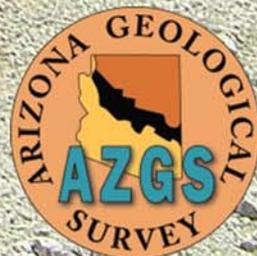


# Arizona Geological Survey

Combined Annual Report  
Fiscal Years 2006—2009



**Janice K. Brewer, Governor**

**M. Lee Allison, Ph.D, R.G., State Geologist & Director**

# **Arizona Geological Survey**

## **Combined Annual Report**

### **Fiscal Years 2006 - 2009**

This report is prepared in accordance with Arizona Revised Statute 27-155: The state geologist shall make an annual report to the governor on the progress and condition of the Arizona geological survey, of pertinent facts concerning this state's geologic setting and of such other pertinent information as the state geologist deems proper.

Compiled by L. Christian Hanson and M. Lee Allison



Cover: AZGS geologists assess Sabino Canyon debris flows, Coronado National Forest, Pima County, Arizona.  
Photo taken August 11, 2006 by Lee Allison

# ARIZONA GEOLOGICAL SURVEY

## History

The Arizona Geological Survey is an independent state agency, reporting directly to the governor, since 1988. Tracing our heritage back to the creation of the Office of the Territorial Geologist in 1888, the agency was part of the University of Arizona from 1893 to 1988, under a number of institutional names.

## Statutory Charges

The AZGS prides itself on a long tradition of supplying unbiased scientific data and advice on a variety of topics to government, the public, and industry.

The AZGS is directed to investigate the mineral resources and geologic characteristics of Arizona under Arizona Revised Statutes, Title 27, Article 4, Objectives of Arizona Geological Survey:

1. Serve as a primary source of geologic information in this state to enhance public understanding of the state's geologic character, geologic hazards and limitations and mineral resources.
2. Inform, advise and assist the public in matters concerning the geological processes, materials and landscapes and the development and use of the mineral resources of this state.
3. Encourage the wise use of the lands and mineral resources of this state toward its development.
4. Provide technical advice and assistance in geology to other state and local governmental agencies engaged in projects in which the geologic setting, character or mineral resources of the state are involved.
5. Provide technical advice and assistance in geology to industry toward the wise development and use of the mineral and land resources of this state.

## DIRECTOR'S LETTER

The past four years have been dynamic for the Arizona Geological Survey. We had many significant accomplishments:

- Responded to natural disasters and hazards
- Built a pioneering Earth fissures program
- Characterized a world-class potash deposit and mapped one of the state's largest copper deposits
- Created a geoinformatics program that is a national and growing international center
- Greatly expanded our geologic mapping activities,
- Delivered dramatically more reports, data, and information online
- Opened an office in Phoenix—the first branch in our 120+ year history



The Earth fissure mapping program was enacted into law in 2006 at the urging of the state's real estate, home building, and environmental communities. AZGS established the first guidelines, standards, and procedures anywhere for identifying and characterizing this new class of features that result from dramatically drawing down of groundwater. This program is a model for other regions struggling to deal with similar situations. While the earth fissures program has garnered much public attention, AZGS has responded to wide range of natural disasters and hazards, including debris flows, landslides, and floods.

AZGS' geologic mapping program is one of the most highly regarded in the nation. In the past few years we took on mapping projects funded by the National Park Service, AZ Department of Transportation, AZ Department of Water Resources, and others.

The AZGS Geologic Extension Service combines all outreach activities, including the library, bookstore, Websites, publications, public inquiries, and education. The results are exciting and impressive. The number of Web visits and mineral resources and natural hazards downloads has exploded.

AZGS' Geoinformatics Section was created by combining our internal IT support, GIS staff, and our unique cyberinfrastructure capabilities. AZGS leads the nation's state geological surveys—in partnership with the U.S. Geological Survey—in build the national Digital Geoscience Information Network (GIN). GIN is being adopted by an increasing number of scientific, government, and business entities.

Overall, the revenues from external contracts and grants increased our budget and staffing significantly over the past four years. These revenues are also underwriting a large part of AZGS' infrastructure and support functions, which until now have allowed us to maintain state-mandated services even while state appropriations declined. Continuing to subsidize state government functions at effective operational levels is our major challenge going into Fiscal Year 2010.

A handwritten signature in black ink that reads "M Lee Allison".

M. Lee Allison, Ph.D., R.G.  
Director & State Geologist

## OPERATIONAL OVERVIEW

- Revenues increased 131%—from \$1.3M in FY05 to \$3.0M in FY09—mostly on external grants and contracts; AZGS now 2/3 funded from outside funds.
- First branch office in 121 years opened in Phoenix.
- AZGS is the designated lead for the State Geological Surveys in building the national digital Geoscience Information Network.
- AZGS Web site usage increased more than 1,000%--with more than 4.5 terabytes of data downloaded in FY09.
- AZGS calculated huge potash resources in the Holbrook basin.
- AZGS and all 3 Arizona universities set up the first statewide seismic monitoring network
- AZGS staff increased from 16 to 26 FTEs (total peaked in FY09 at 35)—a 56% increase.
- Women and minorities filled 17 of the 35 (49%) positions in AZGS.
- Cumulative FY09 budget cuts of 30% were accomplished without layoffs or furloughs.

# MINERAL RESOURCES

## Mineral Resources [§27-152.01-5]

About 65 percent of the nation's annual copper usage is mined in Arizona. Starting in 2005, Arizona has led the nation in production of nonfuel minerals.

Arizona mines and quarries directly employ nearly 22,000, generating more than 1 billion dollars a year in salaries.

As of 2007, Arizona's total mineral production was valued at a record-setting \$7.6 billion, led by copper production at \$5.5 billion. The State remains ranked #1 in the nation for nonfuel mineral production. Rising mineral prices fueled acquisition and exploration of commodities not mined in Arizona for decades, including uranium, manganese, and fluor spar.

The total economic impact of mining in Arizona is about 3.5 billion dollars annually. Of this, about 277 million is accounted for in exports abroad. The future of mining is assured by the following fact: each American uses more than 45,000 pounds of newly mined minerals annually.

Over the years, the Arizona Geological Survey's quarterly magazine, *Arizona Geology*, has hosted numerous articles addressing mineral resources, their genesis, distribution, mining, and what the future holds for Arizona's mineral commodities. In the pages of *Arizona Geology*, you'll also find topical information on geothermal resources, helium production, and uranium ore genesis, among other things.

To better serve those of our constituents with an interest in minerals and mining, AZGS provides the best and most relevant mineral articles as free PDF downloads.

AZGS' bedrock mapping work focuses on minerals and is a valuable resource for helping identify and characterize the State's mineral resources.

## Potash [§27-152.01-5]

The AZGS 2008 publication, *Potash and related Resources*

*of the Holbrook Basin, Arizona*, triggered a modest potash leasing rush in eastern Arizona in the Holbrook Basin region. An exploration company drilled four stratigraphic wells, with more scheduled.

## Uranium [§27-152.01-5]

Over the past two to five years, price increases have triggered a large upturn in uranium exploration activity in northwestern Arizona on public lands of the Colorado Plateau. AZGS continues to provide technical guidance to policy-makers and the public on the geologic-related issues.

## Core and cuttings repository [§27-152.01-5]

AZGS maintains a sample repository of rock cores and cuttings from industry wells that is open to the public for study and analysis. Sampling is allowed in selected

instances with the proviso that AZGS gets copies of all analytical results. Principal users are companies exploring for mineral and energy resources. Leaders in the mining industry said this is the most important service we can provide to industry. They save hundreds of thousands of dollars or more by not having to drill areas that were previously drilled by others, and in some areas, there are new restrictions that make it difficult if not impossible to get access to the land.

### Arizona Geological Survey's Mineral Resource Projects

- AZGS studies delineated 2.2 billion tons of potash in the Holbrook area—a 25% increase in the national resource base.
- With an estimated worth of over \$1 trillion, the potash report stimulated extensive leasing of State Trust Lands and private sector exploration.
  - AZGS is mapping 3 quadrangles adjacent to the proposed Rosemont copper mine to provide constraints on claims about groundwater impacts. AZGS completed a detailed map of the proposed mine in 2007 in cooperation with Rosemont Copper Co.
  - AZGS advised City of Marana on land-use plan constraints to aggregate and sand & gravel mining. As a direct result, the City selected areas to remain open for mining access.
  - AZGS met with residents in the Phoenix west valley area to resolve concerns that local quarries were putting asbestos into the air and creating health problems.



## Copper

In 2006, AZGS geologists mapped the geology of the proposed Rosemont copper mine in the Santa Rita Mountains, Pima County, at a scale of 1:12,000 to serve as a reference for further development and evaluation of potential impacts.

AZGS is a cooperating agency with the U.S. Forest Service (Coraonado National Forest) in preparation and review of the Environmental Impact Statement for the proposed Rosemont Copper mine in the Sant Santa Rita Mountains, in Pima County.

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## ENERGY RESOURCES

### Energy

#### Arizona Oil & Gas Conservation Commission [§27-515.A]



The Arizona Oil & Gas Conservation Commission—established to administer and enforce state laws to conserve oil, gas, and geothermal resources—is administered and supported through the AZGS.

By ensuring proper drilling, completion, and production practices, the Commission promotes conservation and prevents the waste of these energy resources. It also protects land owners' rights to these resources, encourages responsible energy resource exploration and development, safeguards the environment, and promotes public safety.

The Commission fulfills its mission by:

- Issuing permits for oil, gas, and geothermal wells
- Monitoring and inspecting wells and facilities

- Maintaining effective rules in Title 12, Chapter 7, of the Arizona Administrative Code
- Collecting, compiling, and maintaining drilling, production, and subsurface data for industry and public use
- Coordinating enforcement with the AZ Attorney General
- Completing geologic studies to encourage exploring and developing Arizona's oil, gas, and geothermal resources.

In 2008, **30 drilling permits were issued, 14 wells were drilled**, and two wells were plugged and abandoned. In FY2009, 1.35 million acres were leased for oil and gas in Arizona, down only slightly from 1.36 million acres in 2008.

**Helium is on the rise.** The current posted price of \$64.75 per thousand cubic feet has elevated the hunt for helium. **Some of the richest helium-bearing gas in the world** is currently being produced in Arizona. Helium concentrations range from trace amounts up to ten percent in the Holbrook Basin and Four Corners. Both areas have good potential for additional discovery and production of helium.

#### Carbon dioxide sequestration projects [§27-152.01-5]

AZGS is an active member of WESTCARB and SW Regional Partnership to evaluate CO<sub>2</sub> sequestration. Carbon sequestration—the long-term storage of carbon dioxide in geologic reservoirs—offers the **potential to keep coal-fired power plants viable** in anticipation of restrictions being placed on CO<sub>2</sub> emissions.

In 2009, WESTCARB drilled the first CO<sub>2</sub> sequestration test well, near the Cholla Power Plant outside Holbrook, Arizona.

## Geothermal energy [§27-515.A]

AZGS maps and reports are the primary scientific information sources for geothermal energy resources in the state.

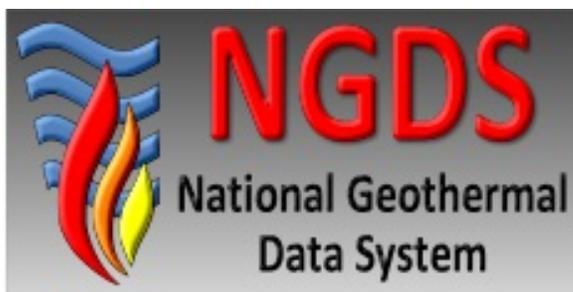
We have been working with trade associations and federal land management agencies to get public lands accessible for exploration and development.

AZGS is negotiating with Northern Arizona University manage and host the state's geothermal energy web site as part of the Geopowering the West initiative.

AZGS has a lead role in the Geothermal Data Consortium selected by the U.S. Department of Energy (DOE) to build the National Geothermal Data System—DOE's system to develop the nation's geothermal resources.

This five-year, \$5 million program is headed by Intermountain West Geothermal Center at Boise State University. As the lead for the Association of American State Geologists (AASG) on this project, AZGS will direct system integration, provide for data access and discovery, and ensure interoperability using the Geoscience Information Network. Project start-up is set for Fall 2010.

AZGS was designated by AASG in June 2009 to lead a coalition of 40 state geological surveys to respond to the U.S. Department of Energy's \$20 million funding opportunity to deploy and populate the National Geothermal Data System.



# GEOLOGIC & ENVIRONMENTAL HAZARDS

## Earth Fissures [§27-152.01-3]

Earth fissures—a result of groundwater overdrafts and subsidence—pose a hazard in the basins of southeast Arizona.



The real estate and homebuilders industries made identifying earth fissures a priority and the **legislation passed in 2006 gave AZGS the responsibility for mapping fissures across the state.**

A key provision in the law protects realty agents, homebuilders, and home sellers from liability if they refer buyers to the AZGS-published earth fissure maps as the official information source.

Subsequently, AZGS Earth Fissure Maps not only serve the realty and homebuilding economic sectors but create new business for the geotechnical and consulting industry as clients seek detailed analyses and mitigation of identified fissures.

AZGS has produced 14 earth fissure maps since launching the program in 2006. These Earth Fissure Maps are a subseries of the Digital Map Series and are currently offered as free online downloads through the AZGS Web site.

More than 50,000 copies of the AZGS Earth Fissure Maps have been downloaded since 2007.

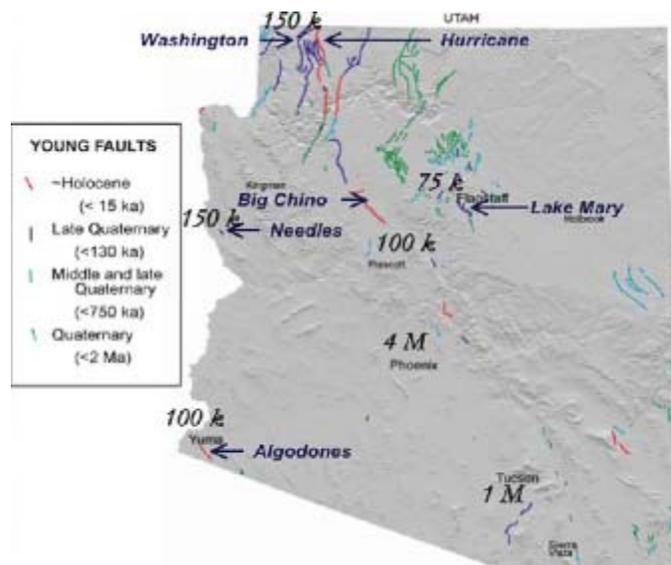
AZGS supports the Arizona Land Subsidence Group (AzLSG), which meets regularly to discuss technical and policy issues related to subsidence and earth fissures. Two AZGS geologists are on the steering committee, and membership comprises a broad spectrum of researchers, consultants, state and local governments, and other stakeholders. AzLSG authored a white paper

on knowledge gaps and research needs with respect to subsidence and earth fissures, which AZGS has published; additionally, AzLSG, with active involvement from AZGS, drafted recommendations for minimum earth fissure investigation requirements to be presented to AZGS for publication.

## Natural Hazards Characterization [§27-152.01-1(c)]

AZGS is increasingly called upon by the real estate industry, home builders, utilities, and local governments to provide information and advice on a range of geologic hazards that could impact facilities and infrastructure. Engineering and geotechnical firms rely on AZGS as an important resource in evaluating sites for industrial, commercial, and residential development.

AZGS geologists have been involved in most of the investigations of young faults—potential sources of large earthquakes—in Arizona during the past several decades. In 2008, AZGS assessed potential hazard posed by these faults based on their long-term rates of activity and proximity to population centers.



The AZGS also acquired eight new seismometers and created the Arizona Integrated Seismic Network in cooperation with each of the state universities. This network enhances our ability to monitor and locate seismic events that impact Arizona, which should aid in our understanding of seismic hazard across the state.

AZGS geologists worked with the Flood Control District of Maricopa County to define and delineate flood hazards associated with active alluvial fans and sheetflooding.

The AZGS released surficial geologic maps and a rough flood hazard assessment for Rainbow Valley southwest of Phoenix. Staff geologists are working with JE Fuller Hydrology & Geomorphology on procedures for dating young alluvial fan deposits and assessing the potential for debris flow on alluvial fans.



## Assessing Hazards to Highways, Dwellings & Tourism Sites after Natural Disasters [§27-152.01-1(c)]

Working with local, state, and federal agencies, AZGS helps restore economic activity after natural disasters by assessing hazards to roadways, dwellings, and tourism sites.

Some recent activity includes:

- An **Easter weekend landslide in 2008** closed State Highway 87 between Phoenix and Payson for six days. AZGS identified the source and extent of the slide mass needing to be stabilized before the road could reopen.
- The Santa Catalina Mountains north of Tucson experienced hundreds of landslides and debris flows in July 2006. As a result, the popular recreation area in **Sabino Canyon** was closed for months. AZGS assessed the nature of the damage in Sabino Canyon and recommended appropriate remediation. In addition, the AZGS was funded by the Pima County Regional Flood Control District to map young debris flow deposits near canyon mouths along the mountain front.
- The **2008 Havasu Creek flood** closed a world-class Grand Canyon tourist destination, causing several million dollars worth of damage, and threatening the Havasupai tribe's primary income from tourist

dollars. AZGS assisted the Tribe in mitigating landslides, reopening trails, and slowing erosion in time for the tourist season.

- **Debris flows at Coronado National Memorial Park** in 2006 badly damaged the park's facilities. AZGS identified unstable areas and recommended relocating key facilities.
- Significant **debris flows at Oak Creek Canyon** in 2006 resulted from post-fire conditions in the area. Responding to this event, AZGS identified unstable areas subject to failure from rainstorms and assisted deploying an emergency warning system for residents along Sedona Highway.

## Monitoring Geologic Hazards

[§27-152.01-1(c)]

Arizona is home to numerous active faults and is adjacent to fault zones with even greater seismic activity. The State has sustained damage and ground shaking from strong earthquakes in historical times. However, seismic risk in Arizona is thought to be underestimated, due in part to a lack of instrumentation to monitor earthquake activity.

When seismometers became available at a reduced rate from the Transportable Array project (funded through Earthscope by the National Science Foundation), the Phoenix Branch of AZGS took the lead in establishing a collaborative effort with all three State universities to pursue funding to acquire as many seismometers as possible.

AZGS was awarded a \$493,000 grant from the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation grant program (competitive nationwide). This award was unprecedented, and led to AZGS visibility across the nation as innovators.

The purpose of the grant is to address the lack of seismic data and to provide a **comprehensive seismic hazard evaluation** for inclusion in state and local Multi-Hazard Mitigation Plans (MHMP). As a result, AZGS was able to establish the first Arizona Integrated Seismic Network (AISN) in an effort to unite disparate sets of seismic data from smaller networks in the state.

