

Inland Geological Society

May 2012

Newsletter of the Inland Geological Society

Volume 28 No. 5

This Meeting:

Thursday,
May 3rd

Time:

Social: 6:00pm
Dinner: 6:30pm
Lecture: 7:00pm

Location:

LSA Associates
1500 Iowa Ave
Suite 200
Riverside, CA
92507

(Map on Pg. 5)

Coming to

Dinner?

Please RSVP:

By Monday 4/30
(951) 784-2168
dixie.lass@att.net

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May Speaker:

Ms. S. Danielle Montgomery

Graduate Student, University of California, Riverside

Kinetics of Scheelite Dissolution in Groundwater: Defining the Release rate of Tungsten Contamination from a Natural Source

Abstracts

Tungsten, an emerging contaminant, has no EPA standard for its permissible levels in drinking water. At sites in California, Nevada, and Arizona there may be a correlation between elevated levels of tungsten in drinking water and clusters of childhood acute lymphocytic leukemia (ALL). Developing a better understanding of how tungsten is released from rocks into surface and groundwater is therefore of growing environmental interest. Knowledge of tungstate ore mineral weathering processes, particularly the rates of dissolution of scheelite (CaWO_4) in groundwater, could improve models of how tungsten is released and transported in natural waters.

Our research is focused on experimental determination of the rates and products of tungstate mineral dissolution in synthetic groundwater, as a function of temperature, pH and mineral surface area. The initial rate method was used to

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develop quantitative mathematical expressions for dissolution rates (rate laws). The specific rate law (moles/m²-sec) for the dissolution of scheelite in groundwater can be expressed as:

$$Rate_{sp} = dM_{scheelite}/dt = -k(M_{H^+})^a$$

where k is the rate constant, and (M_{H⁺})^a is the proton concentration raised to the exponent a; both k and a are determined experimentally. Batch reactor experiments were conducted within constant temperature circulation baths over a pH range of 2-9 and a temperature range of 8-30°C. Cleaned natural scheelite powder with grain diameters of 106-150µm was placed between two screens in a sample platform and then put inside a two liter Teflon vessel filled with synthetic groundwater. Ports on the vessel allowed sample extraction, temperature and pH measurements, gas inflow, and water circulation. Aliquots of solution were taken periodically for product analysis by inductively-coupled plasma optical emission spectroscopy (ICP-OES). Changes in mineral surface characteristics were monitored using scanning electron microscope (SEM) and energy dispersive spectroscopy (EDS) methods.

The dissolution of scheelite shows variable stoichiometry depending on the pH and temperature. At low pH, the release of Ca and W is inhibited by the formation and adsorption of solid tungstic acid onto grain surfaces, implying that this secondary phase controls W release kinetics in acidic groundwaters. In groundwater with progressively higher alkalinity, the release rate of both W and Ca are not inhibited by formation of a visible secondary precipitate, although only the rate of W release increases linearly when plotted against pH. Also, the release rate of tungsten from scheelite followed Arrhenius behavior over the studied temperature range. These results suggest that the warmer and more basic the groundwater that scheelite is in contact with, the greater the propensity for an elevated level of dissolved and mobile tungsten.

Biography:

Ms. S. Danielle Montgomery is a graduate student/researcher and teaching assistant at the University of California, Riverside (UCR) studying for a Master of Science in Earth Sciences. In 2009, she received her Bachelor of Arts in Geology with a concentration in environmental geology from California State University, San Bernardino (CSUSB). She is a McNair Scholar as well as a Louis Stoke Alliance for Minority Participation Scholar. In addition to her research of the release rates of tungsten and lithium from dissolution of common ores in aqueous environments, she's also studied global positioning system measurements of deformation across the San Andreas and San Jacinto faults (with Dr. Sally McGill at CSUSB), preliminary paleo-water chemistry record from banded fault zone calcite at the Mountain Pass Mine, California (with Dr. Erik Melchiorre at CSUSB), and a chemical analysis of Freshwater Lake in Dominica, Lesser Antilles (with Dr. Alan Smith at CSUSB).

Student Presentation: RIMS Science and Engineering Fair 2011 Winners

Using Fossils from the Mojave Desert to Reconstruct a Miocene Period Ecosystem

Hannah and Zack Larsen

The purpose of this investigation was to determine if horse bones and other fossils found in the Barstow Formation from the Miocene period could be used to reconstruct the type of environment from that period.

We compared Merychippus bones we found to other horse bones from the same period as well as looking at other fossils found in the immediate area such as Pseudolauris (an ancient cat), camel, wood, and root casts. If recovered fossils share characteristics with holotype fossils from the same era, then it is possible to identify the species and reconstruct the ancient California ecosystem that existed approximately 14.8 million years ago.

This investigation is important since by revealing the environment of that particular area, we can determine climate, habitat, environmental history, and the animals present during this lush time in southern California's pre-history and get insight into how climate change impacts ecosystems.

On separate occasions, with permission from the BLM, we recovered fossils of various ancient animals, algae, and plants from the Barstow Formation in southern California. Following established procedures for fossil recovery and preservation, we removed diagnostic fossils for further investigation. GPS was utilized to precisely determine the location of our fossils. Recovered fossils were then measured and compared to published measurements.

