



Colorado Scientific Society

*The objective of the Society is to promote
the knowledge and understanding of Earth science,
and its application to human needs*

PERU NIGHT!!!

**Georg Petersen (1898–1985):
Mining and Metallurgy in
Ancient Peru**
*by
William E. Brooks*



**Machu Picchu:
Engineering Practices of
the Ancient Inca**
*by
Andrew Earles, Ph.D.
Wright Water Engineers
Denver, CO*

Thursday, March 24, 2011

Colorado School of Mines—Dept. of Geology and Geological Sciences
Berthoud Hall, Room 241, Golden, Colorado
Social half-hour – 6:30 p.m. Meeting time – 7:00 p.m.

March Talks

Abstract

GEORG PETERSEN (1898–1985): MINING AND METALLURGY IN ANCIENT PERU

by

William E. Brooks

Georg Petersen was born in Germany in 1898 and obtained his Ph.D. in geology from the National University of Kiel in 1922. He arrived in Perú in 1924 with a contract to manage the Zorritos oilfield, northern Perú. His extensive bibliography, published in a newly mastered language, includes research on copper, gold, petroleum, salt, and tin occurrences, as well as reports on the archaeology, botany, climate, and history of Perú.

In 1952, he began teaching economic geology at the Universidad Nacional de Ingeniería. Then, in 1970, with encouragement from archaeologist and friend, Duccio Bonavia, Petersen published *Minería y Metalurgia en el Antiguo Perú*. Petersen's book, essentially a *De Re Metallica* for the New World, includes 10 chapters, extensive endnotes, 13 black and white figures, many of which are photographs taken in the field by Petersen, and 22 tables that provide forward-thinking archaeometric data on ancient gold, copper, silver, and platinum artifacts as well as analytical data on smelter scoria and other geoarchaeological materials from Perú, Bolivia, Chile, Colombia, and Ecuador. His book blends archaeology, art history, biology, Colonial exploration, ethnohistory, geology, metallurgy, and the mining technology of the ancient Andes. Publication of Petersen's book, in English, as Geological Society of America Special Paper 467, will help spread his academic and applied knowledge of the importance and use of mineral resources in the ancient Andes to a broad new audience.

(Note: abstract for second talk was not received by press time, but when received will be posted on the CSS website.—*ed.*)

Dinosaur Tracks Museum—*The best-kept secret in downtown Denver!!*

Did you know there is a **dinosaur track museum** on the University of Denver, Auraria campus?? It is located in the basement of St. Cajetans Center at the corner of 9th St. and Lawrence Way. It is home to more than 2,000 specimens, including:

- Colorado's *oldest* known tracks
- The world's *largest* collection of pterosaur tracks
- The **first** *Tyrannosaurus rex* and *Triceratops* tracks ever found
- The world's **largest** and **smallest** dinosaur tracks
- The **oldest** hominid tracks in both the Old and New worlds...

Creator and director of the museum is Dr. Martin Lockley. His research has taken him to the Colorado Plateau region/western North America, South America (Bolivia), Europe (Portugal, Spain, U.K., Switzerland, Germany, France) east Asia (Japan, Korea, China) and Central Asia (Uzbekistan). "The collection, which is arguably the world's largest and best documented, consists of more than 2,400 tracks (originals and replicas) of all ages from Carboniferous to Recent), a large number of which have been illustrated in several hundred scientific publications. The collection includes more than 75 type specimens of ceratopsian and champsosaur tracks (*Ceratopsipes* and *Champsosaurichnus*, from Golden, CO), Stegosaur tracks (*Stegopodus*, from eastern Utah), the first described *Tyrannosaurus* track (*Tyrannosauripus* from New Mexico), the first large two-toed raptor tracks (*Dromaeopodus* from China), a large number of bird and pterosaur tracks new to science and the ancient human track *Hominipes*."