Since its inception, the new network has recorded a number of earthquakes in Arizona and major events from border states that were felt in Arizona, including a M6.9 earthquake that shook high-rise buildings in Phoenix hard enough to cause the occupants to evacuate temporarily.

# GEOLOGIC MAPPING

## STATEMAP Project [\[§27-152.01-1\]](#)

The AZGS Economic Geology section leads the State Geologic Mapping (STATEMAP) Program and handles all bedrock mapping. In FY 2009, AZGS was awarded \$195,221 in federal funds with equal matching state funds for its 2009 STATEMAP Program. AZGS is gradually mapping the entire state at a scale of 1:24,000, with priorities set by an external committee of industry and agency representatives.

Since 1993, AZGS has been awarded nearly \$3 million in federal funds alone under the STATEMAP Program.

## STATEMAP '06-'07

AZGS was awarded \$202,392 by the USGS with \$203,430 matching state funds for geologic mapping in central and southeastern Arizona for September 2006 to September 2007. Deliverable maps were submitted and accepted in September 2007:

- Soza Canyon 7 ½' Quadrangle, Cochise and Pima Counties
- Wildhorse Mountain 7 ½' Quadrangle, Cochise County,
- Redington 7 ½' Quadrangle, Cochise, Graham, and Pima Counties
- East half of the Black Canyon City 7 ½' Quadrangle and the west half of the Squaw Creek Mesa 7 ½' Quadrangle, Maricopa and Yavapai Counties

## STATEMAP '07-'08

AZGS was awarded \$215,767 by USGS with \$216,250 matching state funds for September 2007 to September 2008, for geologic mapping in central and southeastern Arizona. Deliverable maps were submitted and accepted in September 2008:

- Lookout Mountain 7 ½' Quadrangle, Pinal County
- Mammoth 7 ½' Quadrangle, Pinal County
- Clark Ranch 7 ½' Quadrangle and the west half of the Rhodes Peak 7 ½' Quadrangle, Pinal and Graham Counties
- Peppersauce Wash 7 ½' Quadrangle, Pinal and Pima Counties

- Grasshopper Junction 7 ½' Quadrangle, Mohave County

## STATEMAP '08'09

AZGS was awarded \$217,761 with \$218,058 in matching state funds for September 2008 to September 2009. Field work is complete and map compilation and layout are underway for the following areas:

- Dolan Springs 7 ½' Quadrangle, Mohave County
- Chino Valley North 7 ½' Quadrangle, Yavapai County
- Helvetia, Empire Ranch, and Spring Water Canyon 7 ½' Quadrangles, Pima County

## State Route 95—Mohave County [\[§27-152.01-3\]](#)

**To support ADOT's efforts to re-route State Route 95, AZGS mapped nearly 250 square miles of surface and bedrock geology in Mohave Valley.** AZGS geologists identified and discussed various geologic hazards along the proposed highway route, and identified numerous potential sources of aggregate for construction. In the course of mapping, Charles Ferguson identified the caldera source of the widely dispersed, 18.5-Ma Peach Springs Tuff.

## Mapping Organ Pipe Cactus National Monument [\[§27-152.01-1\]](#)

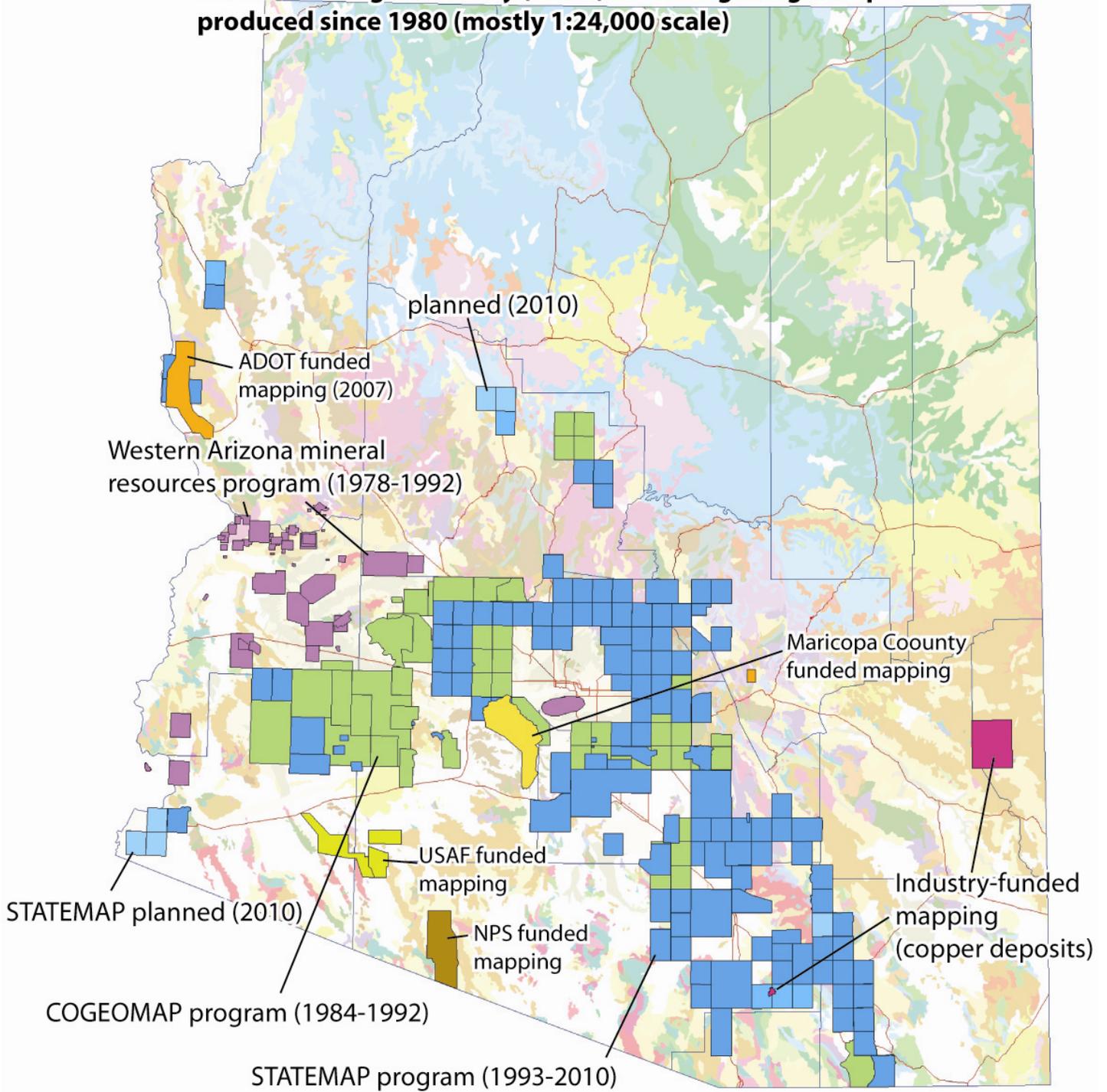
AZGS geologists are **mapping the surficial deposits of this national monument on the border with Mexico, in cooperation with the National Park Service**—an environmentally sensitive area with substantial border-related activity.

A draft geologic map of one 7.5 minute quadrangle has been submitted to the National Park Service. Additional mapping in this area is currently still in progress. AZGS plans to map the entire national monument that is accessible to the public.

## Basin Analysis [\[§27-152.01-1\]](#)

AZGS continues to build on a basin analysis program to characterize framework geology in support of hydrologic modeling efforts by other agencies.

**Arizona Geological Survey (AZGS) detailed geologic maps produced since 1980 (mostly 1:24,000 scale)**



Geologic maps produced by the Arizona Geological Survey with sponsoring or cooperating agencies.

# GEOLOGIC EXTENSION SERVICES

## GES Overview [§27-152.01]

The Geologic Extension Service (GES)—launched in mid-2007—was created to lead AZGS’ education and outreach programs, including:

- AZGS Bookstore
- Library
- AZGS Publishing House
- AZGS websites
- Technology transfer
- Outreach and education
- Bibliography of Arizona Geology (AZGeoBib)

GES’ chief role is to publish, promote, and disseminate the fruits of the Survey’s geologic research. In the space of a year, the Survey receives several thousand public inquiries and engages in about 20 outreach events involving schools, communities, and professional societies. AZGS geoscientists make scores of presentations throughout the year.

The Geologic Extension Service provides an expanded, holistic approach to deliver and interpret AZGS science in support of state and local agencies, the private sector, and the public.

**In 2009, AZGS published nearly 50 map sheets and 22 reports. AZGS distributes more than 80,000 PDF online copies of geologic maps, reports, and bulletins annually.**

Particularly popular were our out-of-print and rare publications on gold mining, mineral resources, and industrial minerals. The Survey is also collaborating with the Arizona Memory Project at the Arizona State Library to publish historic mine files online ([www.azmemory.lib.az.us](http://www.azmemory.lib.az.us)).

## Outreach & Public Inquiries [§27-152.01]

AZGS responds to more than 1,000 inquiries a year—by phone, email, and in-person from the public, industry, and state and federal government. AZGS provides authoritative guidance and technical information on mineral exploration and development, siting buildings and facilities, environmental hazards, and tourism opportunities.

The GES Outreach Program raises the profile of AZGS and alerts the public to the benefits derived from AZGS resources: Published reports and maps, AZGS library, and Down-to-Earth popular geology series. AZGS geoscientists engage in dozens of outreach events that include lectures, field trips, exhibits, and conferences.

### Outreach & Public Inquiries (by relative volume)

Topic		Primary Stakeholder Groups
Geology <sup>1</sup>	25%	Geoscientists, Public, State & federal Agencies
Outreach <sup>2</sup>	15%	Public
Published Materials <sup>3</sup>	15%	Public, Geoscientists, State & Federal Agencies
Mining & Mineral	12%	Geoscientists, Public, State & federal Agencies
Earth Fissures	10%	Public, Realtors, Geoscience Consultants
All others	25%	All

<sup>1</sup>Includes: bedrock geology, oil & gas, geothermal, hydrology, and related subjects.

<sup>2</sup>Includes presentations at other science outlets, e.g., Arizona Science Center, as well as working with dozen of K-12 teachers each year with curriculum development.

<sup>3</sup>Published materials includes: AZGS & USGS reports and maps, topographic maps, field guides and texts.

Recent GES appearances and support regularly include such venues as:

- Arizona Science Center (K-12 Educators, Back to School program)
- Arizona Sonora Desert Museum
- Presentations to Arizona High Schools (Seismicity, Volcanism, Earth fissures)
- Pima Community College No. Campus Earth Day Fair
- Arizona State University GeoFest
- Arizona State Parks Annual Vendors Fair
- Trade Fairs (to showcase the Down-To-Earth popular geology series)
- Phoenix Copper Square Street Fair
- Phoenix Outdoor Recreational Village—a public lands fair
- Gold Prospectors Association of Tucson
- Science Conferences
- Arizona Community Colleges Geoscience ATF Meeting
- Wickenburg Environmental Center
- Glendale Community College
- Pima County Library (Exhibit: Deconstructing Geologic Mapping)

As part of this program we also regularly draft and disseminate news releases of AZGS accomplishments and publications. In July and August 2009, we engaged the news media with releases on earth fissure study area maps, San Pedro Holocene maps, and new geologic maps along the proposed SR-95 route in Mohave Valley.

In October and November 2009, AZGS will host about a dozen earth fissure workshops for municipal and county authorities, realtors, and the public in Cochise, Maricopa, Pima, and Pinal Counties.

## AZGS Online [*\$27-152.01-2(c)*]

To ensure that its services are accessible to the public—at the local, state, and national level—AZGS developed and maintains six Web sites:

- **AZGS** [www.azgs.az.gov](http://www.azgs.az.gov)
- **Arizona Oil & Gas Conservation Commission** [www.azogcc.az.gov](http://www.azogcc.az.gov)
- **Explore Arizona** [www.explorearizona.org](http://www.explorearizona.org)
- **Geoinformatics** [www.geoinformatics.info](http://www.geoinformatics.info)
- **Geoscience Information Network** <http://usgin.org>, <http://lab.usgin.org>

The *Explore Arizona* site was taken offline after AZGS ended its partnership in the Phoenix center.

The AZGS Web site has become a major element of GES outreach efforts. The site receives about 5,300 visitors monthly with 12,000 to 15,000 total visits.

When AZGS uploaded its first earth fissure planning maps in 2007, monthly downloads jumped from several dozen to thousands. We now display hundreds of PDF items—including our newest Digital Geologic Maps and Digital Maps—and the download volume is upwards of 10,000 per month with about 100,000 downloads in FY-2009.

AZGS adopted an online publication model providing round-the-clock access to newly released geologic maps and reports at [www.azgs.az.gov](http://www.azgs.az.gov). And for the geosciences-GIS professional, we now market GIS data of newly released geologic maps.

Virtually all 700+ published Mylar maps have been scanned and soon should be offered digitally.

This Web-based approach to disseminating AZGS materials yielded exponential growth in distribution. For example, a map recently published online was downloaded 900+ times in two months—while we typically distribute only 10-20 print copies over several

### Quick AZGS Web Stats:

- More than 10 Gigabytes of data downloaded *per day*.
- 5.5 million pages requested—more than 15,000 pages *per day*.
- 5,300+ unique visitors a month—12,000 to 15,000 total visits a month
- Dozens of popular reports placed online for free download.
- Video and audio files available on various topics.

months. The bandwidth of [azgs.az.gov](http://azgs.az.gov)—a measure of download activity—has increased ten-fold from 4 GB to about 45 GB monthly since early 2007. With the recent advent of the Online Publications page—the eventual home to hundreds of AZGS publications—we anticipate monthly bandwidth activity

on the order of 60 to 80 GB (15,000 to 25,000 downloads) a month.

## Arizona Geology Blog [*\$27-152.01-2(c)*]

[www.arizonageology.blogspot.com](http://www.arizonageology.blogspot.com)

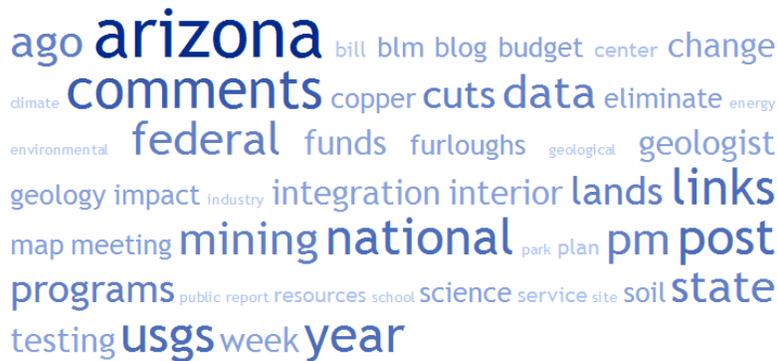
State Geologist Lee Allison started the first—and so far the only—blog among the State Geologists and one of the first by an Arizona state official, in 2007. The **Arizona Geology** blog meets the need for collecting and

sharing current activities, news, and opinions within the Arizona earth science community and broader audiences.

From March 2008, when we started tracking usage, through the end of June 2009, there were 1,423 posts,

attracting 83,409 visitors,

105,537 visits, and 156,879 page views.



**Arizona Geology blog**

Arizona Geology is currently ranked #20 in the top 25 geology blogs by BlogRank based on a set of 20 factors. The blog is also ranked #10 based on sites linking to it and #1 by the number of pages posted. To view the current BlogRank listings visit [www.invesp.com/blog-rank/Geology](http://www.invesp.com/blog-rank/Geology).



## Library [§27-152.01-4]

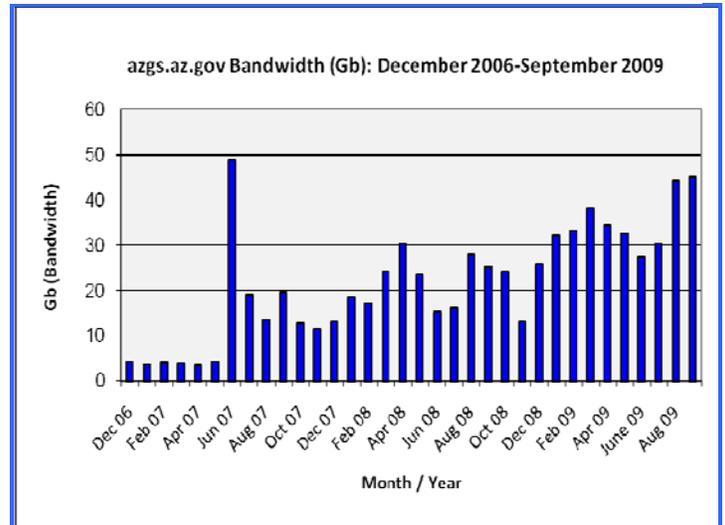
AZGS maintains an **extensive collection of technical resources that is open to the public** and available during regular business hours. These resources are used regularly by consultants, academic researchers, and the mineral exploration industry.

The AZGS Library comprises about **13,500 volumes** that include a complete suite of USGS Arizona-related publications, US Bureau of Mines Publications, and thousands of texts, reports, theses and dissertation, and maps on Arizona geology.

Additionally, the library hosts about 82 linear feet of mine files – maps, reports, cross-sections, descriptions, letters of inquiry, and newspaper clippings. Much of this is one-of-a-kind material and irreplaceable. Stakeholders include the geosciences community, other state and federal agencies and the public.

Each year the library receives several hundred visitors, as well as hundreds of phone calls and e-mails requesting information or citations. We generally respond to information requests in one to two hours. Whenever possible, and where copyright law permits, we scan requested information and deliver it via e-mail.

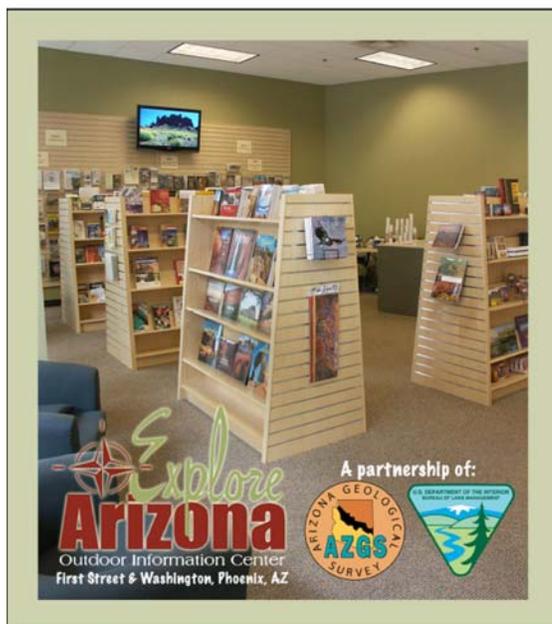
The AZGS library receives several substantial donations of geologic texts, theses and dissertations, maps, reports, aerial photographs and other related materials each year. In FY-2009, we received four substantial donations, one of which included more than a thousand aerial photographs of SE Arizona.



