Guidebook

Society of Economic Geologists Foundation, Inc. Student-Dedicated Field Trip Course – Gold Systems of Northern Nevada

May 12 - 20, 2009

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SEGF Student-dedicated Field Trip Course

Gold Systems of Northern Nevada

Welcome to the Society of Economic Geologists Foundation, Inc. Field Trip Course – Gold Systems of Northern Nevada, May 12 to 20, 2009. This field trip course is the fifth in Society of Economic Geologists Foundations Series that was established as a response to a student petition at the at the recent SEG Conference held in Keystone, Colorado, to provide more support for field trips to important mining districts.

The course starts at the Reno airport at 2:00 pm on Tuesday the 12th at the Reno airport baggage claim area. We will depart from the airport at 2:15. We will drive in two vans to Winnemucca where we will stay the first night at the Gold Country Inn. An orientation meeting will be held following dinner. The next day we will visit the Phoenix deposit south of Battle Mountain and travel to Elko, NV, where we will be based for several nights. Other districts and deposits that will be visited include, Carlin District, Chukar deposit, Pipeline/Cortez District, Cortez deposit, Midas Deposit, Twin Creeks mine, Rochester mine and deposits in the Turquoise Ridge /Getchell district. The field trip course ends in Reno on the evening of Thursday the 20th with participants departing Reno on Thursday the 21st.

Entrance to the mine sites usually follows a specific protocol; please be patient. 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). See itinerary for hosted meals, but be aware that last minute changes are possible.

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. See you in Reno.

Acknowledgements

*This field trip is generously supported through the Society of Economic Geologist Foundation through the **SEGF Student Field Trip Fund**. We also wish to thank the companies that provided access to their operations in Nevada and the many company representatives that gave generously of their time to make this trip a success. Special thanks are due to Pat Donovan, Rachel Burgess, Nancy Richter, Fred Breit, Keith Wood, Gabriel Graf, Henry Follman, Robert Loranger, Susan Abbott, Anita Brown, Jake Margolis, Jennifer Hanson, and John Thoms.*

The Society of Economic Geologists Foundation

Newmont Gold Company

Newmont Mining Corporation

Barrick- Turquoise Ridge Mine

Barrick- Cortez Gold Mines

Redstar Gold Corporation

Kennecott Minerals

Coeur d'Alene

Erich U. Petersen

William X. Chávez, Jr.

Jacob Margolis

Cover: Crystal Hammer, Twin Creeks Mine

SEG Foundation Student-Dedicated Field Trip
May 12 – 20, 2009

Date	Itinerary	Overnight
12 May Tuesday	**2:00PM**: Assemble at Reno Airport Baggage Claim Area Depart for Winnemucca, Nevada via I-80. **Lodging**: **Best Western Gold Country Inn**, **Winnemucca** 921 W. Winnemucca Blvd Winnemucca, Nevada 89445-3638 (775) 623-6999 transfer to 501 Fax: 775-623-9190	Best Western Gold Country Winnemucca, Nevada Contact: Patricia
13 May Wednesday	**6:30AM –** Visit **Phoenix Cu-Au porphyry property** Discuss characteristics of porphyry-style hydrothermal systems. Late afternoon departure for Elko, Nevada. **Lodging**: **Thunderbird Motel** 345 Idaho St Elko, Nevada 89801 P: 775- 738-7115 F: 775-738-2694	Thunderbird Motel Elko, Nevada
14 May Thursday	**6:30AM –** Visit **Carlin District** – review of stratigraphy and structure of Paleozoic sequences; discuss mineralization styles with core review **Contact**: **Rachel Burgess**, Project Geologist Newmont Mining Corp, Carlin Operations Phone 775.778.2034 F: 775.778.4038 rachel.burgess@newmont.com	Thunderbird Motel Elko, Nevada
15 May Friday	**7:00AM** - Visit **Chukar** underground mine, Carlin District Review structural settings of some Carlin systems.	Thunderbird Motel Elko, Nevada
16 May Saturday	**7:00AM** – Visit **Pipeline/Cortez District**; review history of discoveries in northern Nevada. Travel to Winnemucca **Contact**: **Bob Leonardson,** Chief Exploration Geologist Cortez Gold Mines HC66 Box 1250 Crescent Valley, Nevada 89821-1250 Telephone: 775-468-4430 <rleonardson@barrick.com> **Lodging**: **Best Western Gold Country Inn**, **Winnemucca** 921 W. Winnemucca Blvd Winnemucca, Nevada 89445-3638 (775) 623-6999	Best Western Gold Country Winnemucca, Nevada Also: **Kevin Creel**: 775-468-4489

