



# FOUR CORNERS GEOLOGICAL SOCIETY NEWSLETTER

May 2007

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# Four Corners Geological Society

## May Meeting and Presentation

**DATE:**

Friday, May 18, 2007

**SPEAKER:**

Brook Riley, Geologist, ConocoPhillips, San Juan Division, Farmington, NM

**TOPIC:** "LARAMIDE EXHUMATION AND HEATING IN SOUTHEASTERN ARIZONA: LOW-TEMPERATURE THERMAL HISTORY AND IMPLICATIONS FOR ZIRCON FISSION-TRACK SYSTEMATICS"

**PLACE:** [Best Western Inn & Suites](#), 700 Scott Ave, Farmington, New Mexico, (505) 327-5221

**AGENDA:**

5:30 PM – **Social Hour**

6:30 PM Dinner – *Choice of Top Sirloin or Tequila Lime Chicken*

7:30 PM Presentation

**COSTS:**

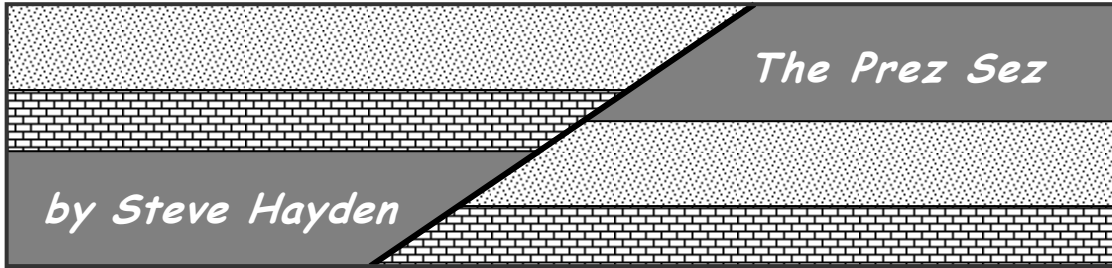
\$20.00 per person (dinner and talk), \$2.00 per person (talk only), students free (talk only)

**Reservations!** For the meeting and presentation should be made by Wednesday, May 16.

**Farmington Contact:** Steve Hayden – email: [steven.hayden@state.nm.us](mailto:steven.hayden@state.nm.us), phone: (505) 334-6178

**Durango Contact:** Kim Hannula – email: [hannula\\_k@fortlewis.edu](mailto:hannula_k@fortlewis.edu), phone: (970) 247-7463





This will be my last newsletter message as President. We will be electing new officers at the May meeting and the new president will take over after that.

The list new of candidates for society officers for the coming year follows:

**Kim Hannula --- President.**

**Charles Head--President-Elect (formerly the vice president position).**

**Jim Hornbeck -- Treasurer**

**Stephanie Johnson--secretary.**

**Gary Gianniny is a candidate for the FCGS Foundation board.**

I will be Past President. If anyone else is interested in running for office for the coming year, please contact Kim Hannula Luke Titus or me soon. The Ballots will go out with the May newsletter and we will vote and count the mailed in ballots at the May meeting, so please let us know soon if you wish to run for office.

[Steve](#)



## **LARAMIDE EXHUMATION AND HEATING IN SOUTHEASTERN ARIZONA: LOW-TEMPERATURE THERMAL HISTORY AND IMPLICATIONS FOR ZIRCON FISSION-TRACK SYSTEMATICS**

**Brook C.D. Riley**  
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The changes associated with deposition, sediment burial, thermal input to the sedimentary section, and finally basin exhumation, are of critical importance to enhancing our understanding of a variety of upper crustal processes. The ability to define the thermal history of basin fill provides the background constraint for understanding the initiation, development, and exhumation of a sedimentary basin. This work details the use of detrital zircon suites to evaluate the provenance of the source material and the timing of post-depositional heating of contractional synorogenic strata of Mesozoic age in southeastern Arizona.

Zircon fission track (FT) ages from sandstones were analyzed to address provenance and post-depositional thermal history of Laramide synorogenic strata. Upper Cretaceous samples show a complex provenance, with significant recycling from underlying rocks. FT peak ages from 14 Jura-Cretaceous sandstones include populations of 570-165, 140-82, and 68-42 Ma. Older single-grain ages (1000-600 Ma) indicate long-term sub-annealing temperatures (<180°C, up to 260°C, depending on single-grain response to heating) for portions of the source area. These older FT ages present in all sampled units indicate little burial of the Jura-Cretaceous rocks prior to recycling into Upper Cretaceous strata; record little variation in the thermal signature of recycled crustal detritus; and show that the older Jurassic and Cretaceous rocks likely provided an important source for Laramide strata. The uniformity of FT ages necessitates that source rocks all record essentially the same thermal signatures. Accordingly, the relative abundance of rock units in the source terrane was rather uniform, and there was no preferential exhumation of one source area over another.

