Guidebook

Society of Economic Geologists Foundation, Inc.
Student-Dedicated Field Trip Course – Precious Metal Deposits of the Southwestern U.S.

May 12 - 18, 2013

Erich U. Petersen¹
William X. Chávez, Jr.²

¹College of Mines & Earth Sciences,
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Welcome to the Society of Economic Geologists Foundation, Inc. Field Trip Course – Precious Metal Deposits of the Southwestern U.S., May 12 to 18, 2013. This field course is the eleventh in Society of Economic Geologists Foundations Series that was established as a response to a student petition at the 2006 SEG Conference held in Keystone, Colorado, to provide more support for field trips to important mining districts.

The course starts in Las Vegas at 1:00 Noon on Sunday May 12, 2013; meet at the McCarran International Airport Car Rental Center (take shuttle bus from airport terminal). We will travel by charter bus to Kingman, Arizona. On Monday we will depart promptly at 7:30 to visit the Gold Road Mine and return to Kingman. On Tuesday, pack all your gear for an early (7:30) departure to the Mineral Park Mine and evening destination of Pahrump, Nevada. Wednesday’s destination is the Sterling Mine in the Bullfrog District with an overnight in Tonopah, NV, where we will stay two nights. Thursday and Friday features visit the Round Mountain Mine and the Goldfield District. The last night will be in Shoshone, California.

Entrance to the mine properties usually follows a specific protocol; please be patient. A proper and professional workplace dress code is required (steel-toe boots, hard hat, eye protection, gloves, reflective vest). At the mines we will receive safety training and a geological / engineering presentation. Do not take any pictures of the presentations unless and until we clear this point with company personnel. We will ask, but in general, participants can take pictures and collect samples on company property. Participants are responsible for their own samples (be aware of weight limits if you plan to take samples back with you). Please read through this website carefully for more detailed information (including a "guidebook") and additional requirements.

We will have VERY LIMITED . . . REPEAT: VERY LIMITED . . . space for luggage, so you should bring clothing and field gear ONLY IN DUFFLE BAGS - NO HARD-SIDED LUGGAGE.

We look forward to a fantastic field trip course. See you in Las Vegas!
Acknowledgements

This field trip is generously supported through the Society of Economic Geologists Foundation through the SEGF Student Field Trip Fund. We thank the companies that provided access to their operations in Arizona and Nevada and the many company representatives that gave generously of their time to make this trip a success. Special thanks are due to Borden Putnam, Brian Hoal, John Thoms, and Vicky Sternicki.

The Society of Economic Geologists Foundation, Inc.

American Bonanza Gold
Addwest Minerals Inc.
Imperial Metals Corporation
   Kinross Mining
   International Minerals
   Gold Road Mine
   Sterling Mine
   Mineral Park Mine
Round Mountain Gold Corporation
   Gemfield
David Hedderly-Smith
   University of Utah
   New Mexico Tech
   Erich U. Petersen
William X. Chávez, Jr.
Jeffrey W. Hedenquist
# SEG Foundation Field Course
## Precious Metal Deposits of the Southwestern U.S.

12-18 May, 2013

Leaders:  
**Dr. William X. Chávez, Jr.**  
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<table>
<thead>
<tr>
<th>Date</th>
<th>Itinerary</th>
<th>Overnight</th>
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| May 12     | **1:00 PM** - Meet at Las Vegas McCarran Airport Car Rental Center. - **Best Western A Wayfarer’s Inn and Suites**  
**6:00 PM** - Safety and logistics meeting for all participants. | Kingman, AZ       |
| Sunday     |                                                                           |                   |
| May 13     | **6:30 AM** - Depart for **Gold Road Mine, Oatman District, Arizona**  
Review low-sulfidation vein systems and Oatman District history. | Kingman, AZ       |
| Monday     |                                                                           |                   |
| May 14     | **6:30 AM** - Depart for **Mineral Park Mine, Kingman, Arizona** - **Best Western Pahrump Station**  
Porphyry Cu-Mo Systems | Pahrump, NV       |
| Tuesday    |                                                                           |                   |
| May 15     | **7:00 AM** - Depart for **Sterling Au-Ag Mine - Best Western Hi-Desert Inn**  
Discuss structural setting of Bullfrog, - Montgomery - Shoshone ore deposits. | Tonopah, NV       |
| Wednesday  |                                                                           |                   |
| May 16     | **7:00 AM** - Depart for **Round Mountain Mine**  
Low-sulfidation, structurally controlled Au system. | Tonopah, NV       |
| Thursday   |                                                                           |                   |
| May 17     | **7:00 AM** - Depart for **Goldfield District**  
Review High-sulfidation systems and alteration geochemistry. | Shoshone, CA      |
| Friday     |                                                                           |                   |
| May 18     | **6:30 AM** Course ends. Travel to Las Vegas Airport  
**plan to arrive after 10:00 am** |                   |
| Saturday   |                                                                           |                   |

**NOTES:**

* Participants must arrive at the Car Rental Center at 7135 Gilespie Street in Las Vegas by 1:00 P.M. on the 12th of May for a safety and logistics meeting.*
* All participants MUST - REPEAT - MUST - bring hardhat with lamp bracket, STEEL-TOE BOOTS, reflective vest, gloves, and eye protection. DO NOT plan to obtain these items during the course, as there is no time to do so!