17 May Sunday	**6:30AM –** Visit **Midas high-sulfidation epithermal system** Discuss characteristics of high-sulfidation hydrothermal systems. **Contact: Gabriel Graf,** Mine Geologist - Midas Operations Newmont Mining Corporation Midas, Nevada 89414 Work: 775.635.6560 Cell: 775.304.7393 E-Mail: Gabriel.Graf@newmont.com	Best Western Gold Country Winnemucca, Nevada Contact: Lydie
18 May Monday	**6:30AM** – Visit **Twin Creeks Mine**. Discuss Getchell Trend ore deposits, Basin and Range structures **Contact:** Patrick J. Donovan Newmont Twin Creeks Mine Geology Manager Golconda, Nevada 775-635-4649 office 775-304-0780 cell pat.donovan@newmont.com **Contact**: Sue Abbott P.O. Box 208 Winnemucca, NV 89446 775-304-8188 sue.abbott@newmont.com **Evening**: 6:30PM Safety Presentations for Getchell Mine visit	Best Western Gold Country Winnemucca, Nevada
19 May Tuesday	**6:45AM** – Depart for visit to the **Getchell Mine.** Discuss high-As systems, importance of volatiles, paragenesis of As and structural controls of precious metals mineralization. **Contact**: Karl Marlowe Chief Exploration Geologist Turquoise Ridge / Getchell Trend HC66 Box 220 Golconda, NV 89414 Office: 775 529-5001 ext. 2329 Mobile: 775 934-3871	Best Western Gold Country Winnemucca, Nevada
20 May Wednesday	**6:00AM – Visit Rochester Ag-Au system**; discuss volcanic-hosted precious metals systems; Ag-dominant systems **Contact**: Mike Maslowski: <MMaslowski@coeur.com Don Birak: <DBirak@coeur.com> At Reno: **Evening Farewell Dinner** **Lodging**: Best Western Airport Inn, Reno Airport 1981 Terminal Way, Reno Telephone: 775/348-6370	Best Western Airport Reno, Nevada F: 775-348-7596
21 May Thursday	Course ends, participants return.	

Timing

- **2:00 PM, Tuesday, 12 May:** Assemble at the Baggage Claim area at the Reno Airport; discuss safety and logistics, course itinerary.

- **2:15 PM:** Load vans, depart for three-hour drive to Winnemucca, Nevada.

Logistics and Field Gear Checklist

- **YOU MUST BRING THE FOLLOWING REQUIRED FIELD GEAR! DO NOT PLAN TO OBTAIN THIS GEAR WHILE ON THE COURSE AS THERE WILL BE NO TIME TO DO SO**.

- **Hardhat ♦Reflective red or orange vest ♦Gloves ♦ Steel toe boots ♦ Protective Eyewear**

- Weather in northern Nevada in May is quite variable, so please bring:
  - Long pants (required; several pair)
  - Long-sleeve shirts (required)
  - Jacket/windbreaker; rain/snow possible, as are very sunny days
  - Cap or hat for sun protection
  - One nice set of clothing for company-sponsored dinners
  - Field/hiking boots for our field days
  - Sunscreen and lip balm
  - Sunglasses

- For our field work:
  - rock hammer
  - hand lens
  - hardness tester (scratcher)

- We will be traveling in two vans, with **very limited space**; **use a duffle bag or soft-sided luggage** for your clothing and personal effects; **no hard-sided luggage**.

- Remember to bring any **prescription medicines** and your **insurance card/proof of insurance. You should also bring any medical information that would be important in case of an emergency.**

- Cameras are permitted, although we ask permission to take photographs at each mine site. Be sure to bring extra film/cards.

- For underground mine tours – bring cool comfortable clothes to wear under coveralls, and bring a bottle of water to take underground.

- SEGF and our mine hosts will provide lodging and transport for students; students **should bring money for snacks/meals, incidental expenses, phone calls, and the like**.

