



# AGS NEWSLETTER

ARIZONA GEOLOGICAL SOCIETY, INC., MAY 2007

## DINNER MEETING, MAY 1, 2007

Eric Seedorff

University of Arizona

*The End of Detachment Faults as We Know Them, with Applications to the Catalina Core Complex and Porphyry Copper Systems*

### ABSTRACT –

An alternative interpretation of the Catalina core complex serves as an illustration of a new model for crustal extension and the origin of Cordilleran metamorphic core complexes, which has implications for reassembling and exploring for dismembered porphyry copper systems. The title of this talk is inspired by the 1987 song by R.E.M., “It’s the end of the world as we know it (and I feel fine).” In the geologic analogy, “as we know them” is meant to imply that the faults remain, but they are merely steeply dipping normal faults that have rotated to lower angles. The concept of detachment faults in extensional tectonics and their current status as a distinct class of faults should “end.”

Normal faults in and around core complexes occur in sets of subparallel faults. The faults are curvilinear to only slightly listric, initiating with dips of ~60° and rotating to lower angles as they move. The amount of rotation of fault blocks is not primarily governed by fault curvature. Reconstructions that honor geologic constraints indicate that faults of a given set moved penecontemporaneously. Faults change with depth from brittle faults to mylonitic shear zones, ultimately merging into a zone of ductile stretching, mid-

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## CALENDAR OF EVENTS

- June 5: AGS Dinner Meeting – Mary Poulton, University of Arizona, *Pattern of Recognition Technologies in the Minerals Sector*
- July 3: AGS Dinner Meeting – Congresswoman Gabrielle Giffords, U.S House of Representatives, *Title of Talk – TBA*
- August 7: AGS Dinner Meeting – Mike Timmons, NM Bureau of Geology and Mineral Resources, *Late Precambrian Grand Canyon Supergroup, Intra-cratonic Basin Formation and Deformation During Rodinia Supercontinent Assembly and Breakup*
- September 4: AGS Dinner Meeting – Keith Long, U.S. Geological Survey, *Life-Cycle of a Technological System: The Inspiration Copper Mine, Miami, AZ*
- September 24-30: **Ores & Orogenesis: Circum-Pacific Tectonics, Geologic Evolution, and Ore Deposits – A Symposium Honoring the Career of William R. Dickinson.**

### NEW DINNER COSTS

The increase in dinner prices beginning this month reflects the rising costs incurred for our monthly dinner meetings. The new rates still do not cover all the costs of our monthly meetings, however, so AGS will continue to subsidize this important activity. AGS officers regret any inconvenience this may cause members and their guests.

### Dinner Meeting Schedule — Inn Suites, 475 North Granada, Tucson

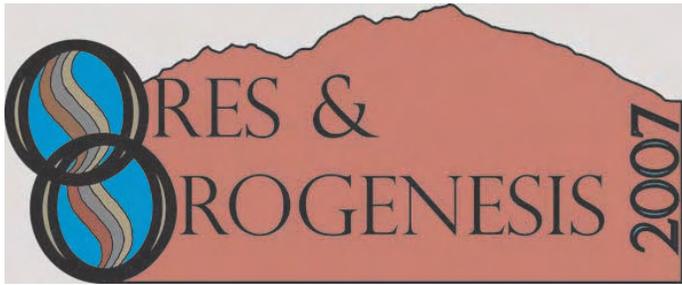
To reserve your place for dinner, please call 520-663-5295 before 5 pm, Friday, April 27, 2007. Indicate if a low-salt or vegetarian meal is required. Please cancel if you are unable to attend.

Cost: With reservation: Members \$24, Guest \$26, Students \$10. Without a reservation, \$3 additional.

Cash Bar @ 6 pm

Dinner @ 7 pm

Talk @ 8 pm



The opening of the *Ores and Orogenesis* symposium is now only five months away and is generating a lot of “buzz” in the structure and tectonic, economic geology, and mining communities. The abstract deadline just passed, and on-line registration is open.

The on-line abstract submittal site received several hundred abstracts, including a number by student presenters. Bob Kamilli and Jon Spencer, who lead the Technical Program Committee, and their session chairs have assembled a great line up of talks by technical experts and industry leaders from around the world. We will have a full technical program of nearly two hundred talks, as well as a large number of poster presentations.

Registration for the meeting is now open on line; register early to take advantage of the early bird registration discounts! The first increase in registration costs begins on the 15<sup>th</sup> of May.

As you know, the meeting is being held at a spectacular venue, the Hilton Tucson El Conquistador Resort. From the outset, we have targeted an attendance of 500-1000 people. The site presents a challenge, however, to feed that many people simultaneously, given the limited restaurant capacity on or near the site and limited parking space. To address those issues, registration for the meeting includes a continental breakfast and a sandwich lunch for each day of registration (i.e., eight meals over four days), as well as beverages and snacks at the morning and afternoon breaks in the technical sessions (i.e., eight snacks over four days).

There are also three luncheons with invited speakers. The first luncheon, aimed at the tectonics community, will feature the meeting’s honoree, Bill Dickinson, as the luncheon speaker. The second luncheon, sponsored by SME, targets the mining community and features

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### AGS Spring Field Trip to Rosemont Ranch

The AGS spring field trip to the Rosemont property on Saturday, April 28 is presently full. To be placed on the waiting list, please contact: Trip Coordinator Rich Brown: [rbrown@clearcreekassociates.com](mailto:rbrown@clearcreekassociates.com).

If knowledge can create problems, it is not through ignorance that we can solve them.

— Isaac Asimov (1920-1992)

ABSTRACT, continued

-crustal flow, and intrusion. This interpretation explicitly precludes any underlying faults, such as a gently dipping detachment fault or subhorizontal decollement at the brittle-ductile transition zone of earlier models. The mid-Tertiary faults have analogs in active normal fault sets in the modern Basin and Range.