While most samples have a similar range of older ages, a small fraction of grains from almost every sample have FT ages younger than the depositional age, and therefore it is clear that resetting has occurred in some grains. The percentage of reset grains varies from sample to sample. The thickness of overlying units was likely less than 2 km; accordingly, the FT age structure is not purely the result of burial and exhumation. Samples with a significant population of reset ages are generally close to magmatic bodies dated independently between 75-40 Ma in age. This setting provides an

opportunity to investigate controls on single-grain response to heating, and to determine the single-grain characteristics that yield provenance data versus those characteristics that yield post-depositional thermal information. One sample from the original suite of many was chosen to evaluate the physical and compositional controls on zircon response to thermal input, and to develop criteria for evaluation of zircon FT age data.

The young component of FT ages in this sample is ~60 Ma, which is younger than the depositional age (85-75 Ma) of the unit. As such, these strata reached temperatures sufficient to anneal fission tracks in certain grains, while maintaining regionally-consistent provenance ages in other grain populations. Geochemical and crystallinity data indicate a correlation between old crystallization ages, high U+Th concentrations, elevated radiation damage, and young reset FT ages. Resetting occurred in zircons with higher radiation damage (lower crystallinity), as these grains are less retentive of fission tracks; annealing of tracks in these grains likely occurs at temperatures of ~180°C-200°C. Radiation-damaged grains would be more susceptible to resetting at lower temperatures, and therefore provide constraints on post-depositional heating. Less damaged zircons have a higher temperature of track retention (between 250-300°C), and therefore would retain a primary detrital signature; such ages represent minimum provenance ages.

Based on these data, this work establishes criteria for identifying reset grains in detrital populations, and suggests revisions to the current methodology. Readily-definable grain characteristics, such as color and U+Th content, can be used to group grains prior to FT analysis. Zircon color is related in part to increasing radiation damage, and can be used for identifying different thermal events in both pre- and post-depositional history of individual zircons. U and Th contents for single grains are easily available via FT methodology and laser-ablation mass spectrometry. Zircons with a variety of crystallinities should be expected in a multi-cycle sandstone, so low-temperature heating might affect damaged grains but not undamaged grains, thus providing the opportunity to use zircons in one sample for provenance, and other zircons from the same sample for identification of post-depositional heating.



## General Announcements/News from other Geo-Societies

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Geologist/Geophysicist

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### [American Association of Petroleum Geologists](#)

The 2007 Rocky Mountain Section Meeting of the AAPG will be held **October 6-9** at Snowbird, Utah. The meeting will be hosted by the Utah Geological Association. The technical program co-chairs are David Lambert, [GL1253@msn.com](mailto:GL1253@msn.com) / (801) 953-3373 and Rich Newhart, [richardnewhart@questar.com](mailto:richardnewhart@questar.com) / (801) 324-2090.

### [Arizona Geological Society](#)

The Ores & Orogenesis Symposium will be held **September 24-30<sup>th</sup>, 2007** at the Hilton Tucson El Conquistador Resort. The abstract deadline has now passed and on-line registration is open. Register early to take advantage of early-bird discounts. The first increase in costs begins May 15<sup>th</sup>. Go to [www.agssymposium.org](http://www.agssymposium.org) or for more information.

### [Arizona Hydrological Society and Southwest Hydrology](#)

The above organizations jointly present, “Sustainable Water, Unlimited Growth, Quality of Life, Can We Have it All?”. The meeting will be held **August 29-September 1, 2007** at the Westin La Paloma Resort and Spa, Tucson, Arizona. There will be technical sessions on August 30 & 31<sup>st</sup>, pre-conference workshops on August 29<sup>th</sup> and post-conference field trips on Sept. 1<sup>st</sup>. Visit [www.watersymposium.org](http://www.watersymposium.org) for details and updates.

### [Canadian Society for Unconventional Gas](#)

The CSUG, sponsored by Halliburton, is holding their 9<sup>th</sup> annual Unconventional Gas Conference, November 14-16 at the Telus Convention Centre in Calgary, Canada. There will be two days of technical presentations on unconventional gas exploration, focusing on geology, completions, stimulation and drilling. In addition, there will be six concurrent, ½ day sessions that will be taught by industry experts targeted to senior engineers and geologists (cutting edge), entry level to intermediate engineers and geologists (developing expertise) and non-technical support staff. To submit an abstract, go to [www.csug.ca](http://www.csug.ca) to download a form. Complete the form and email to [ugcabstracts2007@emc2events.com](mailto:ugcabstracts2007@emc2events.com) before May 7, 2007. Contact Joann Chatterton at (403) 770-1383 or [joann@emc2events.com](mailto:joann@emc2events.com) for more information.