Participants

PARTICIPANTS	UNIVERSITY	COUNTRY	EMAIL
Anderson, L. Page	University of Utah	USA	lpanderson@mines.utah.edu
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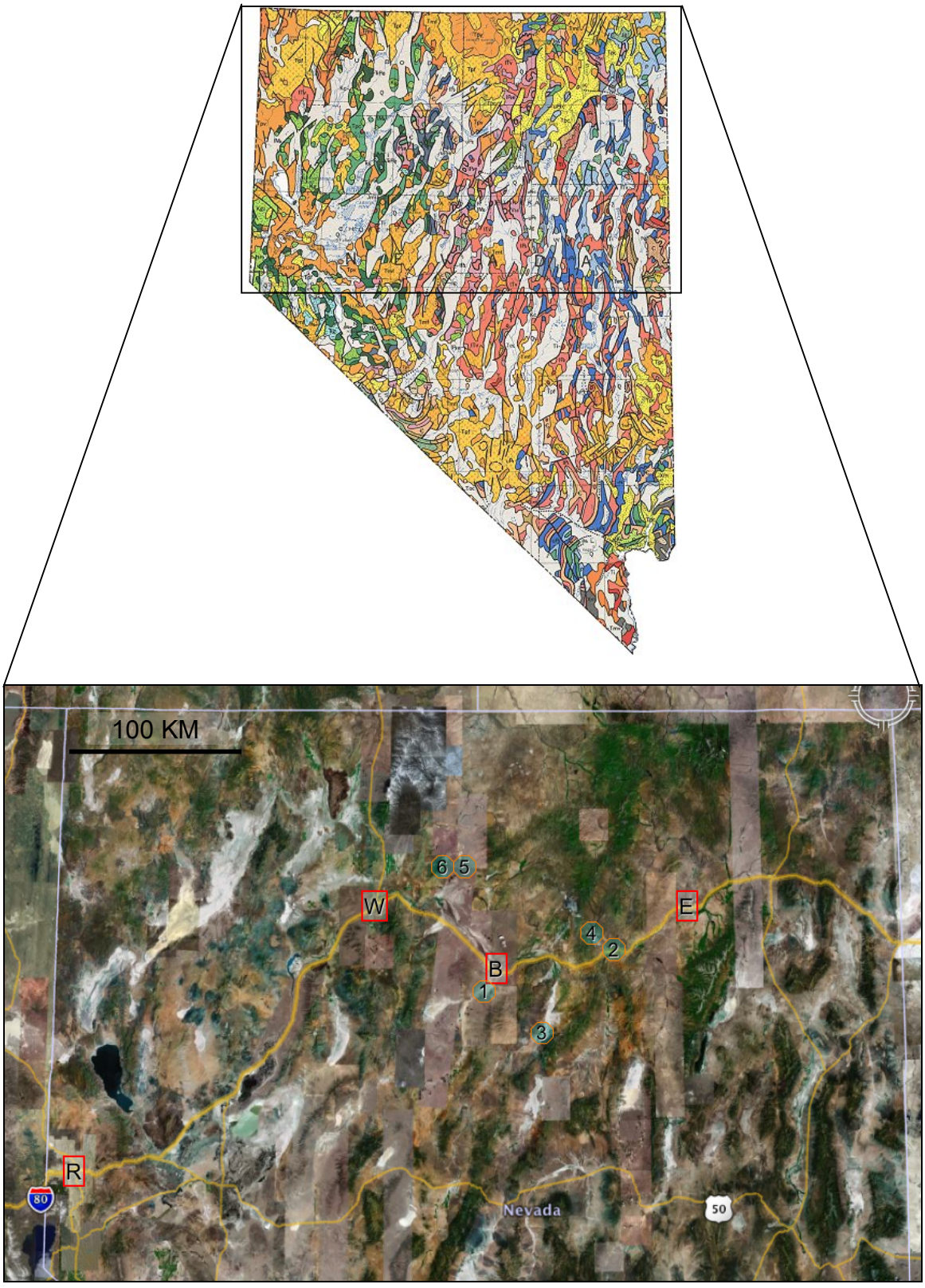
Petersen, Erich U.	University of Utah	USA	erich.petersen@utah.edu