* Participants will need to bring and wear long long-sleeve shirts and pants for the mine visits.

* Participants must provide proof of insurance coverage PRIOR to participation in the course. Please bring your insurance card ID with you.

* All participants must sign a liability waiver form that will be provided by SEGF prior to participation in the course.

* Participants will need to check on USA visa requirements well in advance of their travel.

* All participants will need to submit their passport information (name, country of issue) to SEGF so that this information may be passed along to the mining companies as a part of our mine entrance procedures.

* The weather in Arizona and western Nevada during May is generally balmy and warm; nights may be cool. Please bring layers of clothing for warm days and cool evenings.

* Please bring all prescription medications and your written prescriptions - carry these with you, do not place in your checked baggage. If there are any conditions that might affect you during the course, please advise SEG prior to the course.

* Participants will need money for incidental expenses. SEGF provides transportation during the course, plus lodging and some breakfasts; most mines provide lunches, but prospects may not have facilities to do so. As such, you will need CASH (not credit cards) for your meal and other incidental expenses.

* It is recommended that participants bring sun screen/block, as well as a hat or cap for sun protection.

* Pack Lightly - we have LIMITED SPACE on the bus, so you will need to pack appropriately.
<table>
<thead>
<tr>
<th>Participants</th>
<th>University</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrea Bowen</td>
<td>University of Mississippi</td>
<td>USA</td>
</tr>
<tr>
<td>Andrew Clark</td>
<td>Australian National University</td>
<td>Australia</td>
</tr>
<tr>
<td>Jesse Clark</td>
<td>University of Adelaide</td>
<td>Australia</td>
</tr>
<tr>
<td>Matias Galina</td>
<td>Universidad Nacional La Plata</td>
<td>Argentina</td>
</tr>
<tr>
<td>Katherine Giraldo Africano</td>
<td>Universidad Nacional de Colombia</td>
<td>Colombia</td>
</tr>
<tr>
<td>Joshua Glauch</td>
<td>University of Texas, El Paso</td>
<td>US</td>
</tr>
<tr>
<td>Nyree Hill</td>
<td>University of Leicester</td>
<td>UK</td>
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<tr>
<td>Bartosz Karykowski</td>
<td>Freiburg Univ. Mining &amp; Tech.</td>
<td>Germany</td>
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<tr>
<td>Ivan Krumov</td>
<td>Sofia Univ. St. Kilment Ohridski</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>Freya Marks</td>
<td>University College of Dublin</td>
<td>Ireland</td>
</tr>
<tr>
<td>Christopher Olson</td>
<td>Colorado School of Mines</td>
<td>USA</td>
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<tr>
<td>L. Christine O’Neill</td>
<td>University of Texas, Austin</td>
<td>USA</td>
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<tr>
<td>Justin Palmer</td>
<td>Colorado School of Mines</td>
<td>USA</td>
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<tr>
<td>Krisztina Pandur</td>
<td>University of Saskatchewan</td>
<td>Canada</td>
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<tr>
<td>Jessica Pickett</td>
<td>Queen’s University</td>
<td>Canada</td>
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<tr>
<td>Juanita Rodriguez</td>
<td>Universersidad Estadual de Campinas</td>
<td>Brazil</td>
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<tr>
<td>Nurbol Sailaukhan</td>
<td>National University of Mongolia</td>
<td>Mongolia</td>
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<tr>
<td>Dennis Sanchez Mora</td>
<td>University of New Brunswick</td>
<td>Canada</td>
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<tr>
<td>Erin Summerlin</td>
<td>Auburn University</td>
<td>USA</td>
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<tr>
<td>Dave Hedderly-Smith</td>
<td>Park City, UT</td>
<td>USA</td>
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<tr>
<td>Jeffrey W. Hedenquist</td>
<td>Ottawa, Ontario</td>
<td>Canada</td>
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<tr>
<td>Erich U. Petersen</td>
<td>University of Utah</td>
<td>USA</td>
</tr>
<tr>
<td>William, X., Chávez, Jr.</td>
<td>New Mexico Tech</td>
<td>USA</td>
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Route Map
Geological maps: A) Nevada, B) Arizona
Readings