## Phoenix map store & information center [§27-152.01-2(d)]

AZGS opened a **map store and information center in downtown Phoenix** in 2008 to provide topo map coverage for the entire state—more than 2,000 separate maps—and technical publications that were previously available only from the AZGS Tucson store. The center was a partnership with the Arizona state office of the US Bureau of Land Management.

Subsequent to budget cuts that forced the center's closure in FY2009, it was becoming a **one-stop shop for all state and federal publications and materials natural resources, hazards, environment, and recreation in Arizona**. The center was opened using AZGS internal funds. The store space, utilities, and one full-time staff person were provided by BLM.



The center *Explore Arizona* gave AZGS an outlet in the state's largest city and government and commercial center, while providing services that were not easily undertaken by BLM. BLM provided first-class retail space in the Phelps Dodge Tower and staffing for the daily operations. AZGS ran it as a retail operation but with a significant public outreach and information center.

In Spring, 2008, we cancelled our agreement with BLM because of state budget cuts. Although sales were increasing faster than originally planned, it was still

going to be 18-24 months until the center might be self-supporting.

## Bibliography of Arizona Geology (AZGeoBib) [§27-152.01-2(b)]

**AZGeoBib is a powerful online research tool that contains over 13,000 citations.** It is available online along with some tips on how to conduct fruitful searches. Unfortunately, over the past several years resources have not been available for new data entry and the database is no longer current. Bringing this up-to-date should be a priority of GES.



# GEOINFORMATICS

## Overview

The AZGS Geoinformatics section was formed in 2006 to integrate the IT, GIS, and data base management functions. The section supports geologic map production and construction of a GIS database for *Arizona Geology*, which includes a geologic map index, the bibliography of *Arizona Geology*, and geologic map data at 1:24000, and 1:100,000, and 1:1,000,000 scales.

Key duties:

- IT internal support
- GIS internal support
- Digital products
- Database development and maintenance

Report period projects:

- Geoscience Information Network (funding: National Science Foundation and USGS)
- Data preservation (funding: USGS)
- Tonto National Forest digitization of geological maps (funding: USFS)
- Enterprise geodatabase for AZGS products and data

## Geoscience Information Network (GIN) [§27-152.01-4]

**AZGS has a lead role in a number of ground-breaking national geoinformatics programs:** the national Geoscience Information Network project (GIN; <http://usgin.org>), the National Geological and Geophysical Data Preservation Program (NGGDPP), the USGS National Cooperative Geologic Mapping Database project, and participating in IUGS-CGI Working Group efforts to develop and implement digital information exchange standards (GeoSciML).

The AZGS is dedicated to constructing the **Geoscience Information Network (GIN)**: a joint effort of state geological surveys and the USGS to create a national, distributed, interoperable data network for the geosciences, using open-source standards and protocols.

Funding for GIN comes from the National Science Foundation and USGS. The chief collaborators include: OneGeology-Europe, San Diego Supercomputer Center, EarthChem, and a number of corporate partners, including Microsoft and Schlumberger-MetaCarta.

This project is a nexus of most of the activities in the section. Web services are being implemented to serve geologic map data directly by the internet. A catalog service to search metadata describing information resources is being developed and a prototype is online. AZGS is part of the Geothermal Data Consortium which was awarded a US Department of Energy grant of \$5 million to use GIN in creating the National Geothermal Data System.



Members of the GeoSciML Working Group from seven countries during a break at AZGS in June 2007

## Data Preservation [§27-152.01-4]

The National Geological & Geophysical Data Preservation Program was established by Congress in the 2005 Energy Act with the support of the State Geological Surveys and in response to a National Research Council study that found large amounts of irreplaceable and critical geoscience data and samples were being lost or destroyed. The program is administered by the U.S. Geological Survey and includes a cost share program with State Geological Surveys.

AZGS is an enthusiastic supporter of the program and views it as a valuable aid to our efforts to inventory all our data and samples to be made available in online digital catalogs.

In FY08, **AZGS inventoried over 600 internal collections--of maps, reports, photos, digital files, samples, and more**—that fall into 23 broader categories. These were entered into the new National Digital Catalog. In FY09, AZGS was developing metadata records for key data sets in the NDC

# PHOENIX BRANCH OFFICE [§27-152.01]



## Overview

In addition to conducting geologic investigations, the nascent Phoenix Branch established in 2007 serves as a **hub for working and communicating with AZGS stakeholder agencies, business and industry, the general public, and the media**. Phoenix staff work on a variety of projects, including surface, subsurface, and bedrock geology, basin analysis, and geologic hazard investigations.

## Government Liaison [§27-152.01]

The Phoenix Branch Chief serves as the **liaison to other state agencies, the legislature, members of the state executive branch, and stakeholders**.

The liaison provides a conduit for delivering communications and materials, many of which are of a sensitive nature, urgent, or time-dependent. The Phoenix-based liaison is time and cost-effective, reducing the need to deploy staff from Tucson to handle these duties.

The Phoenix Branch **established the Arizona Association of Government Geoscientists as a support and communication network** for over fifty geoscientists employed by seven different state agencies. AAGG meets bi-monthly, hosted by a different agency, which presents an overview of their activities and projects, each meeting.

## Geologic Hazards [§27-152.01-1(c)]

The Phoenix Branch is responsible for **managing the Arizona Integrated Seismic Network**, which is comprised of seismometers operated by AZGS, Northern Arizona University, and the U.S. Geological Survey. In addition, the Chief coordinates related seismic activities with our collaborators at the state universities, as well as delivering public information about earthquakes in, or affecting, Arizona.

The Phoenix Branch Chief is also the point of contact for the Arizona Division of Emergency Management for emergencies and disasters requiring geological expertise.

AZGS is able to increase its range of rapid response to geological events by having staff co-located in Phoenix, who have provided technical expertise for many major events, including:

- 2008 flood at Havasupai
- 2008 southern California earthquake swarms
- 2008 Easter weekend SR-87 landslide
- 2007 earth fissure re-opening that killed a horse in Queen Creek

State and local agencies regularly rely on the AZGS Phoenix staff to advise on such issues as:

- Earth fissures that impact homes and infrastructure (e.g., Queen Creek, Glendale)
- Sinkholes (e.g., a sinkhole that opened up in the middle of a major road in Gilbert)
- Flood and flash flood hazards and secondary hazards (e.g., Maricopa County Department of Emergency Management)
- Flood interactions with earth fissures (Flood Control District of Maricopa County)
- Earthquakes (e.g., M5.1 Mexicali earthquake that caused damage in Yuma)
- The geologic hazards portion of the monthly threat matrix (produced by ADEM)

Other critical hazard roles the AZGS Phoenix Branch fulfills includes:

- Providing **geologic hazard profiles** for the State of Arizona Multi-Hazard Mitigation Plan (the Plan must be FEMA-approved and adopted by the State in order for Arizona to receive most categories of federal disaster funding, as well as enabling AZGS to obtain funding from FEMA mitigation grants)
- Increasing AZGS participation in the **State Emergency Response and Recovery Plan**, which is promulgated by the governor and which outlines the duties each State agency fulfills in the event of a disaster
- **AZGS representative to the State Emergency Operations Center** in the event of an emergency or disaster with geologic implications

### Seismic activities

In 2009, FEMA designated the Phoenix Branch Chief as their earthquake program management primary point of contact.

The Phoenix Branch expanded its hazards projects to include **building the first statewide-integrated seismic network**.

Also, AZGS coordinates the Arizona Integrated Seismic Network, incorporating eight broadband seismometers AZGS adopted from EarthScope’s Transportable Array program, with the assistance of a grant from the Federal Emergency Management Agency, six analogue seismometers part of the Arizona Earthquake Information Center run by Northern Arizona University, as well as data collected from four Advanced National Seismic System seismometers handled by University of Arizona, the USGS, and others.

Arizona’s three research universities support the network acquisition. The network’s primary goal is to **gather additional seismic hazard data** for the State to be incorporated into a **comprehensive update of state and local hazard mitigation plans**; secondary benefits include new data for shallow crustal structure, as well as deep earth studies.

### Pursuit of Outside Funding Sources [§27-152.01-1]

AZGS Phoenix **brought in more than**

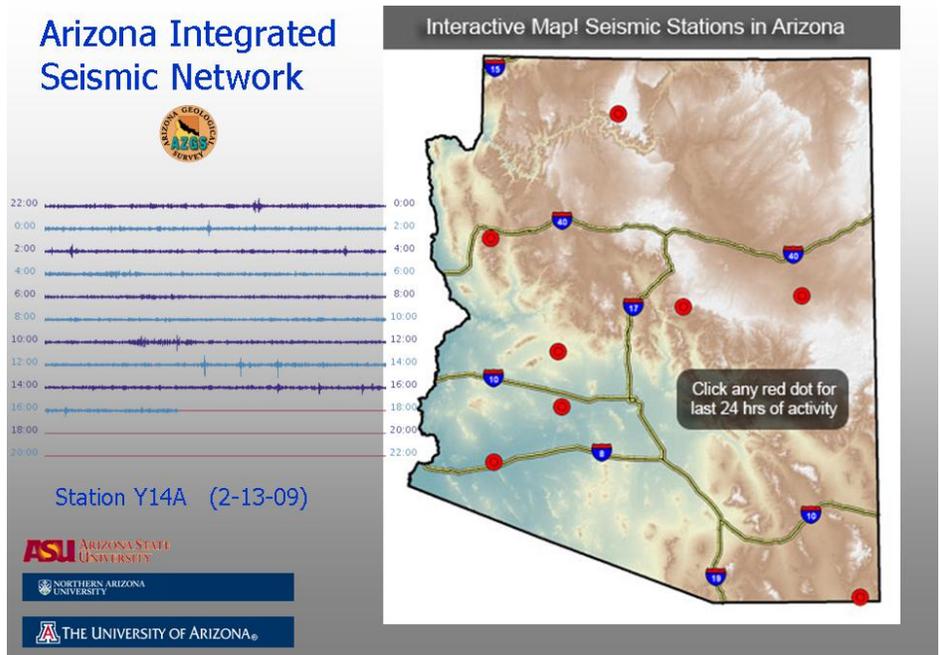
### \$600,000 of funding from outside sources:

- \$572,000 from the FEMA Pre-Disaster Mitigation grant program for the AINS
- \$30,000 from the FEMA Hazard Mitigation Grant Program for the Earth Fissure Education project
- \$82,808 from the Havasupai Tribe for post-flood hazards analysis and mitigation
- A to- be-determined amount for the WESTCARB carbon sequestration project

### Outreach & Public Inquiries [§27-152.01]

The Phoenix Branch handles **upward of several hundred public inquiries per year**, on topics ranging from mining, geologic resources, publications and maps, geologic hazards, and internship and employment opportunities. The requests come from such diverse sources as televised and print media, prospectors, state and local agencies, homeowners, home builders, realtors, and students.

The Branch Chief also gives a wide variety of presentations to these same groups on topics such as AZGS capabilities and projects, geologic hazards, gold prospecting, mineral resources, asbestos, geologic resources, land use planning considerations, and aggregate quarry issues.



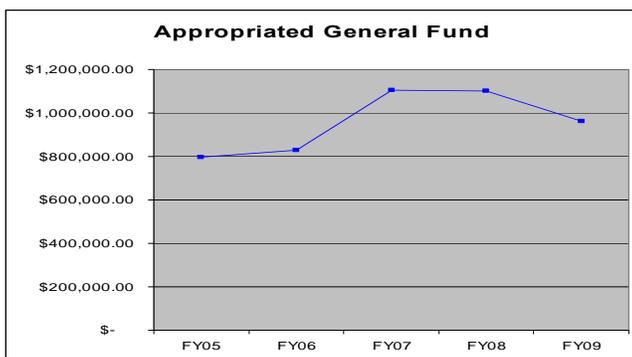
## AZGS BUDGET

AZGS revenues come from appropriations of State General Funds by the Arizona Legislature, sales of publications, and grants and contracts. The Survey charges an indirect cost on external grants and contracts to cover administrative and support costs of those projects. By statute, the revenues from the indirect costs and publication sales are non-lapsing, that is, balances at the end of the state fiscal year are automatically carried over to the next fiscal year.

### STATE GENERAL FUND APPROPRIATION

The Legislature appropriated \$232,000 in FY07 to fund the newly authorized Earth Fissure Mapping Program.

The actual reductions to operating funds were substantially higher because the reductions appear to be offset by increased allocation of state funds for uncontrollable expenses. However, these allocated funds were immediately transferred back to the state to cover mandated higher fees for rent and other state services. Thus, they tend to cover up offsetting budget reductions.



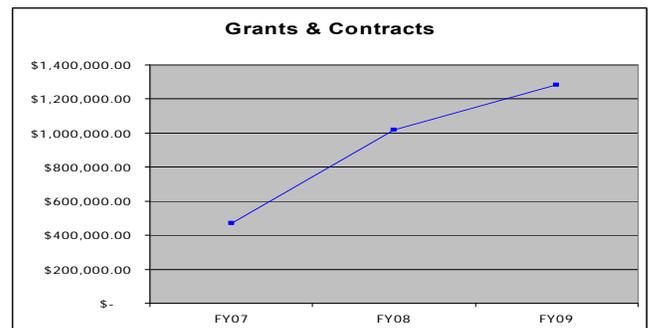
The State General Fund appropriation jumped in FY2007 due to the implementation of the Earth Fissure Mapping Program. The drops in FY2008 and FY2009 are due to budget cuts resulting from the economic downturn. They are partially offset by 'annualization' increases for rent and other uncontrollable costs. AZGS started FY2009 with a 5 percent reduction, and

took another set of cuts of 14.2 percent in early 2009. The net reduction of General Fund appropriations for the FY 2008-2009 period was 17.1 percent; the reduction of controllable funds was 26.8 percent.

### CONTRACTS AND GRANTS

The number and dollar value of contracts and grants increased dramatically during the report period with projects coming from federal, state, and local agencies. AZGS contracted with a variety of agencies for the first time in our history. Part of the big jump in federal funds from FY2008 to FY2009 is due to the one-time acquisition of seismic stations from the EarthScope USArray network, using funds from the Federal Emergency Management Agency (FEMA).

A complete list of externally-funded projects follows this section.



### MAP AND BOOK STORE SALES

The AZGS Map and Bookstore in Tucson sells all agency publications and maps and serves as the official USGS Earth Science Information Center for Arizona, which includes carrying all of the nearly 2,000 USGS topographic maps for Arizona.

The store also carries topographic maps produced by the US Forest Service and US Bureau of Land Management.

AZGS acts under contract as the primary sales outlet for the Arizona Geological Society, a non-profit professional group, headquartered in Tucson.

# AZGS GRANT AND EXTERNALLY-FUNDED PROJECTS

AZGS has a long history of seeking and obtaining external funding for its programs and services. Diverse funding sources include federal, state, local, and other agencies and organizations.

## Currently Active Projects

### Federal

#### Arizona Integrated Seismic Network

**\$493,000** (FEMA 2009, 3 years)

25% state matching funds

#### Earth Fissures Education

**\$28,222** (FEMA 2007, 2 years)

#### INTEROP Geoscience Information Network (GIN)

**\$749,246** (NSF 2008, 3 years)

#### STATEMAP 2009

**\$195,221** (USGS 2009, 1 year)

\$195,221 state matching funds

#### Surficial Geologic Mapping in Organ Pipe Cactus National Monument

**\$192,000** (NPS 2009, 2007, 4 years)

#### Arizona Geoscience Information Network

\$16,620 (National Geological & Geophysical Data Preservation Program, USGS, 2009, 1 year)

\$16,803 state matching funds

### State, local, & other funding

#### Black Hills Tank Dam Removal Project

**\$2,000** (Scottsdale, AZ 2009, 1 year)

#### Mapping Holocene Floodplain Alluvium 2009

**\$290,000** (ADWR 2008, 2 years)

#### Evaluation of Havasu Geologic Hazards

**\$83,000** (Havasupai Tribe 2009, 1 year)

#### WESTCARB CO<sub>2</sub> Sequestration

**\$230,000** (WESTCARB, pending)

\$23,000 state matching funds

#### Maricopa County Alluvial Fan Hazard Identification and Mitigation

**\$20,500** (Maricopa County 2009, 1 year)

#### Peach Spring Tuff: Supereruptions—Magma Chambers and Plutonic Residue

\$29,173 (Vanderbilt University via NSF 2009, 3 years)

#### National Geothermal Database System

**\$691,003** (Boise State University via DOE 2009, 5 years)

## Projects Completed 2006-2008

### Federal

#### Delineating Post-Wildfire Debris Flow Hazards for Pre-Fire Mitigation

**\$25,000** (FEMA 2006, 2 years)

#### Highway 93: Geologic & Natural History

**\$17,000** (Nevada Bureau of Mines and Geology (via BLM) 2005, 3 years)

#### Digitization of Geologic Maps in Tonto National Forest

\$50,000 (U.S. Forest Service, 2008)

\$65,328 state matching funds

#### A Workshop on the Role of State Geological Surveys and U.S. Geological Survey in a Geological Information System for the Nation

\$15,000 (National Science Foundation – on behalf of AASG, 2007)

### State, local, & other funding

#### Highway 95: Geologic Mapping Along Proposed Roadway Realignment

**\$65,000** (ADOT 2007, 2 years)

#### Hydro 2009: Subsurface Investigation of Higley Basin

**\$239,000** (State of Arizona 2008, 1 year)

#### Hydro 2008: Subsurface Investigation of Higley Basin

**\$412,000** (State of Arizona 2007, 1 year)

### **Hydro 2008: Subsurface Investigation of Priority Basins**

**\$181,000** (State of Arizona 2006, 1 year)

### **Santa Catalina Debris Flow Hazards Mapping**

**\$45,000** (Pima County 2007, 1.5 years)

### **Mapping Holocene Floodplain Alluvium 2007-09**

**\$270,000** (ADWR 2007, 2 years)

### **STATEMAP 2008**

**\$217,761** (USGS 2008, 1 year)

\$217,762 state matching funds

### **STATEMAP 2007**

**\$215,767** (USGS 2007, 1 year)

\$215,767 state matching funds

### **STATEMAP 2006**

**\$202,392** (USGS 2006, 1 year)

\$202,392 state matching funds

### **Arizona Geoscience Information Network**

**\$24,959** USGS National Geological & Geophysical Data Preservation Program, 2008, 1 year)

\$25,021 state matching funds

### **Arizona Geoscience Information Network**

**\$5,000** USGS National Geological & Geophysical Data Preservation Program, 2008, 1 year)

\$5,245 state matching funds

## **External Advisory Groups**

AZGS maintains three external advisory groups as authorized by ARS 27-151.C.3.