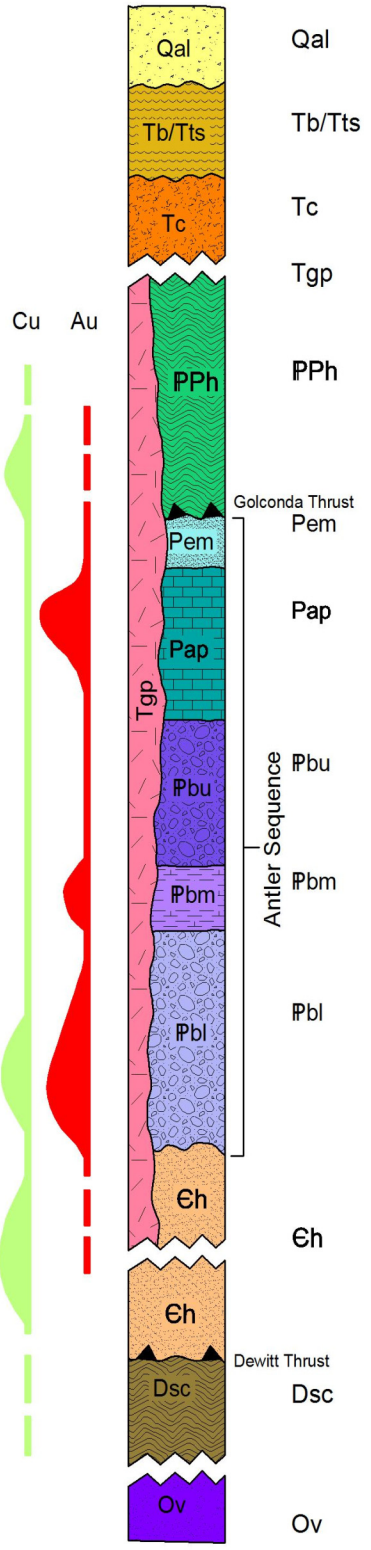


R = Reno, W = Winnemucca, B = Battle Mountain, E= Elko
1, Phoenix Project; 2, Carlin; 3, Cortez Joint Venture; 4, Leeville, Chukar; Twin Creeks; 6, Tourquoise Ridge100 KM