Entrance is free, and the museum is open to the public during the spring and fall semesters. Special tours are available for groups and museum members. **Call or email for current hours or to schedule a tour:**

Museum office phone: 303-556-5261

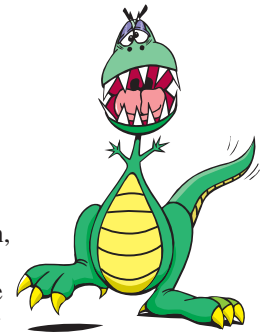
Museum email: dinotracksmuseum@ucdenver.edu

Director's office phone: 303-556-4884

Director's email: martin.lockley@ucdenver.edu

Hurry before it's too late! **The museum will be moving to Boulder by 2012** where it will no longer be viewable by the public. Some of the collection will be moved this summer, so don't dawdle! Get down there!

Parking is crazy when school is in session, so consider taking the light rail, or visiting on a Sunday when there are no classes and the parking is FREE. You can park right by the building.



President's Message from Lisa R. Fisher



Well, the February 16 meeting was certainly not one to have missed! I counted 109 people at our “Snowmastadon extravaganza.” Kirk Johnson and Jeff Pigati were captivating speakers, and the photos and descriptions of the numerous fauna and flora recovered were fantastic. I will be anxious to see what the summer field session recovers as the dig continues. If you missed the talk, the Denver Museum of Nature and Science has a great website to study. <http://www.dmns.org/science/the-snowmastadon-project>

The Thursday, March 24 meeting will be a historic tour of Peru, with a little something for everyone—geology, mining, engineering, hydrology, and archeology! William Brooks’ presentation on ancient mining in Peru, and Andrew Earles’ presentation on Machu Picchu should make for a fascinating evening. Let’s fill the auditorium at Berthoud Hall again!

I am glad to announce that our Emmons Speaker, Dr. Thomas Strasser, has rescheduled his talk on his new Archeological Discoveries on Crete for Thursday April 21. Due to room unavailability on campus, we will hold this talk at the new Golden High School auditorium. It’s only about a mile from the Green Center, and there’s plenty of parking! This may be an opportunity for us to develop a relationship with Golden High and interact with students there. Please contact me if you are interested in volunteering there to work with students and/or teachers.

This spring we have both William Brooks and Thomas Strasser joining us as speakers from out of town. We would like to plan an informal lunch and/or dinner for our guests while they are here, and invite interested members to host or join us for a visit and conversation. Please contact me if you would like to do so.

Cal Ruleman, our field trip chair, is working on our Spring Field Trip to Glenwood Canyon, tentatively set for May 6–7. Details will be announced as arrangements are finalized, .

I hope all have been enjoying the return of the refreshments at our talks. These are provided by volunteers, not from the CSS coffers. If you would like to donate food for a meeting or help cover these costs, please contact our Hospitality Committee Chair, Ben Harrison. We are taking suggestions for goods/swag that display the CSS logo. What kinds of things should we order? Mugs, T-shirts, jackets, hats, pens... ???? What shall we give to speakers now that we are out of the current mug supply? Any ideas are welcome.

Please let me hear from you on these or any other topics!



Emmons Lecture Rescheduled...

for Thursday, April 21st at 8:00 p.m., at the Golden High School Auditorium, 701 24th Street, Golden, CO. (just south of 24th St. and S. Golden Rd.)

The CSS *again* thanks Becky Rucic at *Table Mountain Travel* for her steadfast efforts rescheduling flights for our Emmons lecturer, now due to speak on April 21st.

Table Mountain Travel
Becky Rucic
Phone: 303 277 1580
becky@tablemountaintravel.com
8:30am- 5pm Monday- Friday



Help Wanted!!

The CSS needs a few good volunteers, most especially a Publicity Chairperson and a Program Chairperson.

Contact Lisa Fisher if you’d like to help us out before we burn out!!!