Each set of subparallel faults creates a complex half graben, which defines a narrow rift that widens with time. Fault sets associated with periods of rapid extension have more numerous, closely spaced normal faults. Continuous flow of material broadly concurrent with brittle faulting, to beneath the active half graben from beneath surrounding areas that are not actively faulting, is required to maintain structural balance and to meet other constraints (e.g., lack of extraordinary topographic relief).

After faults rotate from  $\sim 60^\circ$  to  $\sim 20-30^\circ$ , they fail to accommodate further extension and become inactive. If extension continues in the region, a new set of faults forms, initiating with dips of  $\sim 60^\circ$ , rotating to lower angles as they move, and defining a new half graben. Where half grabens spatially overlap, faults associated with a younger half graben cut cleanly across older faults; therefore, geometrical “sets” also constitute temporal “generations.” Even if faults of new and old generations have a similar strike, they may dip in opposite directions. Faults in older generations are rotated passively by movement on faults of younger generations. Depending on the strike and dip directions of younger faults, older faults may continue to rotate to lower dips (eventually through horizontal) or may be back-rotated toward their original, steep dips. In any case, progressive extension produces more fault-bounded blocks of increasingly smaller size.

Formation of features recognized as “core complexes” probably requires both extreme amounts of extension and fault sets with opposing dips, i.e., the east- and west-dipping faults and shear zones in and around the Catalina core complex. The brittle faults in the upper plate of the “detachment” fault formed during early half grabens and are cut off by the “detachment,” rather than merging with it. Fault sets that define the “detachment” (e.g., Catalina fault) are normal faults that initiated at  $\sim 60^\circ$  during formation of an intermediate-stage half graben, placing brittle rocks on a footwall of

(ABSTRACT, continued on page 3)

## Other Geoscience News

### Open House

The U.S. Geological Survey, NOAA, and the National Weather Service invite you to help celebrate the 10th anniversary of the Dennis DeConcini Environment and Natural Resources Building, University of Arizona, with an Open House. Kids are welcome.

April 28, 2007 9 a.m. to 3 p.m.

520 North Park Avenue, Tucson, AZ  
(Northeast corner of 6th St. and Park Ave.)

Learn from leading scientists about local and regional issues. Enjoy hands-on exhibits and displays.

#### O&O, continued

former CEO of Homestake Mining, Jack Thompson. Douglas Silver, CEO of International Royalty, will speak at the Economic Geology luncheon on the final day of the conference. These luncheons will have plated meals in lieu of the sandwich box lunches, and the prices of the luncheons are reduced to reflect this substitution. The main meeting will be preceded by a one-day symposium on *Advances in the Understanding of Supergene Processes*, sponsored by the Society of Economic Geologists on Tuesday the 25<sup>th</sup> of September, the price of which also reflects a plated meal.

We again thank our corporate sponsors for keeping symposium costs affordable for attendees and students.

**ADVERTISE** your professional service and products in the Ores & Orogenesis Symposium *Field Trip Guide Books* and/or the *Program with Abstracts*. Ads can be placed in either the program or all 19 guide books, or for a discounted rate of 1.5 times the single ad rate, your ad can be placed in both.

**DEADLINE** — Ads and payments are due May 15, 2007.

**AD SUBMISSION REQUIREMENTS** — For rates and requirements go to <http://www.agssymposium.org/>.

or

**CONTACT** — Dean Kleinkopf, Advertising Chairman, 520- 670-5572 or [dklnkpf@agssymposium.org](mailto:dklnkpf@agssymposium.org).

### Member News:

Welcome to new members Chris M. Menges, Geologist, US Geological Survey and Elwood R. Brooks, Retired Research Associate, University of California-Davis.

Many thanks to our newest O&O sponsors for their generous symposium support:

Kennicott Exploration Company — Platinum Sponsor  
Stewart Brothers Drilling Co. — Copper Sponsor  
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AGS offers sincere condolences to Betty Goodnick who informed us recently of the death of her husband, AGS member Duane Goodnick. Mr. Goodnick was retired and lived in Green Valley.

As of mid April 2007, we have 384 AGS members.

#### ABSTRACT, continued

mylonite related to the toes of older normal faults. Faults that cut the “detachment” (e.g., Pirate and Martinez Ranch faults) are associated with the youngest half grabens. Rarely do any faults have displacements that exceed 3-4 km. Offsets of geologic markers by tens of kilometers represent net displacement on many faults.

Laramide porphyry copper systems affected by Tertiary extension may be highly dismembered into many tilted, fault-bounded pieces (many faults cutting crystalline basement have not been mapped). Multiple levels of the system may be preserved, though generally not in a simple progression at the present surface from shallow to deep levels. For example, the San-Manuel-Kalamazoo deposits, the Little Hill mine area in the Catalinas, and the Chirreon Wash pluton in the Tortolita Mountains may be fragments of the same system formed at ~69 Ma, strung out over a distance of >50 km.



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For information on ordering AGS  
publications, visit  
www.arizonageologicalsoc.org.

AGS books and maps are also sold at the dinner  
meeting and by the  
Arizona Geological Survey.



*Current membership stands at 384. As always, please keep us up-to-date as you move, change jobs, or E-mail address. Thanks to all our wonderful Membership Directory Sponsors for a great directory.*

## 2007 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: \$15; 2 years: \$30; 3 years: \$40. Full-time students receive free membership (E-mail only). However, a membership application form must be returned to AGS annually to remain on the membership list.

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

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

Enclosed is a \_\_\_\_\_ tax-deductible contribution for the 2007 AGS Symposium.