COPPER CANYON (PHOENIX)
TECTONOSTRATIGRAPHIC COLUMN

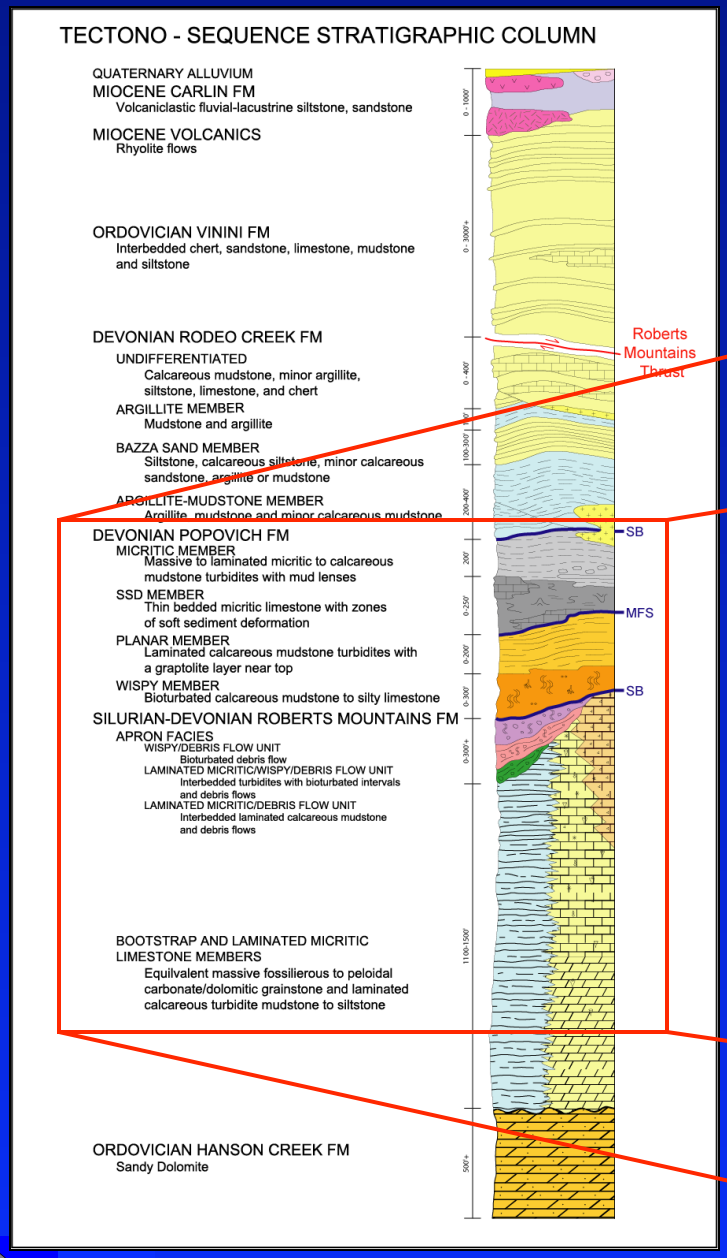
May 2005

0 200 FT

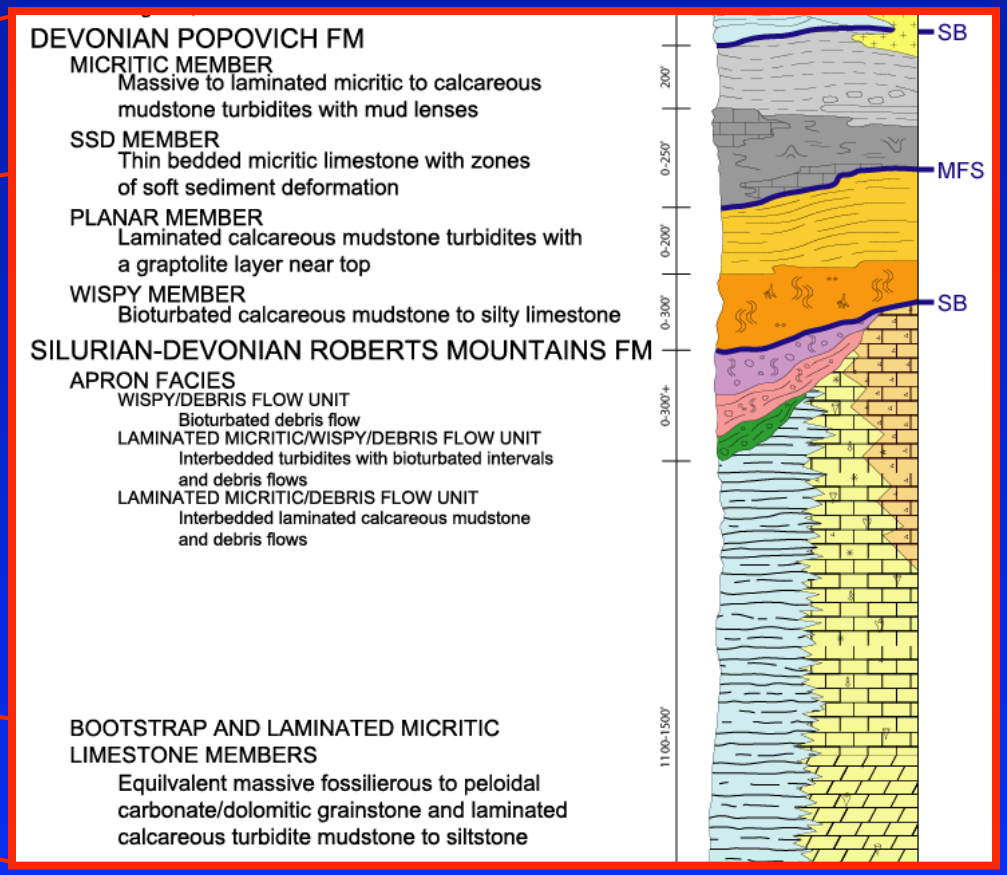


Qal	Alluvium/colluvium
Tb/Tts	Pliocene basalt and interbedded tuffaceous siltstone + sandstone 0-400 ft thick.
Tc	Caetano tuff Oligocene 33 Ma crystal-rich lithic tuff 0-200 ft thick.
Tgp	Eocene 38 Ma granodiorite porphyry of Copper Canyon and Wilson-Independence laccolithic stocks up to 1,500 ft thick. Variable argillic, sericitic, secondary biotite and propylitic alteration.
PPh	Pumpernickel sequence >5,000 ft thick allochthonous argillite + chert with minor sandstone, siltstone, limestone and metavolcanic units. Lower LU-1 and upper LU-2 units (Murchey 1990). LU-1 formerly Pumpernickel Fm of Roberts (1964). Altered to biotite and siliceous hornfels. Golconda thrust = basal contact.
Pem	Edna Mountain Fm 60-120 ft thick lower siliceous pebble conglomerate and upper coarse-grained sandstone and calcareous siltstone. Altered to diopside+siliceous hornfels.
Pap	Antler Peak Limestone 140-220 ft thick medium-bedded micritic and bioclastic limestone with minor shale and conglomerate near lower contact. Altered to marble+actinolite-pyroxene skarn.
Pbu	upper unit of Battle Fm 120-220 ft thick siliceous pebble conglomerate with interbedded shale, siltstone and silty limestone. 0.5-2-inch diameter clasts of of angular to subrounded quartzite and chert in sandy matrix. Altered to biotite+siliceous hornfels.
Pbm	middle unit of Battle Fm 40-125 ft thick thin-bedded calcareous siltstone and shale with minor sandstone. Altered to actinolite+diopside skarn.
Pbl	lower unit of Battle Fm 220-300 ft thick massive siliceous pebble conglomerate with minor sandstone + siltstone. 1-6-inch diameter clasts of angular to subrounded quartzite and chert in sandy hematitic matrix. Altered to actinolite+diopside+epidote skarn + siliceous hornfels.
Ch	Harmony Fm >1,200 ft thick allochthonous micaceous sandstone and arkose with minor shale, siltstone and conglomerate. Altered to biotite hornfels + sericite in matrix. Dewitt thrust = basal contact with Scott Canyon Fm.
Dsc	Scott Canyon Fm > 2,000 ft thick allochthonous chert+argillite (Dsc) with basalt/greenstone (Dsg), limestone (Dsl), and olistostrome (Dso) with olistoliths of limestone, sandstone and chert (Doebrich, 1994).
Ov	Valmy Fm lower quartzite and upper cherty argillite 300-1,000 ft thick.

General Stratigraphic Column for Northern Carlin Trend



Modified from Volk et al. (1996)



Glossary

Brief definitions of terms as used in Nevada (and other places)

