



# AGS NEWSLETTER

ARIZONA GEOLOGICAL SOCIETY, INC., TUCSON, ARIZONA

July 2009

## July 7, 2009 DINNER MEETING

### Restoration of tectonic extension in the greater Tucson area and implications for original distribution of porphyry copper deposits

Jon Spencer, Arizona Geological Survey

**ABSTRACT**—Research to improve understanding of the structural geology and evolution of southeastern Arizona is partly motivated by a desire to better understand the original distribution of porphyry copper deposits. This in turn could assist exploration efforts.

Late Cenozoic normal faulting and extension in an approximately east-west direction produced long, sinuous north-south trending basins, including Oro Valley – Tucson – Green Valley and McClellan Valley – Avra Valley – Altar Valley. Most bounding normal faults are inactive and buried, and geophysical methods are typically necessary to determine approximate basin structure. Total extension is difficult to estimate because of cover, but is probably on the order of a few kilometers in each basin.

Five areas of extension provide a basis for conceptual reconstruction of Oligo-Miocene extension in the greater Tucson area, as follows: (1) In the Sierrita Mountains, restoration of 11 km of north-directed displacement above the San Xavier fault is required to restore the Pima-Mission ore body to a position near the Twin Buttes ore body, as proposed many years ago (Cooper, 1960, USGS Bulletin 1112), and an additional 5 km of extension is necessary to restore the San Xavier North deposit to near Twin Buttes. Although details of matching deformed and altered Paleozoic and Mesozoic strata associated with the ore bodies are insufficiently understood to specify an exact restoration, the structural geology of the San Xavier fault and the stratigraphy of its hanging wall clearly indicate that it is a north-directed, low-angle normal fault with

many kilometers of displacement. (2) A Quaternary normal fault at the foot of the northern Santa Rita Mountains appears to be the modern surface expression of the pre-Quaternary low-angle normal fault that displaced mineralized rocks in the Helvetia area from a position 3 km to the east near the range crest and north of the Rosemont ore body. (3) Total displacement on the Catalina detachment fault necessary to have uncovered the Rincon Mountains footwall is at least 40 km, which is the extension-parallel extent of exhumed footwall crystalline rocks and metasedimentary tectonites. (4) Restoration of 30 to 40 km displacement on the Catalina detachment fault places the western Santa Catalina Mountains below the 72 Ma Amole granite in the northern Tucson Mountains. However, there are no intrusive equivalents to the Amole granite in the Catalina Mountains, as the Leatherwood quartz diorite and granite of Alamo Canyon are both 68-69 Ma, indicating that extension between the Tucson and Santa Catalina Mountains is less than about 20 km for combined middle and late Tertiary faulting. (5) The Guild Wash – Suizo – Durham Hills – Star Flat – Cloudburst detachment system north of the Tortolita and Santa Catalina Mountains must have accommodated ~40 km of extension if it displaced the depositional base of tilted middle Tertiary strata north of the Tortolita Mountains from near the Galiuro Range front in the northern San Pedro Valley. This large amount of offset must be represented farther south by extension between the Santa Catalina and Tucson Mountains, as there are simply no other good options, but that conflicts with maximum 20 km extension between the Tucson and Santa Catalina Mountains (#4 above). Reduced offset on the Guild Wash – Suizo – Durham Hills – Star Flat system is possible if the Cloudburst detachment

Continued on p. 2

## July Dinner Meeting — Sheraton Four Points, Wildcat Room, 1900 E. Speedway

(NO-SALT AND VEGETARIAN/VEGAN MEALS ARE AVAILABLE UPON REQUEST.)

**RESERVATIONS ARE REQUIRED. PLEASE CALL 520-663-5295 BEFORE JULY 3, 2009.**

Cash Bar @ 6 pm

Dinner @ 7 pm

Talk @ 8 pm

Cost: Members \$24, Guests \$27, Students \$10

# ANNOUNCEMENTS

## Welcome to New Members

AGS is pleased to welcome the following new members who joined in May and June :

Kevin D. Mitchell, Southwest Exploration Services  
Michael Conway, Arizona Geological Survey  
Shelby Cave, Arizona State University

## AGS MEMBER, SPENCE TITLEY, ON THE RADIO

On May 15 KUAZ-TV and KUAZ-AM/FM Radio aired Part Four of a special program, "Tucson Remembers: The Korean War," featuring Tucson-area veterans.

Of special interest to AGS members was the prominence of AGS life-member, Spencer Titley, in the program. Shown below is a photograph of the young Lt. Titley who served in the U.S. Army Corps of Engineers. The podcast is still available on the internet. It can be heard and downloaded at: <http://radio.azpm.org/azspotlight/podcasts/2009/5/15/azspotlight-tucson-remembers-the-korean-war-part-four/>.



**ABSTRACT**—Continued from p. 1  
fault projects southward beneath rather than over the San Manuel – Kalamazoo ore body and the Santa Catalina Mountains, and so is a structurally lower, imbricate fault. Restoration of 8 to 15 km of extension on the Cloudburst detachment fault with this geometry places the San Manuel ore body within a few kilometers of the Bunker Hill porphyry copper mineral district in the Galiuro Mountains.

## Spring Field Trip Report

We had great weather, conversation, and companionship on the AGS Spring Field Trip held on April 18<sup>th</sup> in the Tucson Mountains. Leader Doug Shakel took the group of 29 to see outcrops of the famous Tucson Mountains Chaos. Lee Allison made arrangements for us to have lunch under the shady ramadas at the Cooper Center for Environmental Learning adjacent to the Pima County Tucson Mountain Park. Extra copies of the full-color guidebook are available for \$15 at the dinner meetings or by special arrangement (contact Cori Hoag at [choag@srk.com](mailto:choag@srk.com)).



