-June (T. Kanikkeberg).
- Supervisor, Vanessa Thornton, Volunteer Geology Intern, BYU-Idaho, January-March (W.M. Phillips).
- Technical advisor, Statistical analysis of ground- water monitoring data, Idaho Department of Environmental Quality (J.A. Welhan).

Technical advisor, Shoshone-Bannock Tribes' Water Resources Department (J.A. Welhan).

- Technical and planning advisor, Opportunities for Educational Diversity in the Geosciences, Idaho State University, National Science Foundation grant, (J.A. Welhan).
- The Bonneville Flood Revisited, Field trip, Friends of the Pleistocene, September (W.M. Phillips).
- Three Steps for Thriving in Chaos, Professional Development and Learning, University of Idaho, Webinar, May (T. Kanikkeberg).

- Transformation of the Travel Voucher Process, Accounts Payable, University of Idaho, February, (T. Kanikkeberg).
- UI Hiring Guidelines and Applicant Tracking System (ATS) Technical Training, August 2011, (T. Kanikkeberg).

Work Study information, Financial Aid, University of Idaho, March 2012 (T. Kanikkeberg).

Graduate Thesis Committees

Andrew Jansen, M.S. Geology, Washington State University (R.S. Lewis).

Dinesh Grover, M.S. Geological Sciences, Idaho State University (J.A. Welhan).

Keith Gray, Ph.D. Geology, Washington State University (R.S. Lewis).

Liane Stevens, Ph.D. Geology, University of Montana (R.S. Lewis).

Michael Ginsbach, M.S. Geological Sciences, Idaho State University (J.A. Welhan).

Rachel Brewer, M.S. Geology, Washington State University (R.S. Lewis).

Rebecca Ohly, M.S. Geology, Idaho State University (J.A. Welhan).

Vincent Isakson, M.S. Geology, Washington State University (R.S. Lewis).

Will Smith, M.S. Geological Sciences, Idaho State University (J.A. Welhan).

Grants and Contracts

- Abandoned Mine Lands Project, task 2: R.S. Lewis (Idaho Department of Lands, May 21, 2012-May 20, 2014, \$89,857).
- ARRA Geothermal Data Compilation Project: J.A. Welhan (DOE-AASG, May, 2010 May, 2013, \$412,389).
- ARRA Geothermal New Data Supplement Project: J.A. Welhan (DOE-AASG, June, 2011 May, 2013, \$457,663).
- CO₂ Sequestration Assessment: J.D. Kauffman (U.S. Geological Survey CO₂ Sequestration Assessment Program, July 2010-June 2011, \$50,000; no-cost extension to September, 2011).
- Geologic Map of the Big Creek Quadrangle: R.S. Lewis (U.S. Department of Agriculture (U.S. Forest Service, Region 4, June 8, 2010-August 1, 2011, \$19,221).

- Geologic Mapping in the Idaho Falls, Fairfield, Grangeville, Salmon, and Bonners Ferry Areas: R.S. Lewis, W.M. Phillips, J.D. Kauffman, and R.M. Breckenridge (U.S. Geological Survey STATEMAP Program, June 2011-May 2012, \$220,985).
- Geologic Mapping in the Rexburg, Bonners Ferry, Salmon, and Fairfield Areas: R.S. Lewis, W.M. Phillips, D.L. Garwood, and R.M. Breckenridge (U.S. Geological Survey STATEMAP Program, May 2012-April 2013, \$204,695).
- Geologic Mapping of Stibnite 7.5' Quadrangle and Pilot Investigation of Hydrothermal Alteration, Mineralization and Geochronology within Stibnite Mining District, Idaho: V.S. Gillerman and R.S. Lewis (Midas Gold, Inc., May 2012 – December, 2014, \$75,000).
- Geologic Setting and Mapping of East Ada Project Area: V.S. Gillerman, R.S. Lewis, and J. Welhan (Idaho Department of Water Resources, October 26, 2009 – December 31, 2011,\$94,000).
- Idaho Earthquake Mitigation Projects: Boise Area NEHRP Soil Class and Liquefaction Suceptibility Maps: W.M. Phillips, K.L. Othberg, and J.A. Welhan (Idaho Bureau of Homeland Security, July 1, 2010-July 31, 2011, \$35,111).
- Lithologic Characterization of Active ITD Aggregate Sources and Implications for Aggregate Quality: V.S. Gillerman and W.M. Phillips (Idaho Department of Transportation, March 1, 2011 – September 30, 2013, \$119,999).
- National Geological and Geophysical Data Preservation Program FY 2010: R.S. Lewis (U.S. Geological Survey) August 1, 2010-July 31, 2011, \$37,792).
- National Geological and Geophysical Data Preservation Program FY2011: R.S. Lewis (U.S. Geological Survey) August 1, 2011-July 31, 2012, \$21,989).
- NEHRP Soil Class and Liquefaction Susceptibility Maps B Teton County: W.M. Phillips and L.R. Stanford (Idaho Bureau of Homeland Security, May 1, 2011-December 31, 2011, \$30,000).
- Recruiting and Retaining Native American Students in the Geosciences: J.A. Welhan (subcontract to ISU, NSF, Dec., 2011 November, 2013, \$17,122).