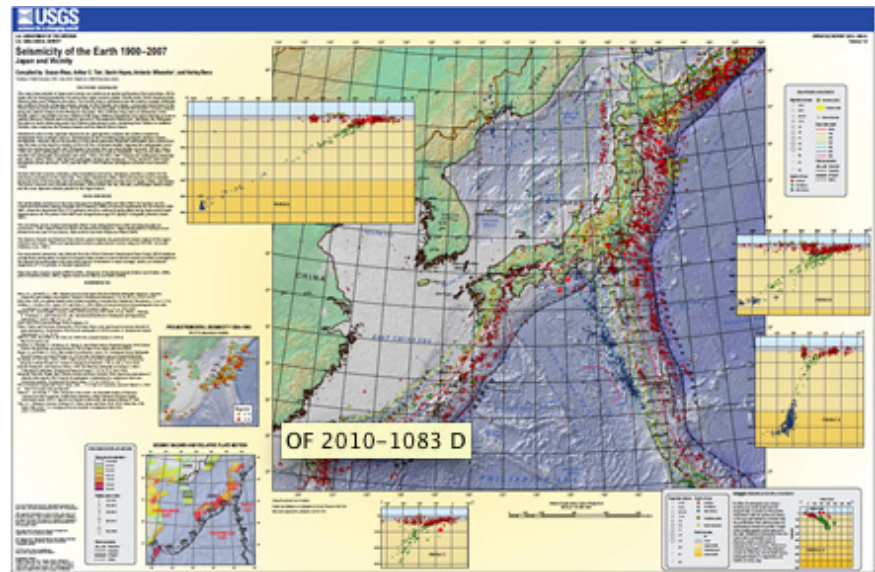
Lisa Fisher, 303-215-0480, lisa.fisher@escalantemines.com



Sat.–Sun., Mar. 19–20, Annual Mineral Sale at the home of Bill Hayward, 10:00 a.m. to 5:00 p.m., 3286 Quitman Street, Denver, Colorado. “Colorado and worldwide crystal specimens”; call 303-455-1977 for more info.

Mar. 25–27, Fort Collins Rockhounds Club Gem and Mineral Show at The Ranch in the Thomas M. McKee 4–H building, Larimer County Fairgrounds, 5280 Arena Circle, Loveland [new location for just this year; normally in downtown Fort Collins]. For more info see: <http://www.fortcollinsrockhounds.org/gemAndMineralShow.shtml>

Current Events



Open-File Report 2010-1083-D

Seismicity of the Earth 1900—2007, Japan and Vicinity

<http://pubs.usgs.gov/of/2010/1083/d/>

Downloadable file is 17.1 MB; 36" x 24".

Friday, March 11th epicenter is just ENE of Sendai, between the labels for 1978 and 1915 earthquakes.

Good Clean WWW Fun—(Thanks to Bruce Wahle for submitting these!)

Could Southeastern Utah Petroglyphs Represent Mammoths in the Ancient Southwest?

While researchers in northern Colorado dig up the bones of giant Ice Age mammoths, others nearby in southeastern Utah are looking at a very different record of these extinct creatures. High on a cliff overlooking the floodplain of the San Juan River, rock art specialists Ekkehart Malotki and Henry Wallace have examined several highly stylized images carved into the rock face including what they believe to be the first example of prehistoric Native American rock art to show a mammoth. While such images are common in the caves of Europe, they are surprisingly unknown in the New World.

<http://blogs.nationalgeographic.com/blogs/news/chiefeditor/2011/02/wildest-mammoth-in-the-west-fo.html>

Indonesian mud volcano flow ‘to last 26 years’

The world’s largest mud volcano, which left 13,000 families homeless, is likely to continue erupting for another 26 years, researchers have estimated. It first erupted back in May 2006, and - at its peak - was spewing 180,000 cubic metres of mud a day, equivalent to 50 Olympic-sized swimming pools. The volcano, in East Java, Indonesia, has buried homes, schools and farmlands over seven square kilometres. The findings have been published in the Journal of the Geological Society.

<http://www.bbc.co.uk/news/science-environment-12567163>

CSS Member does good — or— *Perfesser ‘Nuf Sed Rides Again!!!*

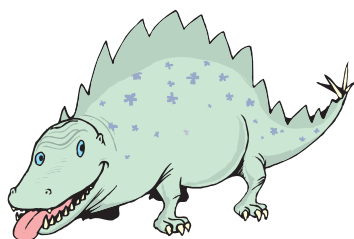
USGS Global Change Emeritus Scientist Walter Dean is the recipient of the 2011 Twenhofel Medal!

The Twenhofel Medal is the highest award given by the Society for Sedimentary Geology (SEPM). This award is given in recognition of “Outstanding Contributions to Sedimentary Geology.” From the guidelines for nominations:

“Nominees will be chosen who are recognized as having made outstanding contributions to paleontology, sedimentology, stratigraphy, and/or allied scientific disciplines. The contributions will normally involve extensive personal research, but may involve some combination of research, teaching, administration, or other activities which have notably advanced scientific knowledge in Sedimentary Geology. A record of sustained high achievement is an essential qualification. Candidates shall be selected from the entire scientific community of sedimentary geologists and are not to be limited to members of any society in particular, nor to citizens of any one country.”