Decalcification— A type of alteration in typically occurring in silty limestone in which the carbonate is removed by dissolution. Generally this leads to increased porosity in the rock.

Pyritization— A type of alteration in which sulfur and possibly iron has been added to the rock mass and lead to the conversion of Fe-bearing minerals to pyrite and/or addition of pyrite.

Carbonaceous matter— A type of alteration in which organic matter is added to the rock mass. This process may complicate gold recovery as gold may adsorb on the organic matter making it difficult to separate later (see preg-robbing).

Restite—A rock that has been decalcified generally consists of clays and quartz.
Jasperoid—A rock mass, formerly limestone, which has been completely silicified. Some have applied this term to any silicified rock.

Preg-robbing—Characteristic of a rock mass that contains organic matter that strongly adsorbs gold.

Carbon-in-pulp— Granular coconut shell activated carbon, is widely used for recovery of gold from cyanide solutions. Gold cyanide is adsorbed into the pores of activated carbon, resulting in a process solution that is devoid of gold. The loaded carbon is heated by a strong solution of hot caustic and cyanide to reverse the adsorption process and strip the carbon of gold. Gold is then removed from the solution by electrowinning. Stripped carbon is returned to adsorption for reuse. Carbon-in-pulp operation is a variation of the conventional cyanidation process. Ore is crushed, finely ground, and cyanide leached in a series of agitated tanks to solubilize the gold values. Granular activated carbon is added to the leached slurry. The carbon adsorbs the gold from the slurry solution and is removed from the slurry by coarse screening. In practice, this is accomplished by a series of five or six agitated tanks where carbon and ore slurry are contacted in a staged countercurrent manner. The opening size of the CIP tank screens is such that the finely ground ore particles will pass through the screens, but the coarse carbon will not.

Roasting—A metallurgical process by which carbonaceous ores (see carbonaceous matter) are heated in air to 1000°F to oxidize the carbon. SO_2 is produced from pyrite, which is a common constituent of the ore and captured to make sulfuric acid.

Autoclave (pressure oxidation)—A metallurgical process by which sulfides (pyrite) is converted to an oxide at high temperature and pressure. It involves a reaction between gas (O_2) and solid. SO_2 is produced and captured to make sulfuric acid.

Sulfide refractory ore without carbonaceous matter is treated by pressure oxidation in an autoclave.

