



# Arizona Geological Society Newsletter

ARIZONA GEOLOGICAL SOCIETY, INC., TUCSON, AZ

JULY 2010

## July 6, 2010 DINNER MEETING

**Jonathan Matti** will be our featured speaker. Please see the title and abstract below.

**Where:** Sheraton Four Points Hotel, Wild Cat Room, 1900 E. Speedway Blvd. in Tucson

**When:** Cash Bar at 6 pm, Dinner at 7 pm, Talk at 8 pm.

**Cost:** With reservation, members \$24, guests \$27, Students \$10.

Without a reservation a \$3 surcharge will be added (if the hotel is able to accommodate you).

**RESERVATIONS: CALL 520.663.5295 by 5 p.m. on July 2, 2010.** Indicate low-salt, vegetarian, or vegan meal preferences. A coffee/salad/roll/dessert option is also available for \$18. Please cancel if unable to attend. The hotel cannot guarantee that meals will be available without a timely reservation.

## **ABSTRACT—Late Cenozoic detachment faulting in the Santa Rosa Mountains region, southern California: implications for evolution of the southern San Andreas Fault system**

**By Jonathan Matti, USGS, Tucson, AZ**

Geologic relations in the Santa Rosa Mountains of southern California provide insight into the tectonic evolution of the southern San Andreas Fault system. On the east flank of the range, a northeast-dipping normal fault (Zosel Fault) places upper Miocene through lower Pleistocene sedimentary rocks (Zosel sequence) against pre-Tertiary bedrock. Zosel deposition occurred as the footwall rose and hanging wall subsided, a tectonic style typical of the regional West Salton Detachment. Hanging wall conglomerate and sturzstrom deposits interfinger laterally with and prograde eastward over finer grained floodplain, marginal marine, and marine deposits, a stratigraphic succession indicating a prograding coastal alluvial fan and fan-delta sequence. Isotopic and trace element data match boulders with bedrock now occurring to the northwest in the White Wash area, on the opposite side of the Clark and Buck Ridge strands of the San Jacinto Fault. Restoration of ~19 km of right slip on the two faults positions the White Wash source opposite the Zosel sequence in the Santa Rosa Mountains, but at a lower elevation than the deposits and separated from them by the 1.7- to 2.2 km-deep structural basin of Clark Valley. Since hanging wall deposition terminated, the topographic elevations of sediment source and sediment sink have reversed, with the Zosel sequence now situated at 1417 m (4650 ft) near the Santa Rosa Mountains range crest and the adjacent basement surface concealed beneath Clark Valley dropped by as much as 3.0 km. The paleogeographic setting of the West Salton Detachment system thus has been modified significantly since disruption of the late Cenozoic detachment system.

Previous workers in the Borrego Desert region associate demise of the West Salton Detachment with initiation of the dextral San Jacinto Fault zone at about 1.1 Ma. Cosmogenic-exposure ages ( $^{21}\text{Ne}$ ) from boulders at the top of the Zosel sequence consistently indicate a minimum exposure age of ~1.2 Ma, suggesting that hanging wall deposition of the Zosel sequence had ceased by early Pleistocene time; this age is compatible with disruption of the West Salton Detachment and initiation of the San Jacinto Fault at 1.1 Ma. In the Santa Rosa Mountains region, the transition from transtension within the West Salton Detachment to right slip on the San Jacinto Fault was accompanied by profound topographic modification of the detachment footwall west of the range, either by down-dropping of footwall terrains now traversed by strands of the San Jacinto Fault or by transpressional uplift of the mountains and the Zosel hanging wall sequence—or both. In either case, the southern San Andreas Fault system in the Santa Rosa Mountains region has experienced a history of late Cenozoic tectonism and landscape evolution not seen elsewhere in southern California.