The award will be presented to Walt at the 2011 Spring Meeting of the Society, to be held in Houston next April 10–13. Walt joins an illustrious list of recipients of this medal—the list reads as a veritable Who’s Who of sedimentary geology. (See <http://sepm.org/awards/pastwinners.htm> for a list of past recipients.)

(written by: Patricia Jacobberger Jellison, Ph.D., Chief, Global Change Research & Development, Office of Global Change, U.S. Geological Survey, Reston VA)



Can you believe it’s been 10 YEARS since the BBC program, “Walking with Dinosaurs” hit the airwaves and became a sensation? A new show on BBC1 called “Planet Dinosaur” will further entrance us by using 3D graphics and computer-generated imagery. Fight scenes for the bloodthirsty viewers will of course be featured as well as new information about the “monsters.” Companion pieces on BBC4 will look at the story behind dinosaurs and prehistoric animals in “How to Build a Dinosaur,” and the issues of survival and extinction in “Survivors.” The season, which airs later this year, will be supported by website, learning, and interactive initiatives on BBC online.

<http://www.guardian.co.uk/media/2011/feb/28/bbc-show-3d-dinosaurs>

Q U O T E D (from the MercuryNews.com)

“I turned the rock over and I saw the clavicle sticking out—that’s the collar bone. I didn’t know what it was at first; I thought it was just an antelope. So I called my dad over and about five meters away he started swearing, and I was like ‘What did I do wrong?’ and he’s like, ‘Nothing, nothing—you found a hominid’.”

—Matthew Berger, 9, son of South African professor and paleoanthropologist Lee Berger, describes the scene in 2008 when he found the first piece of what turned out to be the remains of two creatures who lived between 1.8 million and 2 million years ago and who may represent a new addition to the family tree of humans. The dig site, by the way, was chosen with the aid of Google Earth.



<http://googleblog.blogspot.com/2010/04/google-earth-helps-discover-rare.html>

For you Laramide Lovers...HOT off the PRESS!!!



Hydrodynamic mechanism for the Laramide orogeny

by *Craig H. Jones, G. Lang Farmer, Brad Sageman, and Shijie Zhong*

Geosphere; February 2011; v. 7; no. 1; p. 183–201; doi: 10.1130/GES00575.1; 7 figures; 1 animation.

ABSTRACT

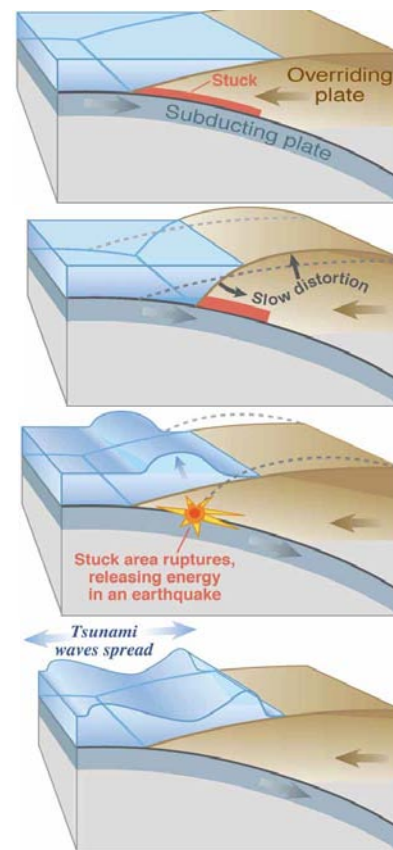
The widespread presumption that the Farallon plate subducted along the base of North American lithosphere under most of the western United States and ~1,000 km inboard from the trench has dominated tectonic studies of this region, but a number of variations of this concept exist due to differences in interpretation of some aspects of this orogeny. We contend that five main characteristics are central to the Laramide orogeny and must be explained by any successful hypothesis: thick-skinned tectonism, shutdown and/or landward migration of arc magmatism, localized deep foreland subsidence, deformation landward of the relatively undeformed Colorado Plateau, and spatially limited syntectonic magmatism. We detail how the first two elements can be well explained by a broad flat slab, the others less so.