### [Colorado Oil and Gas Association](#)

COGA is holding the “Rocky Mountain Strategy Conference and Investment Forum” on August 13-15<sup>th</sup>, 2007 at the Colorado Convention Center in Denver. For more information visit [www.coga.org](http://www.coga.org).

### [Geological Society of America](#)

The GSA Annual Meeting will be held **October 28-31, 2007** at the Colorado Convention Center in Denver, Colorado. For more information visit [www.geosociety.org](http://www.geosociety.org).

### [Geothermal Resources Council](#)

The GRC is holding their annual meeting on **September 30 – October 3, 2007**. The theme of the meeting is, “Renewable Baseload Energy: Geothermal Heat Pumps to Engineered Reservoirs”. For more information visit <https://www.geothermal.org/meet.html>. Or write to GRC / P.O. Box 1350 / Davis / California 95617, or call (530) 758-2360 or email [grc@geothermal.org](mailto:grc@geothermal.org).

### [Montana Geological Society](#)

The MGS is holding two field trips this summer. The first will focus on “Marine Cretaceous Reservoirs in Central and Northern Montana” from **June 15-17<sup>th</sup>**. The trip

will depart Billings on Friday, stopping to examine Upper Cretaceous outcrops near Winnett and Lewiston, and end in Chinook just east of Havre. On Saturday they will drive to the Sweet Grass Hills to look at the Lower Cretaceous Bow Island / Viking outcrops and return to Chinook that evening. Sunday will include stops in the Bear Paw and Little Rocky mountains on the way back to Billings. The trip will be led by Karen Porter, Montana Bureau of Mines and Geology and Jennie Ridgley, USGS (retired). The trip costs \$275 for MGS members, single occupancy, \$225 for MGS members, double – occupancy, \$325 for non-MGS, single occupancy and \$275 for non-MGS, double occupancy. This cost includes transportation, two night’s lodging, three box lunches, daily refreshments and guide materials. No breakfasts or dinners are included.

The second fieldtrip will visit the Pennsylvanian Tensleep Sandstone in the northern Bighorn Basin over **July 9-10<sup>th</sup>**. The trip will be led by David Lopez of the Montana Bureau of Mines and Geology and Steve Van Delinder of Ballard Petroleum. There will be a two-hour presentation on the evening of July 9<sup>th</sup> at the Crowne Plaza Hotel in Billings followed by a one-day trip on July 10<sup>th</sup> that will depart and return to Billings. Because the trip is underwritten by a grant from the DOE, there is no charge, but participants must pre-register. More information and a registration form will be available on the MGS website in May. Any questions can be sent to the MGS via the email link at the website: [www.montanags.org](http://www.montanags.org).

#### [Platts](#)

Platts is sponsoring the 2<sup>nd</sup> Annual Shale Gas Developer conference, **June 7-8, 2007** at the Hilton Americas–Houston Hotel in Houston, Texas. To register call toll-free 866-355-2930 or online at [www.events.platts.com](http://www.events.platts.com). The registration fee is \$1,395.

#### [Society for Petroleum Engineers](#)

The SPE is having a forum on Unconventional Gas Resources, in Colorado Springs, on **June 3-8, 2007**. For more information see [www.spe.org/forums](http://www.spe.org/forums).

#### [Southwest Hydrology and Arizona Hydrological Society](#)

Call for abstracts for the 2007 Regional Water Symposium to be held **August 29-Sept 1, 2007** at the Westin LaPaloma Resort & Spa in Tucson, Arizona. The theme of the symposium is, “Sustainable Water, Unlimited Growth, Quality of Life, Can We Have it All?” The deadline to submit abstracts is February 2, 2007. Visit their website, [www.watersymposium.org](http://www.watersymposium.org), to submit an abstract or propose a session.

#### [Rocky Mountain Association of Geologists](#)

The Coalbed Methane Symposium will be held **June 4<sup>th</sup>, 2007** at the Marriott City Center Hotel in Denver, Colorado. The symposium is sponsored by the RMAG and the Denver Geophysical Society. For more information contact Bruce Kelso, [bsk@bry.com](mailto:bsk@bry.com), 303-825-3344 or Bob Lamarre, [lamarregeo@quest.net](mailto:lamarregeo@quest.net), 720-488-1396. This is NOT the same meeting as the Strategic Research Institute’s 8<sup>th</sup> Annual Coal Bed Methane Conference below on March 29-30.

The RMAG is notifying their members of the RMS-SEPM fieldtrip to be held **June 21-24, 2007**. The topic is Sequence Stratigraphy and Reservoir Characterization of the Middle Mesaverde Group: Genetic Linkage from Rock Springs Uplift (Wy) to Sand Wash Basin (Co) to Middle Park Basin (Co). Leaders will be Ron Steel, UT Austin and Jeff Crabaugh, Exxon Mobil.