The **State Mapping Advisory Committee** (SMAC) sets regional priorities and criteria for geologic mapping by the AZGS for each year. SMAC is established in accordance with rules for the STATEMAP component of the National Cooperative Geologic Mapping Program run by the U.S. Geological Survey. This allows AZGS to successfully compete for funding in the STATEMAP program. AZGS mapping staff propose individual quadrangles to map, in each of the areas selected by SMAC. SMAC meets annually in the early fall.

The **Earth Fissure Advisory Group** (EFAG) was established in 2006 to review and recommend policies, procedures, standards, and protocols for the Earth Fissure Mapping Program.

The **Arizona Land Subsidence Group** (ALSG) is an independent, informal association of mostly geologists and engineers, who have professional interest in subsidence and related phenomena including Earth fissures. At the request of the State Geologist, ALSG serves as technical reviewers and advisors to the AZGS Earth fissure mapping program. ALSG reviews each new fissure study area map prior to its release to ensure accuracy, clarity, and completeness.

# ARIZONA GEOLOGICAL SURVEY PUBLICATIONS: 2006-2009



## Publication Series

- Arizona Geology Newsletter
- Contributed Maps
- Contributed Reports
- Digital Geologic Maps
  - Debris Flow
  - Earth Fissure
- Digital Information
- Down to Earth
- Oil & Gas
- Open-File Reports

## Arizona Geology Newsletter

*Published online since April 2009; print circulation was 4,100 subscribers.*

**Vol. 36, No. 1, Spring 2006.** Bigfoot Arrives in Arizona (L. Abbott and T. Cook).

**Vol. 36, No. 2, Summer 2006.** New Geologic Mapping of Petrified Forest National Park Aids in Understanding Evolution of Land Animals in Arizona (J.J. Raucci, R.C. Blakey and P.J. Umhoefer).

**Vol. 36, No. 3, Fall 2006.** Recent Debris Flows and Floods in Southern Arizona (P.A. Pearthree and A. Youberg).

**Vol. 36, No. 4, Winter 2006.** The Role of AZGS in Mapping Earth Fissures in Arizona (M.L. Allison and T.C. Shipman).

**Vol. 37, No. 1, Spring 2007.** The Role of AZGS in Mapping Earth Fissures in Arizona (M.L. Allison and T.C. Shipman).

**Vol. 37, No. 2, Summer 2007.** Therizinosaur – Mystery of the Sickie-Claw Dinosaur (D.D. Gillette).

**Vol. 37, No. 3, Fall 2007.** Detection of a Unique Earthquake Swarm in Eastern Arizona (K.C. Eagar and M.J. Fouch).

**Vol. 38, No. 1, Spring 2008.** Is Carbon Sequestration in Arizona's Future? (S.L. Rauzi).

**Vol. 38, No. 2, Summer 2008.** Arizona has Potash (S.L. Rauzi).

**Vol. 38, No. 3, Fall/Winter 2008.** Tracking Arizona's Ancient Landscapes (W. Ranney and R. Blakey).

**Vol. 39, No. 1, Spring 2009.** [*1<sup>st</sup> edition of the Online E-Newsletter*] Sunset Crater Volcano: A cinder cone eruption that impacted the ancestral Puebloan Indians (S. Hanson).

**Vol. 39, No. 2, Summer 2009.** Holocene Mapping of the San Pedro River System: A geologic approach to an environmental problem – water resource management (AZGS Staff).



## Contributed Maps

**CM-06-A, 2006.** Surficial Geologic Map of the Mount Hopkins and northern part of the San Cayetano Mountains 7.5' Quadrangles, Santa Cruz and Pima Counties, Arizona. One color map, scale 1:24,000 (D.A. Lindsey and B.S. Van Gosen).

**CM-07-A, 2007.** Geologic Map of the Black Canyon City and Squaw Creek Mesa area, Central Arizona (R.S. Leighty).

**CM-08-A, 2008.** Geologic Map of the Southeastern Santa Catalina Mountains, Pima County, Arizona (A. Bykerk-Kauffman).

## Contributed Reports

**CR-06-A, 2006.** K-Ar Dates of Fault Rocks Along the Catalina Detachment Fault, Tanque Verde Ridge, Rincon Mountains, Arizona, v. 1.0 (Damon, P.E. and Shafiqullah, M.).

**CR-06-B, 2006.** New Theropod Locality at the Jurassic Recreation Red Beds, Tucson Mountains, Arizona (Collins, M.J.).

**CR-07-A, 2007.** Clifton Hot Springs, Arizona: GRED III Final Report, 1-CD-ROM (Brown, D.E.).

**CR-07-B, G., 2007.** Geology of the Bloody Basin: Central Arizona's Transition Zone, CD-ROM, one map sheet, scale 1:24,000 (Rhys-Evans, G.).

**CR-07-C, 2007. Land Subsidence and Earth Fissures in Arizona: Research and Informational Needs for Effective Management, Arizona Land Subsidence Group, p. 21.**  
Free online at [www.azgs.az.gov](http://www.azgs.az.gov)

**CR-08-A, 2008. The Geology of the Safford-San Carlos Area, Graham and Gila Counties, east-central Arizona, 1-CD-ROM (Mock, P.A.).**

**CR-08-B, 2008. Extent of Uranium Mineralization in the Guindani Canyon Area of the central Whetstone Mountains, Cochise County, Arizona (Corn, R.M.), 22 p,**  
available free online at [www.azgs.az.gov](http://www.azgs.az.gov).

**CR-08-C, 2008. Conglomerate Clast Counts in Oligocene-Miocene Strata north from the Catalina Core Complex to the Gila River Valley, southeastern Arizona (Dickinson, W.R.),**  
available free online at [www.azgs.az.gov](http://www.azgs.az.gov).

**CR-08-D, 2008. Facies Reconnaissance of the upper Miocene Big Sandy Formation near Wikieup, Mohave County, Arizona (Dickinson, W.R.),**  
available free online at [www.azgs.az.gov](http://www.azgs.az.gov).

**CR-09-A, 2009. Stratigraphic, Sedimentologic and Paleobotanical Investigations of Terrace Gravels, U.S. Army Yuma Proving Grounds (Nations, D., Swift, R.L., Croxson, F. III and Betts, R., (from 1998 unpublished report)), 101p. w\ 3 appendices, 21 plates.**  
Available free online.

## Digital Geologic Maps

*Available on CD-ROM and printed on request*

**DGM-46, 2006. Geologic Map of the Flatiron Mountain 7.5' Quadrangle, Maricopa County, Arizona, v. 1.0**  
(Spencer, J.E., Youberg, A. and Ferguson, C.A.).

**DGM-47, 2006. Geologic Map of the Wintersburg 7.5' Quadrangle, Maricopa County, Arizona, v. 1.0** (Pearthree, P.A., Ferguson, C.A., and Harris, R.C.).

**DGM-48, 2006. Geologic Map of the Saint David 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Youberg, A.).

**DGM-49, 2006. Geologic Map of the Land 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Shipman, T.C. and Ferguson, C.A.).

**DGM-50, 2006. Geologic Map of the Fairbank 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Ferguson, C.A., Shipman, T.C., Pearthree, P.A., Moore, E.M., Richard, S.M. and Spencer, J.E.).

**DGM-51, 2006. Geologic Map of the Lewis Springs 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Pearthree, P.A., Ferguson, C.A. and Demsey, K.A.).

**DGM-52, 2007. Estimated Depth to Bedrock in Arizona, v 1.0** (Richard, S.M., Shipman, T.C., Greene, L.C. and Harris, R.C.).

**DGM-53, 2007. Geologic Map of the Needles NE-7.5' Quadrangle, Mohave County, Arizona, v.1.0** (Pearthree P.A.).

**DGM-54, 2007. Geologic Map of the Boundary Cone 7.5' Quadrangle, Mohave County, Arizona, v.1.0** (Spencer, J.E., Ferguson, C.A., Pearthree P.A. and Richard, S.M.).

**DGM-55, 2007. Geologic Map of the Fortuna 7.5' Quadrangle, Yuma County, Arizona, v 1.0** (Shipman, T.C., Richard, S.M. and Spencer, J.E.).

**DGM-56, 2007. Geologic Map of the Galleta Flat East 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Youberg, A., Spencer, J.E. and Richard, S.M.).

**DGM-57, 2007. Geologic Map of the Hereford 7.5' Quadrangle and the Northern Part of the Stark 7.5' Quadrangle, Cochise County, Arizona, v 1.0** (Cook, J.P., Shipman, T.C. and Pearthree, P.A.).

**DGM-58, 2007. Bedrock Geologic Map and Cross-Sections of the Hereford 7.5' Quadrangle, Cochise County, Arizona, v. 1.0** (Ferguson C.A. and Johnson B.J.).

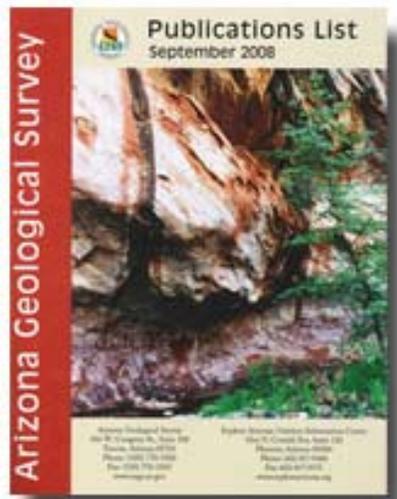
**DGM-59, 2007. Geologic Map of the Rosemont area, northern Santa Rita Mountains, Pima County, Arizona, v. 1.1** (Johnson, B.J. and Ferguson, C.A.).

**DGM-60, 2008. Geologic Map of the Redington 7½' Quadrangle, Cochise, Graham, and Pima Counties, Arizona, v 1.0** (Cook, J.P. and Spencer, J.E.).

**DGM-61, 2008. Geologic Map of the Soza Canyon 7½' Quadrangle, Cochise and Pima Counties, Arizona, v 1.0** (Spencer, J.E., Richard, S.M., Cook, J.P., Dickinson, W.R., Lingrey, S.H. and Guynn, J.H.).

**DGM-62, 2008. Geologic Map of the Wildhorse Mountain 7½' Quadrangle, Cochise County, Arizona, v 1.0** (Spencer, J.E., Cook, J.P., Lingrey, S.H., Richard, S.M., Ferguson, C.A., and Guynn, J.H.).

**DGM-63, 2008. Geologic Map of the Antelope Peak NE 7 ½' Quadrangle and the southern 2/3 of the Maricopa 7 ½' Quadrangle, Pinal County, Arizona, v.1.0** (Pearthree, P.A., Ferguson, C.A., and Mahan, M.K.).



**DGM-64, 2008. Geologic Map of the east half of the Black Canyon City 7 ½' Quadrangle and the west half of the Squaw Creek Mesa 7 ½' Quadrangle, Maricopa and Yavapai Counties, Arizona, v. 1.0** (Ferguson, C.A., Haddad, D. E., Johnson, B.J., Guynn, J. H., and Spencer, J.E.).

**DGM-65, 2009. Geologic Map and Report for the Proposed State Route 95 Realignment Corridor, Mohave County, Arizona, version 1.0** (Pearthree, P.A., Ferguson, C.A., Johnson, B.J., and Guynn, J.) 5 Sheets, scale 1:24,000, 47 p.

**DGM-71, 2009, Surficial Geologic Map and Flood Hazard Assessment, Rainbow Valley, Maricopa County, Arizona, v 1.0** (Pearthree, P.A., Youberg, A., Shipman, T.C.) 1 CD-ROM

*Reversioned DGMs – 2009 (For which GIS data are now available):*

**DGM-34 v. 2.0, 2009. Geologic Map of the Benson 7½' Quadrangle, Cochise County, Arizona** (Youberg, A., Skotnicki, S.J., Ferguson, C.A., Cook, J.P., and Shipman, T.C.), 1 sheet, layout scale 1:24,000.

**DGM-36 v. 2.0, 2009. Geologic Map of the Huachuca City 7½' Quadrangle, Cochise County, Arizona** (Pearthree, P.A. and Youberg, A.), 1 sheet, layout scale 1:24,000.

**DGM-48 v 2.0, 2009. Geologic Map of the Saint David 7½' Quadrangle, Cochise County, Arizona** (Youberg, A. and Cook, J.P.), 1 sheet, layout scale 1:24,000.

**DGM-49 v. 2.0, 2009. Geologic Map of the Land 7½' Quadrangle, Cochise County, Arizona** (Shipman, T.C., Ferguson, C.A., Cook, J.P., and Haddad, D.E.), 1 sheet, layout scale 1:24,000.

**DGM-50 v. 2.0, 2009. Geologic Map of the Fairbank 7½' Quadrangle, Cochise County, Arizona** (Ferguson, C.A., Shipman, T.C., Pearthree, P.A., Moore, E.M., Richard, S.M., Spencer, J.E., Youberg, A., Cook, J.P., and Haddad, D.E.), 1 sheet, layout scale 1:24,000, with text.

**DGM-51 v. 2.0, 2009. Geologic Map of the Lewis Springs 7½' Quadrangle, Cochise County, Arizona** (Pearthree, P.A., Ferguson, C.A., Demsey, K.A., Haddad, D.E., and Cook, J.P.), 1 sheet, layout scale 1:24,000, with text.

**DGM-56 v. 2.0, 2009. Geologic Map of the Galleta Flat East 7½' Quadrangle, Cochise County, Arizona** (Youberg,

A., Spencer, J.E., Richard, S.M., and Cook, J.P.), 1 sheet, layout scale 1:24,000, with text.

**DGM-57 v. 2.0, 2009. Geologic Map of the Hereford 7½' Quadrangle and the northern part of the Stark 7½' Quadrangle, Cochise County, Arizona** (Cook, J.P., Shipman, T.C., Pearthree, P.A., and Haddad, D.E.), 1 sheet, layout scale 1:24,000, with text.

**DGM-60 v. 2.0, 2009. Geologic Map of the Redington 7½' Quadrangle, Cochise, Graham and Pima Counties, Arizona** (Cook, J.P. and Spencer, J.E.), 1 sheet, layout scale 1:24,000, with text.

**DGM-61 v 2.0, 2009. Geologic Map of the Soza Canyon 7½' Quadrangle, Cochise and Pima Counties, Arizona** (Spencer, J.E., Richard, S.M., Cook, J.P., Dickinson, W.R., Lingrey, S.H., and Guynn, J.H.), 1 sheet, layout scale 1:24,000, with text.

**DGM-62 v 2.0, 2009. Geologic Map of the Wildhorse Mountain 7½' Quadrangle, Cochise County, Arizona** (Spencer, J.E., Cook, J.P., Lingrey, S.H., Richard, S.M., and Guynn, J.H.), 1 sheet, layout scale 1:24,000.

## Digital Maps—Debris Flows

*The Debris Flow (DF) subseries of the Digital Map Series (DM) focuses on maps showing debris flow deposits. Maps DM-DF-1A through DM-DF-1K are published as part of OFR-08-06 by Ann Youberg, Michael L. Cline, Joseph P. Cook, and Philip A. Pearthree. All DF maps are scaled at 1:6000.*

**DM-DF-1A. Debris-Flow Deposits at the Mouths of Molino, La Milagrosa and Agua Caliente Canyons, Pima County, AZ** (Youberg, A., Cline, M.L., Cook, J.P. and Pearthree, P.A.).

**DM-DF-1B, 2008. Debris-Flow Deposits at the Mouth of Soldier Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1C, 2008. Debris-Flow Deposits at the Mouth of Gibbon Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1D, 2008. Debris-Flow Deposits at the Mouths of Sabino and Bear Canyons, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1E, 2008. Debris-Flow Deposits at the Mouths of Esperero and Bird Canyons, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1F, 2008. Debris-Flow Deposits at the Mouth of Ventana Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1G, 2008, Debris-Flow Deposits at the Mouths of Finger Rock and Pontatoc Canyons, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1H, 2008, Debris-Flow Deposits at the Mouth of Cobblestone Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

**DM-DF-1I, 2008, Debris-Flow Deposits at the Mouth of Pima Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P., and Pearthree, P.A.).

**DM-DF-1J, 2008, Debris-Flow Deposits at the Mouth of Putsch Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P., and Pearthree, P.A.).

**DM-DF-1K, 2008. Debris-Flow Deposits at the Mouth of Linda Vista Canyon, Pima County, AZ** (Youberg, A., Cline, M.L., Cook J.P. and Pearthree, P.A.).

## Digital Maps—Earth Fissures

*The Earth Fissure (EF) subseries of the Digital Map Series (DM) is focused on earth fissure maps published as part of AZGS's state-wide Earth Fissure Mapping Program. DM-EF maps are published at either 1:12,000-scale or 1:24,000-scale. Individual maps are available free in PDF format at [www.azgs.az.gov/efmaps](http://www.azgs.az.gov/efmaps).*

**DM-EF-1, 2008. Earth Fissure Map of the Chandler Heights Study Area: Pinal and Maricopa Counties, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-2, 2008, Earth Fissure Map of the Apache Junction Study Area: Pinal and Maricopa Counties, AZ** (Arizona Geological Survey), 1 sheet, scale 1:12,000.

**DM-EF-3, 2009, Earth Fissure Map of the Picacho Study Area: Pinal County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-4, 2008. Earth Fissure Map of the Mesa Study Area: Maricopa County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

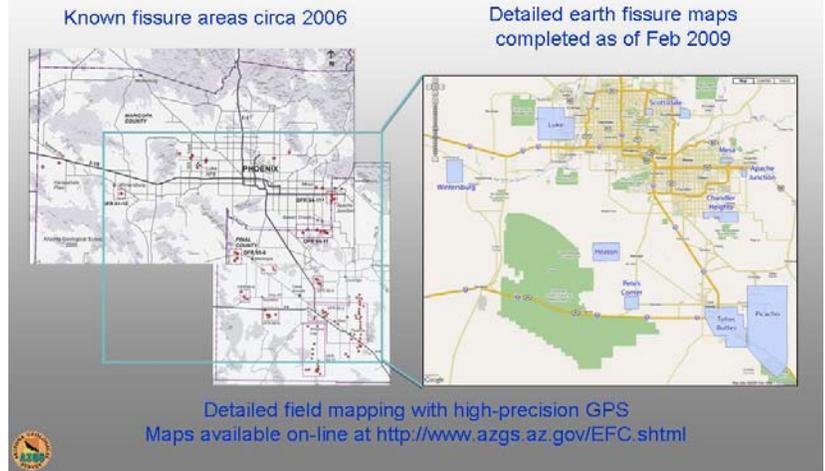
**DM-EF-5, 2008. Earth Fissure Map of the Scottsdale Study Area: Maricopa County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-6, 2008. Earth Fissure Map of the Toltec Buttes Study Area: Pinal County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-7, 2008. Earth Fissure Map of the Pete's Corner Study Area: Pinal County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

## Earth Fissure Mapping Program

State-mandated



**DM-EF-8, 2008. Earth Fissure Map of the Luke Study Area: Maricopa County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-9, 2008. Earth Fissure Map of the Luke Study Area: Maricopa County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-10, 2008. Earth Fissure Map of the Luke Study Area: Maricopa County, AZ** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-11, 2009. Earth Fissure Map of the Tator Hills Area: Pinal County, Arizona** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-12, 2009. Earth Fissure Map of the Friendly Corners Area: Pinal County, Arizona** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-13, 2009. Earth Fissure Map of the Signal Peak Area: Pinal County, Arizona** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

**DM-EF-14, 2009. Earth Fissure Map of the Harquahala Area: Pinal County, Arizona** (Arizona Geological Survey), 1 sheet, scale 1:24,000.