We introduce an alternative hypothesis composed of five particular processes: (1) a more limited segment of shallowly subducting slab is created by viscous coupling between the slab and the Archean continental keel of the Wyoming craton, leaving some asthenosphere above most of the slab; (2) dynamic pressures from this coupling localize subsidence at the edge of the Archean Wyoming craton; (3) foreland shortening occurs after the subsidence of the region decreases gravitational potential energy, increasing deviatoric stresses in lithosphere beneath the basin with no change to boundary stresses near the subduction zone or changes to basal shear stress; (4) shear between the slab and overriding continent induces a secondary convective system aligned parallel to relative plate motion, producing the Colorado Mineral Belt above upwelling aligned along the convection cell; (5) the development of this convective system interrupts the flow of fresh asthenosphere into the arc region farther west, cutting off magmatism even in segments of the arc not over the shallowly dipping slab.

USGS Updates Magnitude of Japan's 2011 Tohoku Earthquake to 9.0 ***Released: 3/14/2011 5:35:00 PM***

The USGS has updated the magnitude of the March 11, 2011, Tohoku earthquake in northern Honshu, Japan, to 9.0 from the previous estimate of 8.9. Independently, Japanese seismologists have also updated their estimate of the earthquake's magnitude to 9.0. This magnitude places the earthquake as the fourth largest in the world since 1900 and the largest in Japan since modern instrumental recordings began 130 years ago.

The USGS often updates an earthquake's magnitude following the event. Updates occur as more data become available and more time-intensive analysis is performed. There are many methods of calculating the energy release and magnitude of an earthquake. Some methods give approximate values within minutes of the earthquake, and others require more complete data sets and extensive analysis. Due to inherent uncertainties in the modeling of energy and magnitude, the results from different agencies often vary slightly. These magnitude discrepancies arise from the use of different data and techniques. For more information on why magnitudes change, see the Earthquake Hazards Program FAQ website. <http://earthquake.usgs.gov/learn/faq/?faqID=297>



SIGN UP for the USGS Earthquake Notification Service (ENS)!! It is a free service that sends you automated notification emails when earthquakes happen in your area. You can customize ENS to only deliver messages for certain areas, at specified times, and to multiple addresses. ENS can even send text notifications to your cell phone. For more information, go to: <https://sslearnquake.usgs.gov/ens/>



Earth Science Meetings and Talks

Newsletter items must be received by the 25th of each month.



Colorado Scientific Society's regular meetings are held the 3rd Thursday of the month at the Colorado School of Mines in Golden (unless otherwise advertised). Social time begins at 6:30 p.m. and talks start at 7:00 p.m. For more information, contact Lisa Fisher, at 303-215-0480, lisa.fisher@escalantemines.com

Café Scientifique 2 Mon., Mar. 28 *Richard Stucky, DMNS curator*, "Salamander Showdown at the Ivory Condominium: Evolution, hopeful monsters, and rethinking our perceptions of the natural world." Meets at Brooklyn's near LoDo, Denver, evening science talks at 6:30 p.m.. Arrive early to get a seat. Free, except for beer. <http://www.cafescicolorado.org>

Colorado School of Mines, Van Tuyl Lectures Thursdays from 4–5 p.m. in Berthoud Hall room 241. **Mar. 24** *Dr. Gary Weissman, University of New Mexico*, TBA. **Mar. 31** *Dr. Stephen J. Mojzsis, University of Colorado Department of Geological Sciences*, "An Eoarchean (ca. 3870–3750 Ma) Age for the Nuvvuagittuq Supracrustal Belt (Canada) and Implications for the Inheritance of Hadean Mafic Crust."