**Jon Matti** obtained BS and MS degrees from U.C. Riverside in 1969 and 1971, respectively. His master's thesis on Silurian and Lower Devonian carbonate rocks in north-central Nevada paved the way for his Stanford University doctoral work on middle Paleozoic limestones and dolomites in the Great Basin. He completed his Ph.D in 1978. Jon started work full time for the U.S. Geological Survey in 1977, where he has developed into a general-purpose geologist working on a variety of assignments including slip-rate investigations of the San Andreas and Cucamonga fault zones, liquefaction potential of the San Bernardino basin, mineral-resource investigations in the San Bernardino National Forest, and tectonic syntheses of the San Andreas fault and San Geronio Pass region.

## July Member Spotlight—Susan Cummins Miller

**Susan Cummins Miller** was born in Inglewood, California, and was raised in a musical family. After receiving a degree in Anthropology and History from University of California, Riverside in 1971, she went on to study geology at UCR, eventually receiving her M.S. in geology in 1978.

Early in her career, Susan worked at the USGS, then at the newly formed Minerals Management Service and the BLM. She also taught geology and oceanography part time at the College of San Mateo. Amidst moves from California to Virginia and finally to Tucson, Susan and her husband Jonathan Matti, also a geologist, started a family. Susan planned to return to geology when the boys, Jordan and Logan, were in school full time, but the pressures of having two field geologists in the family prevailed. So....Susan looked for a way to work from home in order to give her elder son (who, they later learned, has Asperger's Syndrome) the structured environment and intense parenting he needed. She decided to share her passion for geoscience through writing mystery fiction. The result? Susan has been delighting lovers of mystery, suspense and geology since 2002 with her Frankie MacFarlane mysteries published by Texas Tech University Press. Geologist-heroine Frankie was introduced to the reading public in *Death Assemblage*, which was followed by *Detachment Fault* (2004), *Quarry* (2006), *Hoodoo* (2008), and *Fracture* (in editorial review).



photo credit: Jonathan C. Matti

**How did you first become interested in geology?** There are no other scientists in my family, so I blame it on Rachel Carson. She included a stunning photo of a trilobite in *The Sea Around Us*. That triggered my first science report in third or fourth grade. My first geology class was in 8th grade. But I always collected seashells, fossils, arrowheads, and minerals on our family camping trips throughout western North America.

**What was your first job as a geologist?** Beginning in 1971, I worked as a lab tech in the UCR geology department, preparing and curating vertebrate fossils from the western U.S. and Australia. I got to be pretty good at mounting marsupial and small placental mammal teeth on the heads of pins.

**What is your most memorable field experience?** Getting shot at as I was mapping in the Overthrust Belt near Soda Springs, Idaho. It was shift change at the local phosphate mine, and I was driving a government vehicle. The next afternoon they came hunting me again. The events inspired scenes in *Death Assemblage*.

**What do you consider your greatest professional achievement?** I'm hoping it hasn't happened yet. But if I have to choose, I'd say it's a tie between finding a publisher willing to take on literary mysteries with a geologist-heroine, and winning the New Mexico Book Award for *Quarry*.

**How about your greatest achievement EVER?** Greatest achievement? Please ask me again in 20 years--I'll have a better handle on the Big Picture by then...But I can tell you my greatest *experience* ever: Singing Beethoven's *9th Symphony* ("Ode to Joy") with the Reston Chorale to a sell-out crowd at the Kennedy Center as the Berlin Wall was falling. That memory still gives me chills.

**What is the most difficult challenge about writing a novel? How do you approach the process?** I find it much easier to collect, describe and analyze data, write geologic reports, make maps, and teach courses, than to create fictional characters and conflicts that entertain and reveal universal truths. Writing fiction is challenging because there's no road map, no formula, nothing but your imagination to hang your hat on. A scene works or it doesn't. A character may please one reader but irritate another. Same with a plot. There's no way to quantify the magical relationship between writer and reader, or predict what will satisfy. It's a daunting process, and not for the faint of heart.