## Digital Information

*Available on CD-ROM*

**DI-04- V2.0, 2007. Digital Representation of Geologic Map of the Phoenix North 30x60 Quadrangle** (Reynolds, S.J. and Grubensky, M.J.).

**DI-24, 2007. Geological Data for the Southeast Phoenix Metropolitan Area, Maricopa and Pinal Counties, Arizona** (Richard, S.M., Orr, T.E., Moore, E. and Ferguson, C.), v. 1.0, 1:24,000.

**DI-30, 2007. Geological Spatial Data for the northwest Phoenix Metropolitan Area, Maricopa County, Arizona** (Richard, S.M, Moore, E.M., Orr, T.R and Harris R.C. (compilers)), v. 1.0, 1:24,000.

**DI-34, 2006. Geologic spatial data (1:100,000-scale) for the eastern part of the Sells 30' x 60' quadrangle, Pima and Santa Cruz Counties, Arizona, v. 1.0** (Richard, S.M., Moore, E.M, Drake, W.R. and Gyetvai, S. (compilers)), ESRI personal geodatabase, ESRI shapefiles, MS Word documents, FGDC metadata.

**DI-37, 2007. Geological spatial data (1:24,000) for the Southwest Phoenix Metropolitan Area, Maricopa County, Arizona, v. 1.0** (Richard, S.M., Moore, E.M. and Clark, R.J. (compilers)).

**DI-39- 2008. Locations of Mapped Earth Fissure Traces in Arizona, 1:12,000- to 1:24,000-scale ESRI shapefiles of Earth Fissure Study areas** (Arizona Geological Survey) versioned by date of newest release, e.g., v.04.06.08, 2008. Available free online at [www.azgs.gov](http://www.azgs.gov)

**DI-39 (06.22.09), 2009. 1:12,000 to 1:24,000-scale ESRI shapefiles of Earth Fissure Study areas** (Arizona Geological Survey), available free online at [www.azgs.gov](http://www.azgs.gov)

## Down to Earth

**DTE-11, 2001 (reprinted 2008). Rocks in the Chirichauhua National Monument and the Fort Bowie National Historic Site** (J.V. Bezy).

**DTE 18, 2005. A Guide to the Geology of Saguaro National Park** (J.V. Bezy).

**DTE-20, 2009. Geology of the Red Rocks area, Sedona, Arizona** (J.V. Bezy).

## Oil and Gas

**OG-1. Monthly Oil, Gas, and Helium Production Report.** Updated annually; available for free download [www.azogcc.gov](http://www.azogcc.gov).

**OG-2. Annual Oil, Gas, and Helium Production in Arizona, 1954-2009.** Updated annually; available for free download [www.azogcc.gov](http://www.azogcc.gov).

**OG-15. Dineh-bi-Keyah Oil Field, Apache County, Arizona, Well Map, 2007.** Scale 1:63,360 (1 inch:1 mile)

**OG-35. Oil and Natural Gas Occurrence in Arizona, 2007, chart.** Available for free download at [www.azogcc.gov](http://www.azogcc.gov).

## Open File Reports

**OFR-06-01, 2006. A Geologist's Guide to the Core Complex Geology Along the Catalina Highway, Tucson Area, Arizona** (Spencer, J.E.), v. 1.1, 38 p.

**OFR-06-02, 2006. Surficial Geology and Fire in Southeastern Arizona Grasslands - Effects on Soil Geochemistry in Semiarid Ecosystems, Fort Huachuca**

**Military Reservation, Arizona** (Biggs, T.H., Pearthree, P.A., Florkowski, L.N., and Shaner, P.-J.L.), 50 p., 1 CD-ROM,

**OFR-07-01, 2006. Progress Report, Geological Hazards and Limitations of Earth Fissures by Counties** (Allison, M.L. and T. Shipman), 2007, Earth Fissure Mapping Program 25p, scale 1:250,000, 4 sheets [1 Pinal County; 2 Maricopa County; 3 Cochise County; 4 Pima

County].

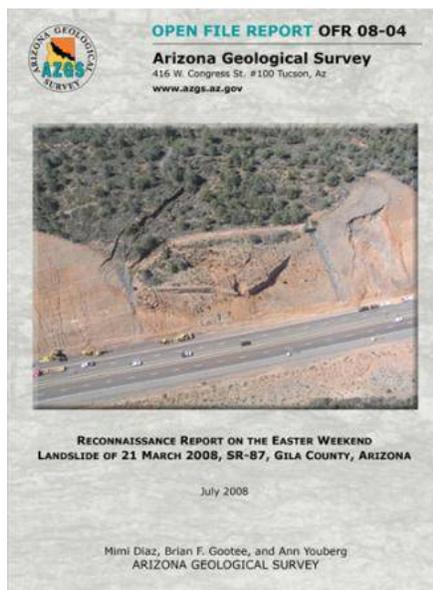
**OFR-07-02, 2007. Geochemical fingerprint of a Plio-Pleistocene tephra in California Wash in the Benson area, San Pedro Valley, southeastern Arizona** (Youberg, A. and Spencer, J.E.), 13 p.

**OFR-08-01, 2008. A Workshop on the Role of State Geological Surveys and U.S. Geological Survey in a Geological Information System for the Nation** (Allison, M.L. and Dickinson, T.L.), 22 p., available free online at [www.azgs.gov](http://www.azgs.gov).

**OFR-08-02, 2008. Earth Fissure Mapping Program: 2007 Progress Report** (Allison, M.L. and Shipman, T.C.), 19 p., available free online at [www.azgs.gov](http://www.azgs.gov).

**OFR-08-03, 2008. Arizona's Earth Fissure Mapping Program: Protocols, Procedures and Products** (Shipman, T.C. and Diaz, M.), free online at [www.azgs.gov](http://www.azgs.gov).

**OFR-08-04, 2008. Reconnaissance Report on the Easter Weekend Landslide of 21 March 2008, SR-87, Gila County, Arizona** (Diaz, M., Gootee, B. and Youberg, A.), available online at [www.azgs.gov](http://www.azgs.gov).



**OFR-08-05, 2008. Geology and Geological Hazards Field**

**Trip of Sabino Canyon: Results of the July 2006 Storms** (Youberg, A. and Cook, J.P.), 13 p., available online at [www.azgs.az.gov](http://www.azgs.az.gov).

**OFR-08-06, 2008. Geological Mapping of Debris-Flow Deposits in the Santa Catalina Mountains, Pima County, Arizona** (Youberg, A., Cline, M.L., Cook, J.P., Pearthree, P.A and Webb, R.H.), 42 p., with 11 sheets (1:6000 scale) on accompanying CD-ROM.

**OFR-08-07, 2008. Potash and Related Resources of the Holbrook Basin, Arizona** (Rauzi, S.L.), 23 p.

**OFR-08-08, 2008. Delineating Post-Wildfire Debris Flow Hazards for Pre-Fire Mitigation, Pine and Strawberry, Arizona: A FEMA 5% Initiative Study** (Youberg, A.), 20 p.

**OFR-07-01, 2009. Pinal County Earth Fissure Planning Map, v. 7.0** (Arizona Geological Survey), 1 sheet, scale 1:250,000 ([www.azgs.az.gov/efplanningmaps](http://www.azgs.az.gov/efplanningmaps))

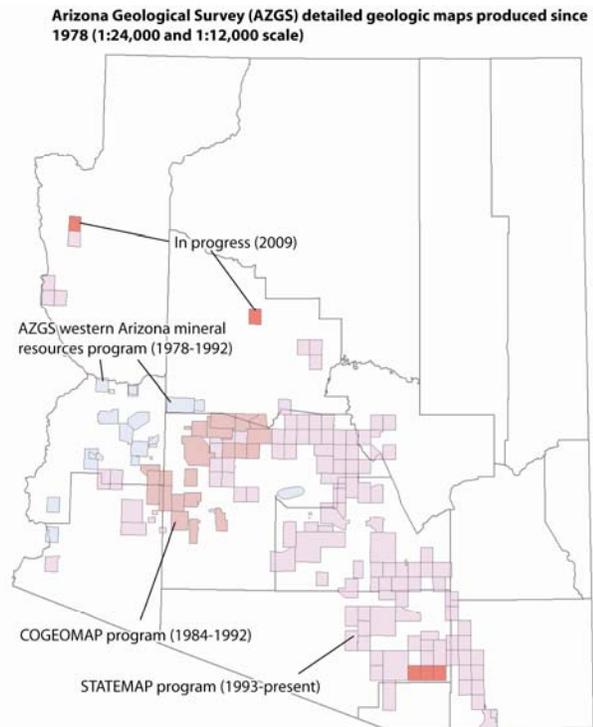
**OFR-07-01, 2009. Maricopa County Earth Fissure Planning Map, v. 7.0** (Arizona Geological Survey), 1 sheet, scale 1:250,000 (1:250,000 scale).

**OFR-09-01, 2009. Geologic Characterization of the Black Hills Dam, Scottsdale, Arizona** (Gootee, B.), 9 p.

**OFR-94-01 v. 2, 2009. Implications of Live Oil Shows in an Eastern Arizona Geothermal Test** (Rauzi, S.), 12 Plates, scale 1:500,000.

**OFR-09-02, 2009. Carbon Sequestration Potential at the 1 Alpine-Federal Site in East-Central Arizona** (Rauzi, S. and Spencer, J.E.).

**OFR-09-03, 2009. Graphics for Core-Complex Morphology and Geologic Continuous Casting** (Spencer, J.E.), PowerPoint Presentation.



# EXTERNAL PUBLICATIONS BY AZGS STAFF [§27-152.01-2(d)]

## 2006

**Harris, Ray, and M. Lee Allison, 2006.** Hazardous Cracks Running Through Arizona. *Geotimes, American Geological Institute*, Vol. 51, #8: 24-27.

**Allison, M. Lee, 2006.** Guest View: Geology Deserves Greater Role in Groundwater Assessment. *Arizona Water Resource*, Arizona Water Resources Research Center, University of Arizona, Vol. 15, #1: 6.

**Allison, M. Lee, 2006.** How Arizona is Dealing with Earth Fissures (abs). *American Council of Engineering Companies of Arizona and Arizona Society of Professional Engineers, "Conference on Engineering Solutions to Ground Subsidence and Earth Fissures"*, August 18, 2006, Scottsdale, Arizona.

**Scotchmoor, Judith G., and M. Lee Allison, 2006.** A National Coalition on the Public Understanding of Science (abs). *GSA Abstracts with Programs*, Vol. 38, #7.

**Allison, Lee, Judy Kass, Michael Mayhew, Richard O'Grady, Judy Scotchmoor, Richard Stucky, 2006.** A Coalition on the Public Understanding of Science (abs). *American Geophysical Union, EOS*.

**Spencer, J.E., and Richard, S.M., 2006.** Application of critical-taper theory to Oligo-Miocene extension and core-complex exhumation in western Arizona, USA: American Geophysical Union, Fall Meeting Program and Abstract (CD-ROM), Abstract T23F-04.

**Youberg, A., Pearthree, P.A., and Baker, V.R., 2006.** Comparison of Debris Flows Generated in Adjacent Unburned and Recently-Burned Areas, Coronado National Memorial, Arizona: *Eos Transactions AGU*, 87(52), Fall Meeting Supplement, Abstract 12661.

## 2007

**Allison, Lee, Tammy Dickenson, and Linda Gundersen, 2007.** The Role of State Geological Surveys and USGS in a Geological Information System for the Nation: A report to the AASG and USGS on the results of a workshop conducted February 21-22, 2007, 18p, <http://www.geoinformatics.info/Resources.html>

**Allison, M. Lee, Tamara Dickinson, Linda C. Gundersen, G. Randy Keller, David Maidment, and J. Douglas Walker, convenors, 2007,** *Report from the Workshop on Envisioning a National Geoinformatics System for the United States*, 6p, <http://www.geoinformatics.info/Resources.html>.

**Allison, M. Lee, and Gundersen, Linda C., 2007.** Association of American State Geologists-USGS Plan for a National Geoscience Information Network (expanded abs), pp 76-77, in ,Brady, S.R., Sinha, A.K., and Gundersen, L.C., editors, *Geoinformatics 2007-Data to Knowledge," Proceedings: U.S. Geological Survey Scientific Investigations Report 2007-5199*, 104p.

**Allison, M. Lee and Linda C. Gundersen, 2007.** Geoinformatics—What We Need to do to Accelerate Web Accessibility, in *Three Dimensional Geologic Mapping for Ground Water Applications," Geological Society of America Workshop Extended Abstracts*, October 27, 2007, Denver, CO, Minnesota Geological Survey Open-file Report 07-04.

**Allison, M. Lee and Linda C. Gundersen, 2008.** How an Integrated State-Federal Geoscience Information Network Can Be Applied in the Borderlands. *Proceedings of a USGS Workshop on Facing Tomorrow's Challenges Along the U.S.-Mexico Border—Monitoring, Modeling, and Forecasting Change Within the Arizona-Sonora Transboundary Watersheds*, 63p, eds, Laura M. Norman, Derrick D. Hirsch, and A. Wesley Ward, USGS Circular 1322, pp 9-10.

**Allison, M. Lee, Linda C. Gundersen, Tamara Dickinson, and John Steinmetz, 2007.** Building the Geological Survey Information Network. *Geological Society of America Abstracts with Programs*, Vol. 39, No. 6, p. 617.

**Allison, M. Lee, Judy Scotchmoor, and Richard O'Grady, 2007.** Celebrating the Year of Science 2009, *Eos Trans. AGU*, 88(52), Fall Meet. Suppl., Abstract PA24A-02.

**Allison, M. Lee, Linda C. Gundersen, 2007,** *Geoscience Information Network*, *Eos Trans. AGU*, 88(52), Fall Meet. Suppl., Abstract IN21C-05.

**Jenkins, S.E., Sieg, C.H., Anderson, D.E., and Pearthree, P.A., 2007.** Using debris flow analyses to quantify long-term fire regimes of northern Arizona ponderosa pine and mixed conifer forests in steep terrain: *Geological Society of America Abstracts with Programs*, Vol. 39, No. 6, p. 139.

**Keller, G. Randy, Maidment, David, Walker, J. Douglas, Allison, Lee, Gundersen, Linda C., and Dickinson, Jenkins, S.E., Sieg, C.H., Anderson, D.E., and Pearthree, P.A., 2007.** Using debris flow analyses to quantify long-term fire regimes of northern Arizona ponderosa pine and mixed conifer forests in steep terrain: *Geological Society of America Abstracts with Programs*, Vol. 39, No. 6, p. 139.

**Magirl, C.S., Webb, R.H., Griffiths, P.G., Schaffner, M., Shoemaker, C., Pytlak, E., Yatheendradas, S., Lyon, S.W., Troch, P.A., Dislets, S.L.E., Goodrich, D.C., Unkrich, C.L.,**

**Youberg, A., and Pearthree, P.A., 2007.** Impacts of recent extreme Arizona Storms: Eos, Transactions, American Geophysical Union, v. 88, no. 17.

**Pearthree, P.A., Youberg, Ann, and Cook, J.P., 2007.** Debris flows – An underappreciated flood hazard in southern Arizona: Geological Society of America *Abstracts with Programs*, Vol. 39, No. 5, p. 11

**Roskowski, J.A., Patchett, P. J., Pearthree, P.A., Spencer, J.E., Faulds, J.E., and Reynolds, A.C., 2007.** A late Miocene-early Pliocene chain of lakes fed by the Colorado River: Evidence from Sr Isotopes of the Bouse Formation between Grand Canyon and the Gulf of California: Geological Society of America *Abstracts with Programs*, Vol. 39, No. 6, p. 435.

**Spencer, J.E., 2007.** *Circum-Pacific Continuous Casting*. Arizona Geological Society Ores and Orogenesis Symposium, unscheduled presentation to fill in for no-show in South American Tectonics Session (September 29, 2007).

**Tamara, 2007.** A Community Workshop and Emerging Organization to Support a National Geoinformatics System in the United States, (expanded abstract), pp.75-76, in Brady, S.R., Sinha, A.K., and Gundersen, L.C., editors, *Geoinformatics 2007-Data to Knowledge, Proceedings: U.S. Geological Survey Scientific Investigations Report 2007: 5199*, 104p.

**Youberg, A., and Spencer, J.E., 2007.** Geochemical fingerprint of a Plio-Pleistocene tephra in California Wash in the Benson area, San Pedro River Valley, southeastern Arizona: Arizona Geological Survey Open-File Report 07-02, version 1.0, 13 p.

## 2008

**Allison, M. Lee, Gundersen, Linda C., Richard, Stephen M., and Dickinson, Tamara L., 2008.** 3-Year Implementation Plan for the U.S. Geoscience Information Network. *Geological Society of America, Abstracts with Programs*, Vol. 40, No. 6, p. 136.

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, 2008.** Implementation Plan for the Geoscience Information Network (GIN), in: Brady, S.R., Sinha, A.K., and Gundersen, L.C., editors, *Geoinformatics 2008—Data to Knowledge, Proceedings: U.S. Geological Survey Scientific Investigations Report 2008-5172*, 76 p., also available online at <http://pubs.usgs.gov/sir/2008/5172>.

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, in press,** *Geosciences Information Network (GIN): A modular, distributed,*

*interoperable data network for the geosciences*, [poster] American Geophysical Union, *EOS*

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, in press,** *Geosciences Information Network (GIN): A modular, distributed, interoperable data network for the geosciences*, [abs] American Geophysical Union, *EOS*.

**Allison, M. Lee, Gundersen, Linda C., Richard, Stephen M., and Dickinson, Tamara L., 2008,** *3-Year Implementation Plan for the U.S. Geoscience Information Network*, Geological Society of America *Abstracts with Programs*, Vol. 40, No. 6, p. 136.