Colorado State University, Dept of Geosciences, Rm 320 Warner College of Natural Resources Bldg., Mondays, 4:00 pm. 970-491-5661. **Apr. 4**, *Dr. Lisa Morgan, USGS*, "TBA: Yellowstone." **Apr. 11**, *Dr. Ye Zhang, Univ. of Wyoming*, "Upscaling & Model Complexity in Subsurface Flow Simulation: Insights Gained & On-going Research." <http://warnercnr.colostate.edu/geo-training/>

DIPS (Denver Intl. Petroleum Society) Apr. 8 *Speaker unknown.* Wynkoop Brewing Company, 1634 18th Street, Denver. Gather at 11:30 am; Lunch served at Noon; Lunch price: \$15.00 for members and \$18 for non-members; \$3 talk only. Contact Keith Murray at 303-986-8554 for more information.

Denver Mining Club Mar. 21 *David R. White and Joline Faylor, HS International*, "Use of the New Social Media in the Mining Sector." **Mar. 28** *Stuart Sanderson, President, Colorado Mining Association*, "Colorado Mining Association and 2011 Mining Update." The DMC meets every Monday at the Littleton Country Buffet near Bowles and Wadsworth (8100 W. Crestline Ave., in the shopping center) 11:30–1:00. Purchase of lunch required. <http://www.denverminingclub.org>

Denver Museum of Nature and Science Wed., Mar. 23, 12:15 p.m., Curator's Lunchtime Lecture, "Showdown at Snowmass: Life Histories of Little Ice Age Critters at High Altitude," by *Dr. Richard Stucky, Curator of Paleoecology & Evolution*, Ricketson Auditorium. Free with Museum admission. <http://www.dmns.org/learn/adults/lunchtime-lectures>

Denver Well Logging Society (DWLS) meets on the third Tuesday of each month, Sept. through May. Lunch and a technical talk at the Wynkoop Brewery begins at 11:30 a.m., 18th and Wynkoop Sts. in Denver. Call Sarah Voight at 720-946-1374 by prior Thursday for reservations. Web page: <http://dwls.spwla.org> **May 14-19, 2011**—SPWLA Symposium, Colorado Springs, CO, <http://www.spwla2011.com/>

Rocky Mountain Association of Geologists (RMAG) Mar. 29 *The RMAG and DGS Present: 17th ANNUAL 3-D SEISMIC SYMPOSIUM*, for more information go to: <http://www.rmag.org/events/index.asp#upcoming> **Apr. 6** Vince Matthews, CGS, "The Global Scramble for Natural Resources: Its Impact on Colorado." Reservations by recording at 303-623-5396 until 10:30 a.m., prior Wed. Luncheon \$30. Talk only (no res.)—\$5. Location: Denver Marriott City Ctr., 17th & California.

Rocky Mountain SEPM Mar. 29 *Paul Myrow, Colorado College*, "Depositional Dynamics of a Highstand Prodeltaic System in the Pennsylvanian Minturn Formation of the Central Colorado Basin: Deposits of Wave-Influenced Turbidity Currents." Reception at 11:30 p.m., lunch at 11:45 p.m., speaker at 12:15 p.m. Reservations: luncheons@rmssepm.org, before noon of preceding Friday. \$20.00 lunch, \$5 talk only. (or call Peter Bucknam at 303-895-4698) Wynkoop Brewing Company, 1634 18th St., Denver. <http://www.rmssepm.org/luncheons.shtml>

Univ. of Colorado, Boulder, Geol. Sciences Colloquium Mar. 30 *Mike Bevis, Ohio State*, "The 2010 (M8.8) Maule, Chile Earthquake and some of its implications." **April 13** *Vasilli V. Petrenko, INSTAAR*, "TBA." Weds., 4:00 p.m., Benson Earth Sci. Auditorium, Rm. 180. Refreshments at 3:30 p.m. on the 3rd floor. <http://www.colorado.edu/geolsci/>

Western Interior Paleontological Society Mon., Apr. 4 *Emmett Evanoff, Ph.D., and Katie Kollar* will give a joint talk on the famous Colorado ammonite site. Evanoff will discuss current research at the site, and Katie will describe her student work inventorying the "birdbaths"—large concretions that have the external molds of the huge *Placenticerias* ammonites. Doors open at 6:30 p.m., talk at 7 p.m., Ricketson Auditorium, Denver Museum of Nature & Science (all welcome, no admission charge). <http://www.westernpaleo.org/events.php>

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**** STOP! Do NOT recycle this until after the talk! Please help us with publicity by posting at least the front page of this Newsletter on a bulletin board. Thank you!**