Continued Page 3

## Member Spotlight—Susan Cummins Miller (continued)

I begin each project with "place"--the intersection of geology, archaeology, history, and geography over time. The title of the book refers to a geological aspect, but it will also carry at least one other meaning--psychological condition, plot aspect, etc. The characters in each story reflect the setting--the Arizona borderlands in *Hoodoo*; the ranching/mining hinterland of northeastern Nevada in *Death Assemblage*; the desolate, uninhabited Mojave Desert in *Quarry*; metropolitan Tucson in *Detachment Fault*; the fault-scarred, upscale Bay Area in *Fracture*. Different settings allow me to write about different parts of the geologic column. Moving Frankie around also keeps the fictional body count from piling up in Tucson--it strains credulity to have an amateur sleuth repeatedly involved in solving murder mysteries in her hometown (the Jessica Fletcher or Miss Marple Syndrome).

**Is Frankie based on anyone in particular, is she a mix of personalities, or is she totally from your imagination?**

**Is she you???** Frankie and I share similar interests and professional experiences, but we're very different "people." For one thing, she's more than thirty years younger than I. In Frankie, I am attempting to capture the traits possessed by the many field geologists and paleontologists with whom I've been privileged to work: intelligence, strength of character, dedication, decisiveness, and perseverance. I gave her roots in the Southwest because that is my heartland. But geology is universal. Frankie has a reason to travel to remote locales where she can encounter, describe and explore different landscapes and environments.

**Could you possibly have any time for hobbies?** A little. I enjoy travel, photography and reading.

**Water, Whiskey or Wine?** It's 106 degrees outside, and the sun isn't over the yardarm in Tucson--so I'll take water (or maybe a margarita).

**Thanks, Susan!**

*Do you know someone who would be an interesting subject for a "Member Spotlight" column? Email his/her name and contact information to [ajones@clearcreekassociates.com](mailto:ajones@clearcreekassociates.com).*

## Audrey Headframe Park opens in Jerome

*Outdoor mining museum open seven days a week*

JEROME - It is the oldest and largest wooden mining structure in Arizona. The Audrey headframe stands above the Audrey shaft, which descends 1,900 feet straight down into the side of Mingus Mountain. The headframe and shaft worked together from 1918 to 1938 to raise more than \$125 million in ore to the surface for United Verde Extension Mining Company.

Now the headframe and shaft are the centerpieces to an outdoor mining museum - The Audrey Headframe Park. The park opened with a reception Thursday night.

"This was a cooperative effort between the Jerome Historical Society and the Jerome Chamber of Commerce," said Tom Pitts, president of the Chamber. "This will be a free park."

The park will be open from 8 a.m. to 5 p.m. seven days a week.

"This started with the idea of restoring the headframe only," Pitts said. "I had the opportunity to write a grant to the Arizona Office of Tourism." That grant came through, and the concept for the headframe restoration turned into an idea for an outdoor mining museum. The Audrey Headframe Park comprises the restored headframe, a structural glass platform where guests can peer down into the shaft, the electric generator that provided power to Jerome and much of Phoenix, numerous pieces of mining equipment and plaques explaining the history of everything on display.

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## Audrey Headframe Park opens in Jerome (Continued from page 3)

A special light and mirror system has been designed so that visitors can see down into the concrete-walled shaft. The platform itself was designed by the same company that built the glass platform that sticks out over a portion of the Grand Canyon.

Jimmy "Rawhide" Douglas took over ownership of the UVX Mining Company and the Little Daisy claim in 1911. He began digging his shaft in 1912, the same year that Arizona became a state. The Audrey headframe was completed in 1918, and it was used until the mine closed in 1938. During that time, the headframe lowered and raised ore cars and elevators full of miners down to side tunnels at 100-foot intervals.

The headframe, shaft and rescue cage were again pressed into service during the late 1980s when Budge Mining Company leased the Little Daisy for gold exploration.

The headframe restoration project got underway in December of 2007. Phase One included photographing and removing the large timbers that were broken and rotten. The first phase included cutting and installing new timbers to rebuild the headframe and sealing all timbers.



**Alan Muma, President of the Jerome Historical Society, shows off the new glass walkway to guests at Jerome Audrey Headframe Park. VVN photo credit: Jon Pelletier**

At that time, Elissa Ballew was a grant writer for the historical society. She explained in 2007 that the historical society got a lease for the property from UVX. Because the headframe was getting close to the point of being lost, the society was using money that it had set aside for the early stages of Phase One. In 2007, Ballew was writing a grant application seeking funds from the Heritage Fund of the State Historic Preservation Office.