Results

Recovered fossils were found to be similar to documented fossils, thus allowing for identification of the species from which the bones came. Bones recovered were determined to be that of Merychippus, a Miocene era three-toed horse. Other fossils found at the site were determined to be that of Pseudolauris, (an ancient cat), as well as an ancient camel, root casts, and algae. Merychippus hoof print impressions were also found in the general area, further substantiating our hypothesis that this area was a Miocene era grassland ecosystem.

Conclusions/Discussion

Based on our fossil discoveries, we determined that the area in and around Barstow was a lush grassland during the Miocene era. This was supported by our identification of fossils of three different animal species that were indigenous to grassland areas. It is likely that the area that we studied was a place that animals visited for water.

Climate change over time led to these areas drying up and transitioning into the desert environment that currently exists.

Upcoming Meetings/Events

Rock & Gem Shows—Various locations

Various rock and mineral shows will be throughout So. California. To find one near you, visit www.rockngem.com/showdates.asp

South Coast Geological Society Meeting



Austin Marshall, Mine Manager of the Mitsubishi Cement Corp. in Lucerne Valley, CA, will be presenting a talk on "Limestone Mining and Exploration Drilling in the San Bernardino Mountains" on **Monday, May 7,**

2012 at the Doubletree Club Hotel in Santa Ana, CA. For more info., visit www.southcoastgeo.org

San Diego Assoc. of Geologists Meeting

Dr. Bethany O'Shea from the University of San Diego will be presenting a talk on the "Arsenic-mineral interaction in groundwater environments" on **Wednesday, May 16, 2012.** For more info, visit www.sandiegogeologists.org

REG REVIEW, Inc.—ASBOG Study Course

Are you taking the CEG or CHG exam in Fall 2012? REG REVIEW, Inc. will be offering a study course for the CEG and CHG exams on **Saturday, June 19, 2012.** The courses will be offered at the Best Western Orange County Airport North in Santa Ana, CA. For more info., visit www.regreview.com/



IGS Meeting Schedule

June 6, 2012 (Wednesday)

TBA

July 12, 2012 (Thursday)

TBA

August 1, 2012 (Wednesday)

Thom Deane, Deane Consulting
The Surface Water Outflow from the Orange Crest/Mission Grove (OCMGA) Area of Riverside, CA

September 6, 2012 (Thursday)

Mr. Austin Marshall, Mitsubishi Cement Corp.
TBA

October 3, 2012 (Wednesday)

TBA

November 1, 2012 (Thursday)

TBA

STUDENTS

Are you graduating this year?
Or maybe you have been
working on a research project?

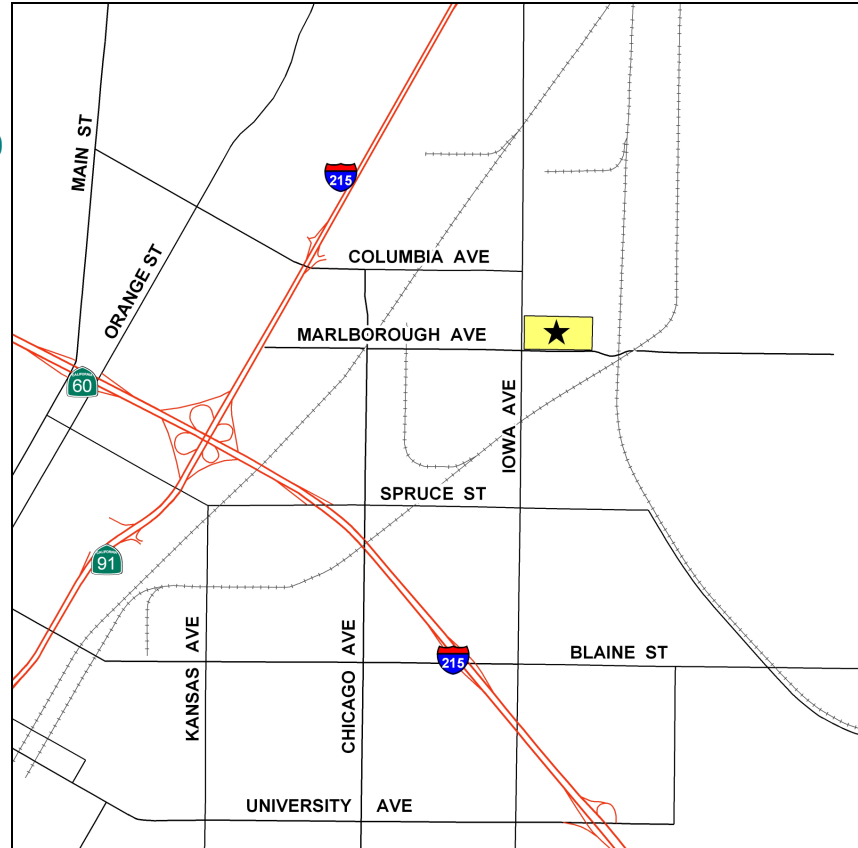
Do you want to practice your
presentation before your
defense? Are you looking to
meet your future employer?

Presenting your research at
an upcoming IGS meeting!

Contact Jon Smith, Debbie
Kunath or Steve Mains to
get your name in the schedule!

IGS MEETING LOCATION:

**LSA Associates, Inc.
1500 Iowa Ave, Suite 200
Riverside, CA 92507**

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