Diaspore (20X, hand lens view). Goldfields.
**Minerals commonly occurring in epithermal deposits**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Chemical Formula</th>
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<tbody>
<tr>
<td>electrum</td>
<td>AuAg</td>
</tr>
<tr>
<td>pyrite</td>
<td>FeS₂</td>
</tr>
<tr>
<td>covellite</td>
<td>CuS</td>
</tr>
<tr>
<td>enargite</td>
<td>Cu₃AsS₄</td>
</tr>
<tr>
<td>luzonite</td>
<td>Cu₃AsS₄</td>
</tr>
<tr>
<td>famatinite</td>
<td>Cu₅SbS₄</td>
</tr>
<tr>
<td>bismuthinite</td>
<td>Bi₂S₃</td>
</tr>
<tr>
<td>bornite</td>
<td>Cu₅FeS₄</td>
</tr>
<tr>
<td>chalcopyrite</td>
<td>CuFeS₂</td>
</tr>
<tr>
<td>chalcocite</td>
<td>Cu₂S</td>
</tr>
<tr>
<td>sphalerite</td>
<td>ZnS</td>
</tr>
<tr>
<td>molybdenite</td>
<td>MoS₂</td>
</tr>
<tr>
<td>mohite</td>
<td>Cu₂SnS₃</td>
</tr>
<tr>
<td>emplectite</td>
<td>CuBiS₂</td>
</tr>
<tr>
<td>hessite</td>
<td>Ag₂Te</td>
</tr>
<tr>
<td>chlorargyrane</td>
<td>AgCl</td>
</tr>
<tr>
<td>tennantite, tetrahedrite</td>
<td>(Cu,Ag)₁₀(Zn,Fe)₂(As,Sb,Bi)₄S₁₃</td>
</tr>
<tr>
<td>goldfieldite</td>
<td>(Cu,Ag)₁₀(Zn,Fe)₂(Te,Sb,As)₄S₁₃</td>
</tr>
<tr>
<td>acanthite</td>
<td>Ag₂S</td>
</tr>
<tr>
<td>kaolinite</td>
<td>Al₂Si₂O₅(OH)₄</td>
</tr>
<tr>
<td>dickite</td>
<td>Al₂Si₂O₅(OH)₄</td>
</tr>
<tr>
<td>pyrophyllite</td>
<td>Al₂Si₄O₁₀(OH)₂</td>
</tr>
</tbody>
</table>
muscovite ......................... KAl₃Si₃O₁₀(OH)₂
illite .............................. K₃Al₂(Si₄₋₃yAl₃₋y)O₁₀(OH)₂ 0.5<y<0.75
montmorillonite .................. (Na,Ca)ₓ(Al,Fe,Mg)₄(Si,Al)₈O₂₀(OH)₄·nH₂O  x ~ 0.3
adularia .......................... KAlSi₃O₈
alunite ............................ KAl₃(SO₄)₂(OH)₆
jarosite ............................ KFe₃(SO₄)₂(OH)₆
diaspore .......................... AlO(OH)
zunyite ............................ Al₁₃Si₅O₂₂(OH)₁₈Cl
topaz .............................. Al₂SiO₄(OH)₂
native sulfur ...................... S
Sinter, chalcedony, residual silica, (opaline, vuggy) ........ SiO₂
barite ............................. BaSO₄
anhydrite ........................ CaSO₄
calcite ............................. CaCO₃
chlorite ........................... (Mg,Fe)₃(Al,Si)₄O₁₀(OH)₂.₃(Mg,Fe)₃(OH)₆
epidote ............................. Ca₂FeAl₂Si₃O₁₂(OH)
biotite ............................ KFe₃AlSi₃O₁₀(OH)₂
alkali feldspar .................. KAlSi₃O₈
plagioclase ....................... (Ca,Na)Al₂₋₁Si₂₋₃O₈
tourmaline ....................... (Na,Ca)(Li,Mg,Al)(Al,Fe,Mn)₆(BO₃)₃Si₆O₁₈(OH)₂
turquoise ......................... CuAl₆(PO₄)₄(OH)₈·4H₂O.
Contacts and other important information

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At the end of the trip, and as soon as possible, please send a brief e-mail to Borden Putnam with a copy to Brian Hoal and John Thoms describing your experience on the trip and acknowledging the support of the Society of Economic Geologists. This is very important, as the feedback received by SEG is critical for the planning of future field trip courses. You will also find that maintaining contact in this manner will greatly benefit your career whatever course it may follow. The note may be in your native language.