The Audrey Headframe Park is located at 55 Douglas Road., next to the Jerome State Historic Park.

*This article, written by **Philip Wright**, originally appeared in the June 2, 2010 edition of the **Verde Independent**. It is reprinted here with the permission of the Verde Valley Newspapers.*

## RESOLUTION COPPER FIELD TRIP

Our field trip to Rio Tinto's Resolution Copper deposit in Superior, Arizona on June 5 was a resounding success! The 40 spots for the trip filled up rapidly, and our hosts graciously allowed for more to attend. The project is in the pre-feasibility phase, and production is expected to begin in 2020. The morning was spent in presentations about the mine plan, the economics of the deposit and the economic implications for the State of Arizona, geology, hydrogeology, and advancement of the No. 10 shaft. In the afternoon we went outside to view core, a scenic overlook with a panoramic photo showing the outline of the deposit, and other informational displays. We also were able get a good look at the new No. 10 headframe, which has a decidedly modern and symmetrical look!

AGS is grateful to the Rio Tinto employees who gave up a Saturday to tell us about this fascinating project and answer our questions. Special thanks to Rich Heig, Tom Goodell, Carl Henke, Randy Seppola, Greg Ghidotti, Hamish Martin and Casey McKeon.



The new No. 10 headframe (left) and the No. 9 headframe. The No. 10 shaft is being advanced at a rate of about 10 feet per day.



**Hamish Martin**, Chief Geologist of Resource Evaluation at Resolution Copper, discusses hydrothermal alteration and the lithology of the deposit with curious AGS members.



The deposit is located more than a mile below the area shown in this photo. It will be mined by block caving methods.

**MORE  
PHOTOS on  
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**Ann Pattison** and **Doug Shakel** are speechless. . . stunned at the sheer magnitude of the Resolution Copper Deposit.

**Carl Henke** (left) and **Rich Heig** answer questions posed by the AGS field trippers.



The eager hoard of geologists gathers around the core boxes.



This helpful display shows the various types of alteration seen in the different rock types at the deposit.





**Dick Jones** at the scenic overlook of the Resolution Copper Deposit. The panoramic photo behind Dick shows the outline of the deposit projected on the land surface.



**Don Hammer** returns to his old Magma Copper stomping grounds to get a good look at the Resolution Copper deposit core during the AGS field trip on June 5, 2010.

**Welcome NEW AGS MEMBER: Diane Love**, Principal Geologist, Tetra Tech, Inc. Tucson, AZ

## Upcoming AGS Dinner Meeting Speakers

**August 3, 2010:** Ray Grant, Geology and Mineralogy of the Grandview Copper Mine, Grand Canyon, AZ.

**September 7, 2010:** Marcia McNutt, U.S.G.S Director. Topic TBA.

**October 5, 2010:** Geoff Plumlee, Earth sciences in helping assess environmental health consequences of disasters.

## GRAND CANYON GEOLOGY RAFT TRIP

Preliminary interest is looking good for the 2011 raft trip! We will be picking dates (July or August) soon and then we will start taking deposits. Dr. Stan Beus is tentatively on board as the geology leader, pending selection of a date for the trip.

If you have an interest or for more information, please call Alison Jones at 520-622-3222 or email her at [ajones@clearcreekassociates.com](mailto:ajones@clearcreekassociates.com). A detailed description of the trip is in the June newsletter.



Rafters examine the **GREAT UNCONFORMITY** in Blacktail Canyon at Grand Canyon. You can put your finger on the line that marks a 1,100 million year gap in the rock record.



**ARIZONA GEOLOGICAL SOCIETY**

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**2010 AGS MEMBERSHIP APPLICATION OR RENEWAL FORM**

Please mail check with membership form to: Arizona Geological Society, PO Box 40952, Tucson, AZ 85717

Dues (check box) ☐ 1 year: \$20; ☐ 2 years: \$35; ☐ 3 years: \$50; ☐ full-time student (membership is free)

NEW MEMBER or RENEWAL? (circle one)

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

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