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, 2008,** *Implementation Plan for the Geoscience Information Network (GIN)*, in: Brady, S.R., Sinha, A.K., and Gundersen, L.C., editors, *Geoinformatics 2008—Data to Knowledge, Proceedings: U.S. Geological Survey Scientific Investigations Report 2008-5172*, 76 p., also available online at <http://pubs.usgs.gov/sir/2008/5172>.

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, 2008.** Geosciences Information Network (GIN): A modular, distributed, interoperable data network for the geosciences, [abs] *Eos Trans. AGU*, 89(53), Fall Meet. Suppl., Abstract IN31D-02.

**Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, and Tamara L. Dickinson, 2008.** Geosciences Information Network (GIN): A modular, distributed, interoperable data network for the geosciences, [poster] *Eos Trans. AGU*, 89(53), Fall Meet. Suppl., Abstract IN13A-1073.

**Haney, J.A., D.S. Turner, A.E. Springer, J.C. Stromberg, L.E. Stevens, P.A. Pearthree, and V. Supplee, 2008.** Ecological Implications of Verde River Flows. A report by the Arizona Water Institute, The Nature Conservancy, and the Verde River Basin Partnership, 114 p.

**Haney, J.A., D.S. Turner, A.E. Springer, J.C. Stromberg, L.E. Stevens, P.A. Pearthree, and V. Supplee, 2008.** Ecological Implications of Verde River Flows. A report by the Arizona Water Institute, The Nature Conservancy, and the Verde River Basin Partnership, 114 p.

**House, P. K., Pearthree, P. A., and Perkins, M. E., 2008.** Stratigraphic evidence for the role of lake-spillover in the inception of the lower Colorado River in southern Nevada and western Arizona, in Reheis, M.C., Hershler, R., and Miller, D.M., eds., *Late Cenozoic Drainage History of the Southwestern Great Basin and Lower Colorado River Region: Geologic and Biotic Perspectives: Geological Society of America Special Paper 439*, p. 335-354, doi: 10.1130/2008.2439(15).

**Klump, Jens, Lee Allison, Kristine Asch, Peter Fox, Linda**

**Gundersen, Ian Jackson, Peter Loewe, Walter Snyder, 2008.** Enabling Global Collaboration in the Geosciences. *Geoinformatics 2008: Potsdam, Germany, 11-13 June 2008*, AGU EOS, v89, #49, December 2, 2008, pp503-504.

**Klump, Jens, Lee Allison, Kristine Asch, Peter Fox, Linda Gundersen, Ian Jackson, Peter Loewe, Walter Snyder, 2008.** Enabling Global Collaboration in the Geosciences. *Geoinformatics 2008: Potsdam, Germany, 11-13 June 2008*, *Eos Trans. AGU 89(49)*, December 2, 2008, pp503-504.

**Magirl, C.S., Webb, R.H., Griffiths, P.G., Schaffner, M., Shoemaker, C., Pytlak, E., Yatheendradas, S., Lyon, S.W., Troch, P.A., Dislets, S.L.E., Goodrich, D.C., Unkrich, C.L., Youberg, A., and Pearthree, P.A., 2007.** Impacts of recent extreme Arizona Storms: *Eos, Transactions, American Geophysical Union*, v. 88, no. 17.

**Pearthree, P.A., and House, P.K., The age and character of the northern Bouse Formation, Mohave and Cottonwood Valleys, Arizona, in Reynolds, R.E., ed., Trough to Trough, the Colorado River and the Salton Sea, the 2008.** Desert Symposium Field Guide and Proceeding, p. 58-61.

**Pearthree, P.A., Freeman, Andrea, and Klawon, J.E., 2008.** Geomorphology and geoarchaeology of northern Growler Valley: Implications for prehistoric human occupation and landscape changes, in Altschul, J. and Rankin, Adrienne, eds., *Fragile Patterns: Perspectives on Western Papagueria Archaeology*: SRI Press, p. 139-163.

**Pearthree, P.A., Spencer, J.E., Faulds, J.E., and House, P.K., 2008.** Comment on "Age and evolution of the Grand Canyon revealed by U-Pb dating of water table – type speleothems": *Science*, v. 321, p. 1634c.

**Pearthree, P.A., Spencer, J.E., Faulds, J.E., and House, P.K., 2008.** Technical Comment on "Age and evolution of the Grand Canyon revealed by U-Pb Dating of water table-type speleothems": *Science* 19 September 2008: v. 321. n. 5896, p. 1634.

**Scotchmoor, Judith G., Lindberg, David R., Caldwell, Roy L., O'Grady, Richard, Hehn, Jack, and Allison, M. Lee, 2008.** Improving the Public Understanding of Science. *Geological Society of America, Abstracts with Programs*, Vol. 40, No. 6, p. 184.

**Scotchmoor, Judith G., Lindberg, David R., Caldwell, Roy L., O'Grady, Richard, Hehn, Jack, and Allison, M. Lee, 2008,** *Improving the Public Understanding of Science*, Geological Society of America *Abstracts with Programs*, Vol. 40, No. 6, p. 184.

**Shipman, T.C., Diaz, Mimi, Mahan, Mike, and MacFarlane, Bryan, 2008.** Arizona Geological Survey Earth

Fissure Mapping Program: Geological Society of America *Abstracts with Programs*, Vol. 40, No. 1, p. 80.

**Shipman, T.C., Conway, Michael, and Diaz, Mimi, 2008.** Informing the public of a developing geologic hazard in rapidly urbanizing areas of south-central Arizona: Geological Society of America *Abstracts with Programs*, Vol. 40, No. 1, p. 97.

**Spencer, J.E., Pearthree, P.A., Roskowski, J.A., and Patchett, P.J., 2008.** Extent and age of the Bouse Formation as indicated by strontium isotope and tephrochronology, in Reynolds, R.E., ed., *Trough to Trough, the Colorado River and the Salton Sea, the 2008 Desert Symposium Field Guide and Proceeding*, p. 69-71.

**Spencer, J.E., Pearthree, P.A., and House, P.K., 2008.** Some constraints on the evolution of the latest Miocene to earliest Pliocene Bouse lake system and initiation of the lower Colorado River, in Reheis, M., et al., eds., *Late Cenozoic Drainage History of the Southwestern Great Basin and Lower Colorado River Region: Geologic and Biotic Perspectives*: Geological Society of America Special Paper 439.

**Spencer, J.E., Smith, G.R., and Dowling, T.E., 2008.** Middle and Late Cenozoic geology, hydrography, and fish evolution in the American Southwest, in Reheis, M., et al., eds., *Late Cenozoic Drainage History of the Southwestern Great Basin and Lower Colorado River Region: Geologic and Biotic Perspectives*: Geological Society of America Special Paper 439.

**Spencer, J.E., and Titley, S.R., eds., 2008.** Ores and orogenesis: Circum-Pacific tectonics, geologic evolution, and ore deposits: *Arizona Geological Society Digest* 22, p. 618.

**Spencer, J.E., and Titley, S.R., 2008.** Introduction to the proceedings volume for the 2007 AGS Ores and Orogenesis Symposium, in Spencer, J.E., and Titley, S.R., eds., *Ores and orogenesis: Circum-Pacific tectonics, geologic evolution, and ore deposits*: Arizona Geological Society Digest 22, p. 1-3.

**Spencer, J.E., and Ohara, Y., 2008.** Magmatic and tectonic continuous casting in the circum-Pacific region, in Spencer, J.E., and Titley, S.R., eds., *Ores and orogenesis: Circum-Pacific tectonics, geologic evolution, and ore deposits*: Arizona Geological Society Digest 22, p. 31-53.

**Spencer, J.E., 2008.** Geologic and landscape evolution, in Ffolliott, P.F., and Davis, O.K., eds., *Natural environments of Arizona: From deserts to mountains*: University of Arizona Press, Chapter 4, p. 40-57.

# TECHNOLOGY TRANSFER, OUTREACH, & ASSISTANCE BY AZGS STAFF: 2008-2009

[§27-152.01-2]

## FY2008

Staff	Forum	Topic	Type	Location
S. Rauzi	WESTCARB Public Open House meeting	CO2 sequestration	Briefing	Holbrook, AZ
L. Allison	ESRI User Conference; Arc GIS Geology Data Model meeting	Geoinformatics	Briefing	San Diego, CA
L. Allison	OneGeology Management Organization	GIN	Briefing	Ottawa Canada
S. Rauzi	Oil & Gas Conservation Commission Meetings	Oil & Gas regulations	Briefing	Phoenix, AZ
J. Spencer	Arizona Geological Society Spring Field Trip	Core complex geology along the Catalina Highway	Field trip	Santa Catalina Mountains, AZ
J. Spencer	Arizona Geological Society Ores and Orogenesis Symposium: <i>Core complex geology along the Catalina Highway</i>	Technical paper	Field trip	Santa Catalina Mountains, AZ
J. Spencer	California State University Desert Studies Center, 2008 Symposium and Field Trip	Technical paper	Field Trip & presentations	Lower Colorado River Valley
T. Shipman	Prescott College	Earth Fissure	Fieldtrip	Chandler Heights, AZ
T. Shipman	Chandler Gilbert Community College	Earth fissures	Fieldtrip	Apache Junction, AZ
M. Diaz and T. Shipman	Carlos Santamaria, Geogia Tech, w/ Mike Rutger, AMEC	Earth Fissures and GDC	Fieldtrip	Chandler Heights, AZ
T. Shipman	Rodgers Fieldtrip, USGS ret., Maricopa Flood Control, and UA grad students	Rodgers Earth Fissure	Fieldtrip	Harquahala
J. Spencer	Interview with Tucson Citizen reporter Brad Poole	Age and origin of the Grand Canyon	Media interview	Tucson, AZ
J. Spencer	Pioneer Productions; London, UK	Colorado River	Media interview	UA
L. Allison	"Rosie on the House" radio call-in show: KNST, KAZM, KTAR	Earth fissures	Media interview	Phx, Tucson, Prescott, AZ
L. Allison	Arizona Republic; Mike Walberg reporter	Earth fissures	Media interview	Tucson
M. Diaz	Phoenix Channel 12	Earth fissures	Media interview	Phoenix, AZ
M. Diaz	Phoenix Channel 12	Earth fissures	Media interview	Apache Junction, AZ
M. Diaz	Phoenix Channel 3	Earth fissures	Media interview	Chandler Heights, AZ
P. Pearthree	KUAT television and radio	Earth fissures	Media interview	Tucson
T. Shipman	East Valley Tribune; Sara Bogan	Earth fissures	Media interview	Chandler Heights, AZ
T. Shipman	Fieldtrip Eloy Airport and Casa Grande Mnts	Earth fissures	Media interview	Eloy, AZ
T. Shipman	Phoenix Channel 12; Ben Lemoine	Earth fissures	Media interview	Apache Junction, AZ
T. Shipman	Phoenix Channel 5	Earth fissures	Media interview	Chandler Heights, AZ
M. Diaz				
L. Allison	Access Tucson, "Government Connections" TV	General / policy	Media interview	Tucson, AZ
J. Spencer	National Public Radio: Phone interview about Tucson area geology	General geology	Media interview	Tucson, AZ
J. Spencer	Tucson Citizen: <i>Age and origin of the Grand Canyon</i>	General geology	Media interview	Tucson, AZ
J. Spencer	New York Times: <i>Why does Arizona have so much copper</i>	General geology	Media interview	Tucson, AZ
J. Spencer	Earth Magazine: <i>Age and origin of the Grand Canyon</i>	General geology	Media interview	Tucson, AZ
T. Shipman	Printed Media	Media interview	Media interview	Apache Junction, AZ
L. Allison	Arizona Republic; Ryan Randazzo	Tellurium resources	Media interview	Phoenix, AZ
L. Allison	AZ Rock Products Assoc Annual Convention	AZGS Update	Presentation	Laguna Beach, CA
L. Allison	American Geophysical Union fall meeting	<i>Celebrating the Year of Science 2009</i>	Presentation	San Francisco, CA
P. Pearthree	Geological Society of America Rocky Mountain Section	Debris flow	Presentation	St. George, UT
A. Youberg	Coronado National Memorial Workshop	Debris flow	Presentation	Tucson, AZ
A. Youberg	Geological Society of America Annual Meeting	Debris flow	Presentation	Denver CO
L. Allison	AZ Chapter, American Public Works Assoc.	Earth fissures	Presentation	Tempe, AZ

L. Allison	City of Casa Grande Building Officials meeting	Earth fissures	Presentation	Casa Grande, AZ
L. Allison	So. AZ chapter, International Code Council	Earth fissures	Presentation	Catalina, AZ
M. Diaz	AZ Dept of Environmental Quality	Earth fissures	Presentation	Phoenix, AZ
M. Diaz	AZ Dept of Real Estate	Earth fissures	Presentation	
M. Diaz	AZ Division of Emergency Management	Earth fissures	Presentation	Phoenix, AZ
M. Diaz	AZ State Lands Dept	Earth fissures	Presentation	Phoenix, AZ
M. Diaz	City of Mesa	Earth fissures	Presentation	Mesa, AZ
M. Diaz	City of Mesa	Earth fissures	Presentation	Mesa, AZ
M. Diaz	City of Phoenix	Earth fissures	Presentation	Phoenix, AZ
M. Diaz	Pinal County	Earth fissures	Presentation	
M. Diaz	Town of Gilbert	Earth fissures	Presentation	Gilbert, AZ
T. Shipman	Arizona Hydrologic Society-Tucson Chapter	Earth fissures	Presentation	Tucson, AZ
T. Shipman	Arizona Land Subsidence Group	Earth fissures	Presentation	Phoenix, AZ
T. Shipman	Pima County Emergency Management	Earth fissures	Presentation	Tucson, AZ
T. Shipman	Presentation of a Poster at Regional GSA	Earth fissures	Presentation	Las Vegas, NV
T. Shipman	Printed Media	Earth fissures	Presentation	Queen Creek, AZ
T. Shipman	Structural Engineers Association of Arizona 2007 Convention	Earth Fissures	Presentation	Phoenix, AZ
T. Shipman	Tucson Realtors	Earth fissures	Presentation	Tucson, AZ
T. Shipman	Tucson Realtors Association	Earth Fissures	Presentation	Tucson, AZ
T. Shipman	Arizona Land Subsidence Group meeting with Pinal Government attending	Earth fissures	Presentation	Casa Grande, AZ
L. Allison				
M. Diaz	Maricopa County officials	Earth fissures & planning maps	Presentation	Phoenix, AZ
P. Pearthree	Verde River Ecological Flows Workshop	Fluvial geomorphology	Presentation	Mingus Mtn, AZ
L. Allison	Arizona Geological Society monthly meeting: <i>Intelligent Design and the Attack on Science</i>	General / policy	Presentation	Tucson, AZ
L. Allison	City of Tucson Environmental Services Dept: <i>Intelligent Design and the Attack on Science &amp; Religion</i>	General / policy	Presentation	Tucson, AZ
L. Allison	Nat'l Assoc. of Black Geologists & Geophysicists, Annual Technical Conf	General / policy	Presentation	Chandler, AZ
S. Rauzi	IOGCC Annual Meeting	General / policy	Presentation	New Orleans, LA
J. Spence	Pima Association of Governments: <i>Geology and uses of copper</i>	General geology	Presentation	Tucson, AZ
T. Shipman	Presentation of a Talk at Regional GSA	Geohazards	Presentation	Las Vegas, NV
L. Allison	American Geophysical Union fall meeting: <i>Building a Geoscience Information Network</i>	Geoinformatics	Presentation	San Francisco, CA
L. Allison	Geological Society of America Annual Meeting, Hot Topics panel : <i>Google Earth, Geology Style</i>	Geoinformatics	Presentation	Denver CO
L. Allison	Geological Society of America Annual Meeting: <i>Building a Geological Survey Information Network</i>	Geoinformatics	Presentation	Denver CO
L. Allison	Geological Society of America Workshop: <i>Three Dimensional Geologic Mapping for Ground Water Applications</i>	Geoinformatics	Presentation	Denver CO
L. Allison	AAPG Annual Meeting: <i>Building a Global Interoperable Geoscience Information Network</i>	Geoinformatics / GIN	Presentation	San Antonio, TX
L. Allison	Twenty-eighth Annual ESRI International User Conference: <i>A Digital, Global, Interoperable, Data Network for the Geosciences</i>	Geoinformatics / GIN	Presentation	San Diego, CA
J. Spencer	Pima Association of Governments monthly meeting	Geology and uses of copper	Presentation	Tucson, AZ
S. Richard	Digital Mapping Techniques workshop	GeoSciML	Presentation	Columbia, SC
S. Richard	GEON summer cyberinfrastructure institute	GeoSciML	Presentation	San Diego, CA
J. Cook	National Karst Map Workshop	Karst features	Presentation	Lava Beds NM, CA
S. Rauzi	Oil & Gas Conservation Commission Meeting	Oil & Gas wells and rules	Presentation	Phoenix, AZ
J. Spencer	University of Arizona College of Public Health, Seminar class #696R Environmental and Occupational Health: <i>Radon gas: A geologic</i>	Technical lecture	Presentation	Tucson, AZ

J. Spencer	<i>hazard that no one can completely avoid</i> Arizona Geological Society Ores and Orogenesis Symposium: <i>Circum-Pacific continuous castin</i>	Technical paper	Presentation	Oro Valley, AZ
J. Spencer	California State University Desert Studies Center, 2008 Symposium and Field Trip	Technical paper	Presentation	Baker, CA
J. Spencer	Geological Society of America, Joint Meeting-- Cordilleran and Rocky Mountain Sections	Technical paper	Presentation	Las Vegas, NV
J. Spencer	Geological Society of America, Joint Meeting of the Cordilleran & Rocky Mountain Sections	Technical paper	Presentation	Las Vegas, NV
J. Spencer	University of Arizona, upper division undergraduate class on tectonics: <i>Cenozoic tectonics in Arizona and importance for the origin and distribution of metallic and industrial mineral deposits</i>	Technical paper	Presentation	UA (Tucson)
J. Spencer	University of Michigan Geology Department: <i>Crust with a memory: Three generations of tectonics in the eastern Mohave Desert</i>	Technical paper	Presentation	Ann Arbor, MI
J. Spencer	Geological Society of America joint meeting of the Cordilleran and Rocky Mountain sections: <i>Influence of the Maria fold and thrust belt on styles of Oligo-Miocene extension in western Arizona: Application of critical-taper theory</i>	Technical paper	Presentation	Las Vegas, NV
J. Spencer	Geological Society of America joint meeting of the Cordilleran and Rocky Mountain sections: <i>The Espiritu Canyon shear zone in the footwall of the San Pedro – Catalina detachment fault east of Tucson, Arizona: An exhumed, deep-seated segment of the San Xavier detachment fault?</i>	Technical paper	Presentation	Las Vegas, NV
J. Spencer	University Desert Studies Center, Zzyzx, California: Symposium title: "Trough to trough: The Colorado River and the Salton Sea: <i>Extent and age of the Bouse Formation as indicated by strontium isotopes and tephrochronology in Blythe basin.</i>	Technical paper	Presentation	CA
J. Spencer S. Richard	SME Arizona Conference: <i>Structural geology of the San Manuel and Mammoth mining districts north of Tucson</i>	Technical paper	Presentation	Oro Valley, AZ
J. Spencer	Coronado National Forest: Prepare and deliver text and graphics for four informational signs along Catalina Highway	Technical support	Presentation	Tucson, AZ
L. Allison	Celebrating the Year of Science 2009. AAPG Annual Meeting, poster session.	Year of Science 2009	Presentation	San Antonio, TX