Charles Ferguson (L) and Jim Briscoe (R) compare notes.



(L to R) Bob Hildebrand, Barb Thomssen, Bob Kamilli, Bob Powell, Don Applebee, and Sarah Baxter review the geology at Gates Pass.

**Please make your AGS dinner-meeting reservation BEFORE Friday, July 7, 2009. Call 520-663-5295 today or go online to [www.arizonageologicalsoc.org/](http://www.arizonageologicalsoc.org/)**

**Civilization exists by geological consent, subject to change without notice.**

— Will Durant (1885-1981)

## AGS WEB SITE

The AGS web site is now able to accept reservations for the monthly dinner meeting. Several people used it last month, and while a few reservations did not make it through, the others did. Our web master, Greta Orris, reports that the last glitches have been worked out for making a reservation. Look for the button on the Home page, right side below the picture.

Keep checking the web site. As issues are resolved, additional pages will be added.

**Digest 22 Vouchers**—Vouchers have been emailed to U.S. folks who purchased Digest 22 at the Ores and Orogenesis Symposium. A voucher is not available to Digest 22 authors who were provided a complimentary copy of the volume.

The voucher is good for any product or service offered for sale by AGS. That means it can be used for field trip fees or a dinner meeting, as well as for AGS publications. It is being honored also by the AZGS for purchase of any AGS publication.

### 2009 Member Directory Sponsorship

AGS is now accepting advertisements for the 2009 AGS Member Directory. High quality photos of scenic Arizona, interesting outcrops, and members also are needed. The rates for advertising are listed below:

PAGE SIZE	RATE	DIMENSIONS
Business Card	\$25	Std Business Card
½ Page	\$100	4.7" W x 4" H
Full Page	\$200	4.7" W x 7.9" H
Inside Cover (Color)	\$400	4.7" W x 7.9" H

**What is needed:** AGS can work with a variety of formats for your company ads – camera-ready, a business card, or an electronic file (.bmp, .doc, .jpg, .tif, .pdf, etc). The artwork will fit in the size limitations listed above. Feel free to submit a digital or hard copy sized to 8.5" x 11" and we will size it to fit. AGS retains digital copies of all ads published in 2008, so we can place those ads again if desired. Please keep length-to-width ratios in mind if you are designing a new ad.

**Date needed:** July 30 deadline – directory will be published in early August. Advertisers will receive a copy of the directory.

**Send to:** Email digital copies directly to VP Marketing, Lukas Zürcher, at lzurcher@email.arizona.edu or mail a hard copy to: Lukas Zürcher, AGS, P.O. Box 40952, Tucson, AZ 85717. If you have questions, please call Lukas at (520) 300-0368 or Cori Hoag at (520) 544-3688. Remit payment by check with the copy of the advertisement. AGS will send you an invoice if needed and a receipt. Thanks for your support of the Society.

## 2009 EVENTS CALENDAR

08/04/09

**Mark Cocker**, USGS, *Impacts and their record in the Southeastern Coastal Plain of the United States*

09/01/09

**Mike Zientek**, *Topic to be announced*

10/06/09

**Fleetwood Koutz**, *Geology and mineralization of the Hard-shell silver, base-metal, manganese oxide deposits, Santa Cruz County, AZ*

11/03/09

**Leslye Obiora**, UA Law Professor, formerly Minister of Solid Minerals in Nigeria: *The challenges of mining and mineral exploration in Africa*

### Arizona Earthquake Information Center

**DID YOU KNOW?** The Arizona Earthquake Information Center (AEIC), located in the Geology Department on the campus of Northern Arizona University, collects and distributes information on Arizona earthquakes, and conducts research on them. The URL of their interesting web site, which lists related publications, maps, emergency agencies, and other seismic observatories is [www4.nau.edu/geology/aeic/aeic.html](http://www4.nau.edu/geology/aeic/aeic.html).

The most recent Arizona earthquake with a magnitude >5 occurred in 1993 in Cataract Creek. Although the AEIC web-site bulletin reports otherwise, the tabular data indicate that the magnitude of that quake was 5.4. The majority of felt earthquakes in Arizona appear to be in the 3 to 4 range.

The picture below, taken from the AEIC web site, is from *Historical Seismicity in Arizona* by DuBois, Sbar, and Nowak, 1982, AZ BGMT Open-File Report 82-02, 199 p.

#### Liquefaction effects in Yuma from the 1940 Imperial Valley earthquake





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ARIZONA GEOLOGICAL SOCIETY  
AND UPCOMING EVENTS  
VISIT OUR WEBSITE  
www.arizonageologicalsoc.org

AGS books and maps are sold at the monthly dinner meeting and by the Arizona Geological Survey. Visit the AZGS website www.azgs.state.az.us and click on Non-AZGS Publications



*As always, please keep us up to date as you move, change jobs, or change your e-mail address.*

2009 AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

Please mail check with membership form to: Arizona Geological Society, P.O. Box 40952, Tucson, AZ 85717. Dues (circle one): 1 year: \$20; 2 years: \$35; 3 years: \$50. (Full-time students receive free membership. The newsletter is by e-mail only, and a membership application form must be returned to AGS annually to remain on the membership list.)

Name: \_\_\_\_\_

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Zip Code

Work Phone: \_\_\_\_\_ Home Phone: \_\_\_\_\_

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Please send the newsletter by e-mail only  by regular mail only  by e-mail AND regular mail

If registered geologist or engineer, indicate registration number and state: \_\_\_\_\_

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Enclosed is a \_\_\_\_\_ tax-deductible contribution to the J. Harold Courtright Scholarship Fund.