The RMAG will be holding three “On the Rocks” field trips this summer. The first, **May 26-28** is the “Geology and Scenery of the Paradox Basin”, to be led by Don Rasmussen. The second, **July 28<sup>th</sup>**, is titled, “Sackenung Structures in Rocky Mountain National Park” by Vince Matthews. The last, **September 29<sup>th</sup>**, will look at “Pegmatites along the South Platte, by Pete Modreski. Sign up with Dan Plazak, [Plazak@cs.com](mailto:Plazak@cs.com) or call (303) 525-9902.

#### [Western States Seismic Policy Council](#)

The annual conference of the Western States Seismic Policy Council and International Code Council will be held **September 30 – October 3, 2007** at the Grand Sierra Resort in Reno, Nevada. The theme of the meeting is “Risk Communication, Building Codes and Consequences: The Future of Earthquake Safety in the U.S.”. For more information go online to [www.wsspc.org](http://www.wsspc.org), or write to: WSSPC, 801 K. St., Ste. 1436, Sacramento, California 95814. Or call (916) 444-6816.

#### [Wyoming Geological Association](#)

The theme of the 2007 WGA Field Conference, to be held **August 2-5, 2007**, will be, “The Powder River Basin: From the Margins Looking In”. Technical sessions will be held on Thursday, August 2<sup>nd</sup> at the Parkway Plaza in Casper. A field trip on August 3-5 will circle the basin with excursions to the interior. Stops will include, but are not limited to, uranium solution mining, coal extraction, the Hot Springs Mammoth Site, outcrops on the west flank of the Black Hills, the Newcastle “Oil Mine”, coalbed methane surface facilities, Salt Creek and the Teapot Dome. A guidebook will include papers both specific to the conference and relevant to understanding Wyoming geology. The WGA is soliciting 20 minute presentations for the technical sessions, deadline June 29<sup>th</sup>, 2007. Abstracts should be mailed to [laurie.fletcher@jhu.edu](mailto:laurie.fletcher@jhu.edu) (307-259-5721). The deadline for guidebook papers has already passed but for more information email [jlawlor@gga-inc.com](mailto:jlawlor@gga-inc.com) (307-265-9199). The Conference Chairman is Mark Milliken.



**Ballot for FCGS Officers, May 2007 Election**

**President** \_\_\_\_\_ ***Kim Hannula*** \_\_\_\_\_  
Write in Candidate \_\_\_\_\_ \_\_\_\_\_

**President Elect** \_\_\_\_\_ ***Charles Head*** \_\_\_\_\_  
Write in Candidate \_\_\_\_\_ \_\_\_\_\_

**Treasurer** \_\_\_\_\_ ***Jim Hornbeck*** \_\_\_\_\_  
Write in Candidate \_\_\_\_\_ \_\_\_\_\_

**Secretary** \_\_\_\_\_ ***Stephanie Johnson*** \_\_\_\_\_  
Write in Candidate \_\_\_\_\_ \_\_\_\_\_

**FCGS Foundation Board** \_\_\_\_\_ ***Gary Gianniny*** \_\_\_\_\_  
Write in Candidate \_\_\_\_\_ \_\_\_\_\_

\*\*Please fill out and return to FCGS prior to the meeting on Friday, May 18<sup>th</sup> if you will not be in attendance. Those attending may bring the ballot with them or fill one out at the meeting.



**Advertising rates for the Four Corners Geological Society newsletter:**

Full Page Ad (7½" x 9½") \$100/mo. or \$1000/yr.    Half Page Ad (7½" x 4½") \$50/mo. or \$500/yr.  
¼ Page Ad (3½" x 4½") \$25/mo. or \$250/yr.    Business Card (3½" x 2") \$10/mo. or 100/yr.

Odd sizes are \$3.50 per column inch per month, minimum \$10.00

**For more information, please contact the FCGS Treasurer, (vacant). Proceeds will go toward the further development of the Society (i.e., offset meeting costs, publications, etc.).**

**Four Corners Geological Society**

P.O. Box 1501, Durango, CO 81302

[www.fourcornersgeologicalsociety.org](http://www.fourcornersgeologicalsociety.org)

**2006-07 Officers**

**President** – Steve Hayden: phone: 505.334.6178, email: steven.hayden@state.nm.us  
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**Secretary** – Kim Gerhardt: Phone: 970.375.2700, e-mail: kd@mydurango.net  
**Treasurer** – Steve Cossey: phone: 970-385-4800, email: cosseygeo@aol.com  
**Book Chairperson** – Tom Ann Casey: phone: 505-326-3753, email: tcasey@djsimmons.com  
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**Field Trip Coordinator**– Kim Gerhardt: Phone: 970.375.2700, e-mail: kd@mydurango.net  
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