## FY2009

L. Allison	ARPA So. AZ Bd of Directors	AZGS update	Briefing	Tucson, AZ
L. Allison	State Land Dept	Potash resource	Briefing	Phoenix, AZ
M. Diaz				
L. Allison	ADOT	SR87 landslide	Briefing	Phoenix, AZ
M. Diaz				
B. Gootee				
B. Gootee	Havasupai Tribal Council: Flood assessment & recommendations	Technical guidance	Briefing	Supai Village, AZ
L. Allison				
B. Gootee	Havasupai Tribal Council: Preliminary assessment of flood impacts	Technical guidance	Briefing	Havasupai Village, AZ
A. Youberg				
J. Young	ASLD Briefing	Project update; new scope of work	Discussion	
J. Young	Participate in Univ. of Arizona Geodesy Campaign		Field trip	
P. Peathree				

C. Ferguson	Field excursion with two professors, and 4 students from Vanderbilt University, and 2 students from Los Alamos, New Mexico	Field trip	Field trip	Warm Springs Wilderness, Mohave County, AZ
C. Ferguson	Field trip to Mt Fagan Caldera and Cienega Gap for Washington University (St.Louis) field school with participants from UA	Field trip	Field trip	Mt Fagan, Pima County, AZ
B. Gootee	Field trip to McDowell Mountains Preserve	Led volunteers to characterize new outcrop discovery	Field trip	Scottsdale, AZ
B. Gootee	Field trip to McDowell Mountains Preserve	Overview of Lost Dog Tool site geology project and new discovery of limestone outcrop	Field trip	Scottsdale, AZ
J. Spencer	Field interview for Alhurra Arabic-language satellite-TV news show (recorded)	Compare the Sonoran and Arabian deserts, including geology	Field trip and media interview	Gates Pass, AZ
B. Gootee	Scottsdale Community College	Field Geology of the Grand Canyon and C. Plateau	Field Trip class	Grand Canyon and other AZ
C. Ferguson	Short course for students from USC and Vanderbilt: Volcanic short course & field trips	Whole Lava Love	Field trips	Mohave County, AZ
L. Allison	Energy News - Rick Adair	AASG geothermal energy proposal	Media interview	Seattle, WA
L. Allison	AZ Daily Star	AZ mineral production	Media interview	Tucson, AZ
L. Allison	NPR <i>Science Friday</i>	<i>Celebrating the Year of Science, 2009</i>	Media interview	phone from NYC
L. Allison	AZ Republic	Coal ash sludge ponds	Media interview	Phoenix, AZ
L. Allison	Bioscience magazine, Geoff Cohn	COPUS	Media interview	phone, DC
L. Allison	Chemical & Engineering News	COPUS/Year of Science	Media interview	Tucson, AZ
J. Spencer	Alhurra Arabic-language satellite-TV: Field interview for news show	General geology	Media interview	Tucson, AZ
L. Allison	Earth magazine, Mary Morton	Geoblogging	Media interview	phone, DC
P. Pearthree	Tucson Citizen, Brad Poole	Grand Canyon age	Media interview	Tucson
J. Spencer				
J. Spencer	Earth magazine, Erin Wayman	Grand Canyon incision	Media interview	Tucson, AZ
L. Allison	AZ Daily Star	HB2352 Aquifer protection	Media interview	Tucson, AZ
L. Allison	AZ Daily Star	Mammoth fossil	Media interview	Tucson, AZ
L. Allison	Arizona Daily Star - Tony Davis	Salt storage, brine injection	Media interview	Tucson, AZ
S. Rauzi	Arizona Daily Star - Tony Davis	Salt storage, brine injection	Media interview	Tucson, AZ
S. Rauzi	Arizona Daily Star - Tony Davis	Salt storage, brine injection	Media interview	Tucson, AZ
J. Spencer	Gas Utility Week - Susan Nelson	Salt storage, brine injection	Media interview	Tucson, AZ
J. Spencer	National Public Radio	Tucson area geology	Media interview	Washington D.C. - phone to Tucson
L. Allison	Geotimes magazine	USGS-NOAA merger	Media interview	Arlington VA -phone
L. Allison	NY Times, John Rudolph	Why does Arizona have so much copper?	Media interview	Tucson, AZ
J. Spencer				
L. Allison	AASG Annual Meeting	IT Trends in the Geosciences	Moderate session	Park City, UT
L. Allison	AIPG National Bd of Directors	AASG update	Presentation	Tucson, AZ
L. Allison	TUSD Science Facilitators Workshop	American Competitiveness and the Year of Science	Presentation	Tucson, AZ
L. Allison	TUSD Science Facilitators Workshop	American Competitiveness and the Year of Science	Presentation	Tucson, AZ
Conway	Arizona-Sonora Desert Museum	Arizona Volcanism	Presentation	Tucson, AZ
L. Allison	AIPG AZ Section annual meeting	AZGS update	Presentation	Tucson, AZ
S. Rauzi	Geothermal working group	CO2 sequestration	Presentation	Tucson
L. Allison	NSF Town Hall Meeting, at GSA Annual Mtg.	COPUS	Presentation	Houston, TX
L. Allison	SciEnTek-12 Foundation, Bd of Directors Mtg.	COPUS	Presentation	Tucson, AZ
B. Gootee	Hazards presentation to Havasupai Tribe	Natural hazards	Presentation	Flagstaff, AZ

T. Shipman	ACEC of Arizona and Pinal County Liaison Luncheon Meeting	Earth fissures & subsidence	Presentation	Casa Grande, AZ
L. Allison	BLM Leadership Academy	<i>Explore Arizona</i> Partnership	Presentation	Phoenix, AZ
L. Allison	ESRI User Conference: <i>Digital, Global, Interoperable, Data Network for the Geosciences</i>	Geoinformatics	Presentation	San Diego, CA
L. Allison	National Research Council, Board on Earth Science & Resources, Geoinformatics Roundtable: <i>A Growing Consensus on a National Geoinformatics System</i>	Geoinformatics	Presentation	Irvine, CA
L. Allison	SME Pinal Mtn Section: <i>A National Data Network for the Geosciences</i>	Geoinformatics	Presentation	Globe, AZ
L. Allison	17th International Conference on Geoinformatics (Geoinformatics 2009): <i>Improving Accessibility to Geospatial Data Using Geographic Search</i>	Geoinformatics	Presentation	Fairfax, VA
L. Allison S. Richard	GSA Annual Meeting: <i>A 3-year implementation plan for the Geoscience Information Network</i>	Geoinformatics	Presentation	Houston, TX
S. Richard	Digital Mapping Techniques: <i>Web map Services and Catalog Services in the Geoscience Information Network</i>	Geoinformatics	Presentation	Morgantown, WV
S. Richard/L. Allison	American Geophysical Union: <i>Geoscience network web services</i>	Geoinformatics	Presentation	San Francisco, CA
S. Richard	UA geosciences talk	Geoinformatics / GIN	Presentation	Tucson
L. Allison	ESRI Petroleum User Group conf.	Geoinformatics / GIN	Presentation	Houston, TX
L. Allison	GIN Steering Committee	Geoinformatics / GIN	Presentation	Denver CO
S. Richard	Digital Mapping Techniques	Geoinformatics / GIN	Presentation	Morgantown, WV
L. Allison	Central Arizona Geology Club	Geologic hazards	Presentation	Tucson, AZ
L. Allison	Present Geologic Hazards Assessment to Havasupai Tribal Council	Geologic hazards	Presentation	Supai, AZ
B. Gootee	ACEC regional meeting	Geological hazards	Presentation	Tucson, AZ
T. Shipman	Gates Pass Area Neighborhood Association	Geology - Tucson Mountains	Presentation	
L. Allison	AZ Trailblazers Hiking Club	Geology of local trails	Presentation	Mesa, AZ
B. Gootee	Geology of Phoenix Valley Area	Public outreach	Presentation	Tempe, AZ
B. Gootee	Geology of the Grand Canyon	Public outreach	Presentation	Phoenix, AZ
J. Spencer	UA College of Public Health, seminar	Radon gas	Presentation	Tucson
R. Clark	Digital Mapping Techniques	Sharing Geologic Maps as Web Map Services	Presentation	Morgantown, WV
B. Gootee	Meet with Havasupai Tribal Council: Discuss geology assessments	Technical guidance	Presentation	Supai, AZ
A. Youberg	Vanderbilt University Invited Speaker Series	Technical paper	Presentation	Nashville, TN
C. Ferguson	Vanderbilt University Invited Speaker Series: <i>Silver Creek caldera, probable source of the Miocene Peach Spring Tuff</i>	Technical paper	Presentation	Nashville, TN
J. Spence	SME Arizona Conference: <i>Structural geology of the San Manuel and Mammoth mining districts north of Tucson</i>	Technical paper	Presentation	Oro Valley, AZ
S. Richard	National Groundwater Association Meeting: <i>Hydrogeologic Controls On Fissuring</i>	Technical paper	Presentation	Tucson, AZ
S. Richard	AASG Annual Meeting	Web Map Services for Geologic Delivery	Presentation	Park City, UT
B. Gootee	Grand Canyon Association and GCFI	Geologic hazards	Training Seminar	Grand Canyon Village, AZ
L. Allison S. Richard	GSA Annual Meeting	GIN Workshop	Workshop	Houston, TX

# AZGS SERVICE TO COMMUNITY & PROFESSIONAL GROUPS

[§27-152.01-2(d)]

## **American Association of Petroleum Geologists**

**Astrogeology Committee** (member, M.L. Allison, 2006-2010)

## **American Geophysical Union**

Book series reviewer for technical papers (Spencer, J.)

*Eos* - Associate Editor for Informatics (M.L. Allison, 2008-9)

Earth & Space Science Informatics Focus Group  
Executive Committee (Member, M. L, Allison, 2008-2009)

**Arizona Geological Society (AGS)**— editor of Arizona Geological Society Digest 22; 618 pages, 44 chapters (Spencer, J.E., with co-editor Spencer Titley)

**Arizona Geological Society 2007 Dickinson Symposium, Digest Committee**—co-chair for tectonics (Spencer, J.E., with Spencer Titley, 2007)

**Arizona Geological Society 2007 Dickinson Symposium, Program Committee**— co-chair for tectonics (Spencer, J.E., 2007).

## **Arizona Geological Society Executive Committee—**

Councilor (Spencer, J.E., 2006-2008), M.L. Allison 2007)

President (M.L. Allison, 2008)

Past-president [M.L. Allison, 2009]

**Association of American State Geologists (AASG) –**  
Geoinformatics Committee (Chair, M.L. Allison, 2008-2009)

Communications Committee (Chair, M.L. Allison, 2006-2007)

Geoscience Information Network Steering Committee (Co-chair, M.L. Allison, 2007-2009)

## **Coalition on the Public Understanding of Science**

Organizing Committee, co-chair, 2006-2007

Steering Committee (M.L. Allison, 2006-present)

**Coronado National Forest**—Prepare text and graphics for four informational signs along Catalina Highway (Spencer, J.E., 2008)

**European Science Foundation**— reviewer for technical papers (Spencer, J.)

**Geography textbook**— reviewer for chapter on Arizona, for 5<sup>th</sup> through 8<sup>th</sup> graders; for Editorial Directions, Inc. (Spencer, J.)

**GEOLOGY Journal**—reviewer for technical papers (Allison, M.L. and J. Spencer)

**Geological Society of America** — reviewer for technical papers (Spencer, J.)

**International Union of Geological Sciences, Commission on the Management and Integration of Geological Information, GeoSciML Working Group** (Member, S.M. Richard, 2000-present)

## **iPlant Collaborative (University of Arizona)**

Member of the Education, Outreach and Training Committee (M.L. Allison, 2009)

**Journal of Sedimentary Research**— reviewer for technical papers (Spencer, J.)

**National Science Foundation - Geoscience Education Panel** (Conway, 4-6 February 2008)

**Petroleum Research Fund**— reviewer for technical proposal (Spencer, J.)

**Saguaro National Park**— reviewer for Geologic Resource Evaluation Report (Spencer, J.)

**TECTONICS (AGU)**— reviewer for technical papers (Spencer, J.)

**U.S. Geological Survey**— reviewer for technical papers (Spencer, J.)

**University of Arizona**— serve on thesis committee for M.S. student Jennifer Roskowski (Spencer, J.E., 2006-2007)

Adjunct professors, Department of Geosciences (M.L. Allison, P.A.Pearthree, S.M. Richard, J.A. Spencer)

**University of Melbourne Ph.D. Dissertation**—serve on thesis committee (Spencer, J.)

# ARIZONA GEOLOGICAL SURVEY AWARDS AND RECOGNITIONS 2006-2009

## Awards and Honors

The American Institute of Professional Geologists recognized **M. Lee Allison** with the **John T. Galey Jr. Award for Public Service**, presented at the AIPG International Professional Geologists conference, in Flagstaff, September 24, 2008.



AIPG President Daniel St. Germain presents AZGS Director Lee Allison with the John T. Galey Award for Public Service.

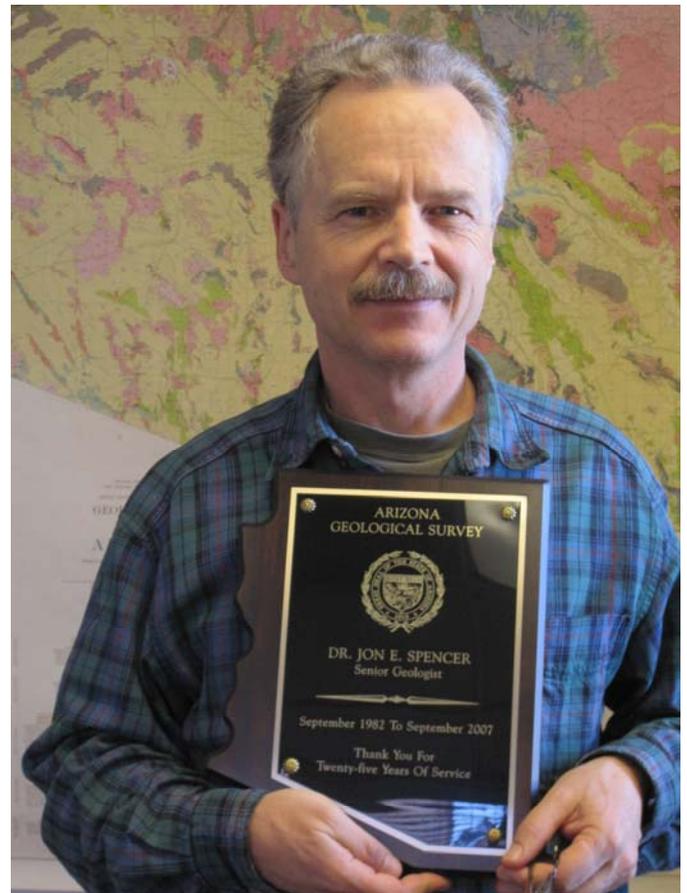
For his public service and his contributions to California geology, the Dibblee Geology Center honored AZGS Director **M. Lee Allison** by dedicating the Geologic Map of the Mojave & Castle butte 15 Minute Quadrangles, Kern County, California (released August 2008), as the **M. Lee Allison Honorary Map**.

The Association of American State Geologists presented **M. Lee Allison** with its **Presidential Award** (June 2009).

**M. Lee Allison** was named as **Distinguished Alumnus** by the Department of Geosciences, University of Massachusetts, Amherst (announced 2009; award presentation scheduled for October 2009).

## Staff Recognition

**Dr. Jon Spencer**, pictured below, holds a plaque for 25-years of service from 1982 to 2007. Jon is AZGS's Senior Geologist and Chief of the Economic Geology Section. He also directs our StateMap program – in partnership with the US Geological Survey – which has published more than 80 geologic maps since 1994.



**Dr. Phil Pearthree** (below), is Chief of the Environmental Geology Section and reached his 20<sup>th</sup> anniversary with AZGS in 2008. Dr. Pearthree is widely recognized for his work and expertise in seismic hazards.



**Dr. Stephen Richard** (below), Chief of AZGS's Geoinformatics Section, was recently honored for 15-years of service from 1992 to 2007. Steve and his team are building AZGS's online map server for displaying digital geologic maps and information via a suite of web applications. Dr. Richard is an international expert in digital data integration.



**Richard Trapp**, IT Manager and geologist, served AZGS and the Arizona public for 26 years before retiring in September 2009. In addition to running the computer systems, Rick was the principal geologist populating AZGS's Bibliography of Arizona Geology (AZGEOBIB) with more than 13,000 citations of geologic literature pertinent to Arizona.

# AZGS STATUTES

## **§27-151. Arizona geological survey; state geologist; powers; definition**

- A. The Arizona geological survey is established with offices located in proximity to the University of Arizona in Tucson. The governor shall appoint a state geologist, pursuant to section 38-211, to be the administrative head of the Arizona geological survey and to serve at the pleasure of the governor. The state geologist shall be registered as a geologist by the state board of technical registration, a graduate of an accredited institution and otherwise qualified by education and experience to direct the research and information functions of the Arizona geological survey.
- B. The state geologist may organize the Arizona geological survey into such administrative units, and employ such permanent, temporary, part-time and volunteer professional and support staff, as necessary to achieve the objectives and promote the policies prescribed by this article.
- C. The state geologist may:
1. Retain the services of faculty members or students, and shall have reasonable access to the data and other resources, of the University of Arizona or any other state university in this state to conduct or supervise research, experimentation or other related work of the Arizona geological survey.
  2. Organize field expeditions to perform work for the Arizona geological survey using university students who are sufficiently advanced in their study of geology to be able to perform satisfactory work.
  3. Establish and appoint an advisory board consisting of independent practicing geologists, university or college faculty, mining geologists and others who use and rely on data, information and other services of the Arizona geological survey.
- D. The expenses of the Arizona geological survey shall be paid by annual appropriation from the state general fund and as otherwise provided by this article.
- E. For purposes of this article, "mineral resources" means all metallic, nonmetallic and energy resources, including coal, oil, natural gas, geothermal resources, carbon dioxide and helium.