Minerals

Mineral	Chemical Formula
Orpiment	As_2S_3
Realgar	AsS
Galkhaite	$(Cs,Tl)(Hg,Cu,Zn)_6(As,Sb)_4S_{12}$
Arsenopyrite	FeAsS
Pyrite	FeS_2
Dolomite	$CaMg(CO_3)_2$

Realgar from Turquoise Ridge, Getchell District, NV (Width = 2 cm); Photo: Erich U. Petersen

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Many of the articles listed below are available in electronic format on the following website: http://www.mines.utah.edu/pyrite/SEGFnevada2007/index.htm

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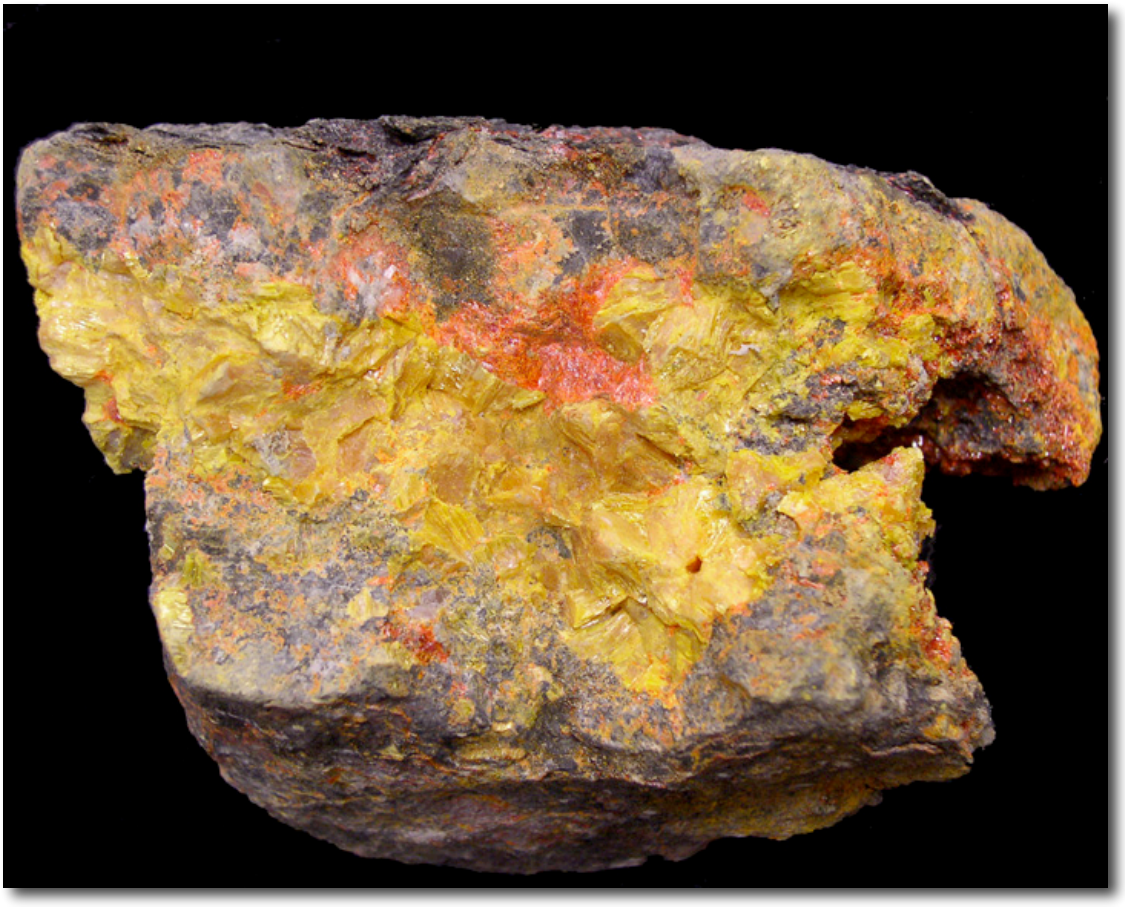

Orpiment and Realgar from Leeville Mine, Carlin, NV (Width = 15 cm); Photo: Erich U. Petersen

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At the end of the trip, and as soon as possible, please send a brief e-mail to either John Thoms with a copy to Brian Hoal 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 course trips. You will also find that maintaining contact in this manner will greatly benefit your career what ever course you may follow. Your note may be in your native language.