## **§27-151.0127-151.01. Qualifications of employees; private activities relating to geological services prohibited**

Qualifications of employees of the Arizona geological survey shall be prescribed by the state geologist with the concurrence of the governor. Neither the state geologist nor any employee shall:

1. Acquire a pecuniary interest in any mineral resources property in the state.
2. Act as broker or agent for any purchaser, owner or agent of mineral resources property, equipment or products.
3. Accept any commission or compensation for services rendered in connection with industry in this state.
4. Make an investigation or report on an individual Arizona deposit of mineral resources or metallurgical process other than pursuant to such employee's official duties.

## **§27-152. Objectives of Arizona geological survey**

The objectives of the Arizona geological survey are to:

1. Serve as a primary source of geologic information in this state to enhance public understanding of the state's geologic character, geologic hazards and limitations and mineral resources.
2. Inform, advise and assist the public in matters concerning the geological processes, materials and landscapes and the development and use of the mineral resources of this state.
3. Encourage the wise use of the lands and mineral resources of this state toward its development.
4. Provide technical advice and assistance in geology to other state and local governmental agencies engaged in projects in which the geologic setting, character or mineral resources of the state are involved.
5. Provide technical advice and assistance in geology to industry toward the wise development and use of the mineral and land resources of this state.

## **§27-152.01. Duties of Arizona geological survey**

The Arizona geological survey shall:

1. Map and describe the bedrock and related geologic materials and processes in Arizona, as follows:
  - (a) Prepare geologic maps that show the distribution of rock formations and surficial materials at the surface and in the subsurface.

- (b) Describe the character of rock and surficial materials, including their age, origin and physical and chemical properties.
  - (c) Map, describe and monitor known and potential geologic hazards and limitations to land and resource management.
  - (d) Map and characterize energy and mineral resources and identify areas that may have potential for future discoveries.
2. Provide objective, scientific information about the geologic character of this state as follows:
- (a) Provide timely, courteous responses to requests for information, advice and assistance from the public.
  - (b) Maintain a computerized bibliographic database of maps and reports on the geology of this state that is accessible to the public.
  - (c) Maintain an internet web site that includes information about the Arizona geological survey, products and services available and the geologic character of this state.
  - (d) Give lectures and talks, conduct workshops, lead field trips and provide information and assistance to public, educational and professional groups.
  - (e) Publish reports and other information, written in nontechnical terms, to inform those not trained in geology about the geologic character of Arizona.
3. Beginning on or before January 1, 2007 and every five years thereafter, submit to the state land department copies of all data files of known areas of earth fissures for the purposes of section 37-173, paragraph 11. On receipt of the earth fissure maps from the state land department that are based on data files submitted, the Arizona geological survey shall provide any map to any member of the public in printed or electronic format on request. The following notice shall be displayed below each map:

*Notice:*

*The state of Arizona has made a reasonable effort to ensure the accuracy of this map when it was produced, but errors may be present and the state of Arizona does not guarantee its accuracy. The map supplements, and is not a substitute for, a professional inspection of property for defects and conditions.*

**§27-152.02. Powers and duties of state geologist; fund**

- A. The state geologist shall:
- 1. Establish such administrative functions and offices as necessary to achieve the purposes of this article.
  - 2. Prescribe the number and professional disciplines of the technical staff and their office and laboratory associates.
  - 3. Direct the work of the Arizona geological survey and the formulation of its program and policies.
  - 4. Adopt such rules as are necessary to carry out the purposes of this article.

5. Purchase or lease necessary office and laboratory equipment and acquire facilities from the state or lease necessary office and laboratory space.
6. Apply for and accept gifts, bequests or legacies of real or personal property or any other contribution, financial or otherwise, for use pursuant to the direction of the donor or, in the absence of an express direction, to be disposed of for the best interests of this state. The state geologist shall honor any restriction imposed by the donor on divulging contributed information or tangible personal property.
7. Accept from the federal, state and local governments or their agencies monies made available to this state for the purposes of this article.
8. Enter into cooperative agreements with federal, county or municipal governments or their agencies or with any agency or governmental unit established by the law of this or any other state for the purpose of carrying out the provisions of this article.
9. Contract with persons and organizations, public or private, to provide services for the Arizona geological survey.
10. Appoint a person with a background in oil and gas conservation to act on behalf of the oil and gas conservation commission and administer and enforce the applicable provisions of chapter 4 of this title relating to the oil and gas conservation commission.

B. The state geologist or the geologist's designee, at any time, may enter the property and inspect wells drilled for oil, gas, geothermal resources, helium or carbon dioxide and shall control property, machinery and appliances necessary to gauge the wells.

C. A geological survey fund is established for the purposes provided in this article consisting of appropriations and all monies received pursuant to this section and sections 27-152.01, 27-153 and 27-515. Monies shall be separately accounted for and used as a continuing appropriation by the state geologist for the purposes provided from each source. Monies in the fund are exempt from the provisions of section 35-190 relating to lapsing of appropriations.

#### **§27-153. Publications; deposit**

A. The state geologist may publish, in the form of bulletins, circulars, maps and other related series, or otherwise make available to state agencies, government officials, industry and the public the

results of geological and related research and investigation undertaken by the Arizona geological survey. A publication shall not include any confidential information pursuant to section 27-522. The state geologist shall consult with the operator and obtain the approval of the scope of work for the publication before the state geologist releases any proposed publication pertaining to a project regulated by the oil and gas conservation commission.

- B. The publications of the Arizona geological survey shall be printed as the state geologist determines and distributed or sold as the interests of this state or science demand. Money obtained by the sale of publications shall be deposited in the geological survey fund established by section 27-152.02 for printing further publications.
- C. All materials collected, after having served the purpose of the Arizona geological survey, shall be made available to the universities, community colleges and high schools of this state.

#### **§27-155. Annual report of state geologist**

The state geologist shall make an annual report to the governor on the progress and condition of the Arizona geological survey, of pertinent facts concerning this state's geologic setting and of such other pertinent information as the state geologist deems proper.

#### **§41-3012.07. Arizona geological survey; termination July 1, 2012**

- A. The Arizona geological survey terminates on July 1, 2012.
- B. Title 27, chapter 1, article 4 is repealed on January 1, 2013.

## **Arizona Oil and Gas Conservation Commission**

#### **§27-515. Administration; powers of the commission; fees**

- A. The commission shall administer and enforce the provisions of this article and other laws relating to conservation of oil and gas. The commission and administrative staff may, at any time, enter upon property and inspect wells drilled for oil or gas, and well records, and shall control property, machinery and appliances necessary to gauge the wells. The Arizona geological survey shall provide staff support to the commission to administer the provisions of this chapter.
- B. The commission may:

1. Administer oaths to a witness in any hearing, investigation or proceeding held under this article or other law relating to conservation of oil and gas.
  2. Issue subpoenas requiring attendance and testimony of witnesses and production of books, papers and records deemed material or necessary, and direct service of subpoenas by a sheriff or other officer authorized by law to serve process.
  3. Prescribe rules and do all acts necessary or advisable to carry out the provisions of this article.
  4. Collect such fees as will cover the costs of such services as, but not limited to, reproduction of records or any portion thereof and copies of rules. The monies so collected shall not be subject to the provisions of section 27-523 but shall be deposited, pursuant to sections 35-146 and 35-147, by the commission in the fund from which the expenditure was originally made.
  5. Publish technical maps, cross sections and reports and sell these materials for such fees as will cover the costs incurred in their preparation, reproduction and distribution.
- C. The commission may enter into cooperative agreements with agencies of the United States government, with agencies of state or local government or with Indian tribes for the purpose of protection of the fresh water supplies of the state from contamination or pollution brought about by the drilling of any well or for any other purpose of this article.
- D. The commission may apply for and accept gifts, devises and donations of books, well records, maps or other materials. All donated materials shall become public records.
- E. Monies collected under subsection B, paragraph 5 of this section shall be deposited, pursuant to sections 35-146 and 35-147, in the geological survey fund established by section 27-152.02 and shall be used to prepare, reproduce and distribute further publications. Monies in the fund are not subject to section 27-523.

## Department of Real Estate

### **§33-423. Disclosure; reports; indemnity; applicability; violation; classification**

- A. A disclosure report pursuant to this section may be provided to the buyer or seller of real property by a third party as authorized by the buyer or seller and

shall be based on officially adopted and electronically posted or otherwise readily available governmental maps or information that discloses whether the real property is subject to one or more of the following:

1. Special flood hazard areas designated by the federal emergency management agency pursuant to 42 United States Code chapter 50.
  2. Military airports and ancillary military facilities as defined in section 28-8461 or as disclosed pursuant to section 28-8484 or 32-2113.
  3. Military training routes as shown in the map produced pursuant to section 37-102 and military restricted airspace as shown in the map produced pursuant to section 37-102.
  4. Public and private airports that are approved by the federal aviation administration.
  5. Expansive soils as shown on maps issued by the natural resource conservation service or on other officially adopted and readily available governmental maps.
  - 6. Fissures as shown on earth fissure maps issued by the Arizona geological survey or pursuant to section 27-152.01, paragraph 3.**
  7. Special tax assessment areas or taxing authority and amount of special assessments in addition to ad valorem taxes as shown in the current tax records of the applicable county assessor.
  8. Radon gas potential zones as shown on current maps issued by the United States environmental protection agency.
  9. Environmental hazard superfund sites including the sites listed in the Arizona superfund program list and the water quality assurance revolving fund registry, or listed by the United States environmental protection agency including the national priorities list, the comprehensive environmental response compensation and liability information system database or on maps issued by the department of environmental quality or equivalent databases of those sites.
  10. Any other condition that affects the real property that the buyer or seller authorizes and the third party provider agrees to provide in a third party provider disclosure report.
- B. For any third party provider of information as prescribed by this section, the following apply:
1. A seller or buyer shall not be required to provide the written disclosure provided by this section to

an insurance company, a lender or a governmental agency.

2. The third party provider shall carry errors and omissions insurance coverage with limits of at least one million dollars per occurrence and in an aggregate of at least ten million dollars. A person who violates this paragraph is guilty of a class 1 misdemeanor.
- C. If an action is brought as a result of an error, inaccuracy or omission in the disclosure made only by a third party provider who provides information pursuant to subsection A of this section, the third party provider shall provide a defense against the action, shall indemnify the buyer or seller who authorized the disclosure report and persons licensed pursuant to title 32, chapter 20 who represent the buyer or seller for any judgment rendered and shall reimburse reasonable attorney fees and costs incurred in defending the action, unless the buyer, seller or agent for the buyer or seller had knowledge of the error, inaccuracy or omission or the buyer, seller or agent for the buyer or seller modified the disclosure and the modification resulted in the error, inaccuracy or omission. Nothing in this section shall be construed to prohibit a third party provider of information from agreeing by contract that the third party provider shall indemnify a person to a greater extent than is required by this section.
- D. If information that is disclosed pursuant to this section is subsequently rendered inaccurate as a result of any governmental action, map revision, changed information or other act or occurrence after the delivery of the disclosure, no person is liable for the information that was disclosed unless the person had knowledge of the error, inaccuracy or omission.
- E. This section shall not be construed to create a cause of action for the use of maps or other information pursuant to this section. This section does not apply to the sale of real property by any person pursuant to section 32-2183 or section 32-2195.03, or any affiliate of that person.
- F. This section does not obligate any person to provide or purchase a disclosure report that is the subject of this section.
- G. The listing of a condition in subsection A of this section or in a third party provider disclosure report does not by itself make that condition material or immaterial to a particular real estate transaction. The materiality of any disclosure is governed as otherwise provided by law.

# STATUTORY AUTHORITY FOR PROGRAMS

## Geologic Extension Service

**Library. §27-152.01-4.** Operate and maintain a central repository and a computerized database for reports, books, maps and other publications regarding the geology, mineral resources and associated technologies. Such repository and database shall be available for the use of the public and may be located at or connected with the university of Arizona or another state university or agency of this state.

**Bookstore. §27-153 B.** The publications of the Arizona geological survey shall be printed as the state geologist determines and distributed or sold as the interests of this state or science demand. Money obtained by the sale of publications shall be deposited in the geological survey fund established by section 27-152.02 for printing further publications.

**Publications (including AZ Geology). §27-152.01-2(e).** Publish reports and other information, written in nontechnical terms, to inform those not trained in geology about the geologic character of Arizona. 27-153.A.: The state geologist may publish, in the form of bulletins, circulars, maps and other related series, or otherwise make available to state agencies, government officials, industry and the public the results of geological and related research and investigation undertaken by AZGS.

**Public inquiries. §27.152.01-2.** Provide objective, scientific information about the geologic character of this state as follows: Provide timely, courteous responses to requests for information, advice & assistance from the public.

**Education & outreach. §27-152.01-2(d).** Give lectures and talks, conduct workshops, lead field trips and provide information and assistance to public, educational and professional groups; (e) Publish reports and other information, written in nontechnical terms, to inform those not trained in geology about the geologic character of Arizona.

**Websites. §27-152.01-2(c).** Maintain an internet web site that includes information about the Arizona geological survey, products and services available and the geologic character of this state.

**AZGeoBib. §27-152.01-2(b).** Maintain a computerized bibliographic database of maps and reports on the geology of this state that is accessible to the public.

## Environmental Geology

**Earth fissures. §27-152.01-3.** Beginning on or before January 1, 2007 and every five years thereafter, submit to the state land department copies of all data files of known areas of earth fissures for the purposes of section 37-173, paragraph 11. On receipt of the earth fissure maps from the state land department that are based on data files submitted, the AZGS shall provide any map to any member of the public in printed or electronic format on request.

**Surficial geologic mapping. §27-152.01-1.** Map and describe the bedrock and related geologic materials and processes in Arizona, as follows: (a) Prepare geologic maps that show the distribution of rock formations and surficial materials at the surface and in the subsurface; (b) Describe the character of rock and surficial materials, including their age, origin and physical and chemical properties.

**Geohazards. §27-152.01-1(c).** Map, describe and monitor known and potential geologic hazards and limitations to land and resource management.

**Geologic framework. §27-152.** The objectives of the Arizona geological survey are to: 1. Serve as a primary source of geologic information in this state to enhance public understanding of the state's geologic character, geologic hazards and limitations and mineral resources; 2. Inform, advise & assist the public in matters concerning the geological processes, materials and landscapes and the development and use of the mineral resources of this state; 3. Encourage the wise use of the lands and mineral resources of this state toward its development; 4. Provide technical advice & assistance in geology to other state and local governmental agencies engaged in projects in which the geologic setting, character or mineral resources of the state are involved; 5. Provide technical advice & assistance in geology to industry toward the wise development and use of the mineral and land resources of this state.

## Economic Geology

**AZ Oil & Gas Conservation Commission. §27-515.A.** The Arizona geological survey shall provide staff support to the commission to administer the provisions of this chapter.

**§27-152.02-10.** Appoint a person with a background in oil & gas conservation to act on behalf of the oil and gas conservation commission and administer and enforce the applicable provisions of chapter 4 of this title relating to the oil and gas conservation commission; B. The state geologist or its designee, at any time, may enter the property and inspect wells drilled for oil, gas, geothermal resources, helium or carbon dioxide & shall control

property, machinery and appliances necessary to gauge the wells.

**Bedrock geologic mapping. §27-152.01.** The Arizona geological survey shall: 1. Map and describe the bedrock and related geologic materials and processes in Arizona, as follows: (a) Prepare geologic maps that show the distribution of rock formations and surficial materials at the surface and in the subsurface; (b) Describe the character of rock and surficial materials, including their age, origin & physical & chemical properties.

**Core and sample repository. §27-152.01-5.** Operate and maintain a central repository for rock cores, well cuttings and related subsurface samples and all associated supplemental data consistent with the laws of this state requiring the deposit of such material and information. Such repository shall be available for the use of the public.

**Energy and mineral resources. §27-152.01-1(d).** Map and characterize energy and mineral resources and identify areas that may have potential for future discoveries.

## Geoinformatics

**IT Support. §27-152.01-2(b).** Maintain a computerized bibliographic database of maps and reports on the geology of this state that is accessible to the public; (c) Maintain an internet web site that includes information about the Arizona geological survey, products and services available and the geologic character of this state.

**GIS Support. §27-152.01-4.** Operate and maintain a central repository and a computerized database for reports, books, maps and other publications regarding the geology, mineral resources and associated technologies. Such repository and database shall be available for the use of the public and may be located at or connected with the university of Arizona or another state university or agency of this state. 27-152.01-1. Map and describe the bedrock and related geologic materials and processes in Arizona.

**Enterprise Geodatabase. §27-152.01-4.** Operate & maintain a central repository and a computerized database for reports, books, maps and other publications regarding the geology, mineral resources and associated technologies. Such repository & database shall be available for the use of the public and may be located at or connected with the UofA or another state university or agency of this state.

**Data preservation. §152.01-4.** Operate and maintain a central repository and a computerized database for reports, books, maps and other publications regarding the geology, mineral resources and associated technologies. Such repository and database shall be available for the use of the public and may be located at or connected with the

university of Arizona or another state university or agency of this state.

## Phoenix Branch

**§27-152.02 A.** The state geologist shall: 1. Establish such administrative functions and offices as necessary to achieve the purposes of this article; 2. Prescribe the number and professional disciplines of the technical staff and their office and laboratory associates; 5. Purchase or lease necessary office and laboratory equipment and acquire facilities from the state or lease necessary office and laboratory space.

## AZ Integrated Seismic Network

**§27-152.01-1(c).** Map, describe, and monitor known and potential geologic hazards and limitations to land and resource management.

## Management

**§27-151 A.** The state geologist shall be registered as a geologist by the state board of technical registration, a graduate of an accredited institution and otherwise qualified by education and experience to direct the research and information functions of the Arizona geological survey.

## Administration

**§27-151 B.** The state geologist may organize the Arizona geological survey into such administrative units, and employ such permanent, temporary, part-time, and volunteer professional and support staff, as necessary to achieve the objectives and promote the policies prescribed by this article.

## Finance & Accounting

**§27-152.01-6.** Receive and expend any monies arising from grants, contracts, contributions, gratuities or reimbursements payable or distributable to this state from the United States, or from state, county, municipal or other governmental sources. The Arizona geological survey shall also receive and expend any monies arising from grants, contracts, contributions, gratuities or reimbursements donated by private persons or corporations. Monies received pursuant to this paragraph shall be deposited in the geological survey fund and handled pursuant to section 27-152.0

Over 125 years serving Arizona:

1883 Territorial Geologist position established

1888 First Territorial Geologist appointed

1893 Reorganized as the University of Arizona Bureau of Mines

1915 Arizona Bureau of Mines (University of Arizona)

1977 Arizona Bureau of Mines and Mineral Technology (University of Arizona)

1988 Arizona Geological Survey



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