GSN NEWSLETTER

February 2006, Vol. 21, No. 2

CALENDAR OF GSN EVENTS

Feb. 8
Wednesday

WINNEMUCCA CHAPTER MEETING. Speaker: Harry E. Cook, Emeritus U.S. Geological Survey, Menlo Park, CA. Title: “Carbonate Sequence Stratigraphy: An Exploration Tool for Sediment-Hosted, Disseminated Gold Deposits in the Great Basin”. The Martin Hotel, Melarkey and Railroad Streets. Drinks at 6:30 pm, presentation at 7:00 pm. Contact Kim Craig, Chapter President, for more info, 775/529-5001 x1340, kim_craig@Placerdome.com. See abstract on page 9.

Feb. 16
Thursday

ELKO CHAPTER MEETING. Speaker: John Muntean, Nevada Bureau of Mines & Geology. Title: “The Porphyry-Epithermal Transition: Examples from the Maricunga Belt, Northern Chile”. Western Folklife Center, Elko, NV. Drinks at 6:00 pm, talk at 7:00 pm. Contact John Watson, Chapter President, for more info, 775/738-2062, jwatson@barrick.com. See abstract on page 11.

Feb. 17
Friday

GSN MEMBERSHIP MEETING. Speaker: Eric Saderholm, Newmont Mining Corp. Title: “Phoenix Mine – New Life in an Old District”. Reno Elks Lodge, 597 Kumle Ln, Reno, NV. Drinks at 6 pm, dinner at 7 pm, talk at 8 pm. Contact Laura Ruud for reservations, 775/323-3500, gsn@mines.unr.edu.

Feb. 23
Thursday

SOUTHERN NEVADA CHAPTER MEETING. Speaker: Maxwell Blanchard, Planetary Scientist Retired from NASA - Ames Research Center & Johnson Space Center. Currently: Astronomy Instructor, CCSN. Topic: “Using Thermal Infrared Imagery in Geologic Studies”. Room 105, Lily Fong Geoscience Building, UNLV, Las Vegas, NV. Social half hour at 6:00 pm, presentation at 6:30 pm. Contact Robyn A. Howley, Chapter President, 702/895-5054, robynhowley@yahoo.com for more information. See abstract on page 8.

Mar. 17
Friday

GSN MEMBERSHIP MEETING. Speaker: Bill Neal, Midway Gold. Title: “Coarse Gold at Midway Gold’s Spring Valley Deposit, Pershing County, Nevada”.

GSN Newsletter is published monthly except June and July
Geological Society of Nevada, PO Box 13375, Reno, NV 89507 USA, 775/323-3500, www.gsnv.org
Office location: Laxalt Mineral Research Center, Rm 266, UNR. Hours: Mon thru Fri, 1-4 pm

FROM THE PRESIDENT

Dieter Krewedl, *GSN President 2004-2006*

The **GSN 2005/2006 membership directory** has been assembled and is currently being distributed to all of our members. Many thanks go to Greg French, Raye Buckley and Laura Ruud for putting it together. Besides being a great source of information about the GSN and its members, this year’s directory for the first time contains a list of the past officers and a brief history of the GSN, which was written by Roger Steininger. This initial effort to summarize GSN’s history is an attempt to put together the almost 50

continued on page 2

FROM THE PRESIDENT *continued from page 1*

years of Friday evening meetings, social events, field trips, symposiums, and informal meetings. I hope this summary will stimulate others to come forward with additions, corrections, notes, documents, etc., so that an expanded GSN history can be produced in the future.

Since its foundation in 1957, the GSN has grown from a small, Reno-based organization into a world renowned professional Society with members living and working throughout the United States and internationally. Its success is due to the many volunteers that have served the Society over the past almost 50 years. Many members attending the meetings, field trips and symposiums have developed not only professional and personal friendships, but have also developed a great loyalty to the organization. The GSN is a unique Society and we should plan to have a special celebration in 2007 to commemorate our **50th anniversary**.

The presentation by Mike Brady during the January membership meeting was a good summary of gold mining and exploration in Nevada from 1993 to 2004. Mike's research showed the discovery cost per gold ounce is low in Nevada and greater exploration expenditures are needed to maintain or exceed current state wide gold production. Certainly, the recent increase in exploration expenditures has resulted in a number of exploration successes during 2005. For the remainder of GSN's 2005/2006 fiscal year, I intend to highlight some of these successes through the presentations at our membership meetings. We will begin in February with Eric Saderholm discussing the Phoenix Mine where Newmont is investing millions of dollars to mine a gold sulfide reserve of 8.5 million ounces beginning this year. We also want to thank **Inspectorate** for hosting the social hour during the February meeting.

Also in February, the GSN Board of Directors will be holding their second quarterly meeting when they will be addressing issues and opportunities that will help the GSN and its three chapters grow and meet the needs of the entire organization. Also, the GSN 2005 Symposium Proceedings are scheduled to be distributed in February. This two volume set will be an important addition to everyone's library. Many thanks go to all of the volunteers, who helped make the GSN Symposium such an outstanding success, but especially to Greg Hill for his tireless efforts to get the proceedings printed and distributed.

Finally, this is the time of the year when the GSN and its chapters recruit volunteers for next year's officers. Please contact me or one of the Presidents of the three chapters if you would be interested in serving this great Society.

Thanks and I hope you will be able to attend at least one of the four membership meetings at the GSN or its chapters during February.

Thank you to our generous donors

GSN Foundation

Steve Bussey
Martha DeLong
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Steve Lappin

Student Dinner Fund

Alan Branham
Del Flint
Bob Horton
Steve Lappin

GSN 2005 SYMPOSIUM VOLUMES UPDATE

The wait is almost over! Word has it that the Proceedings Volumes from the GSN's 2005 Symposium "Window to the World" are at the printer. They will still need to be sent to the bindery and boxed and labeled for shipping. **The estimated mailing date that Johnson Printing has given us is mid-February.** They will be arriving via U.S. Postal Service unless you specified that you were going to pick it up. You will receive an email from the GSN office once we have confirmed that they are actually in the mail.

Thanks to ALS Chemex for hosting the January meeting.

GSN February 17, 2006 Membership Meeting

Date: Friday, February 17, 2006

Time: Social-6:00, Dinner-7:00, Meeting-8:00

Reservations: 775/323-3500; fax 323-3599, e-mail gsn@mines.unr.edu

Deadline: Reserve by 11 am Thursday, February 16th

Location: Elks Lodge, 597 Kumle Lane, Reno, NV

Directions: Across (W) from the Reno-Sparks Convention Center (S Virginia St), behind the Les Schwab Tire Center

Speaker/topic: Eric Saderholm, Newmont Mining Corporation See abstract below.

PHOENIX MINE - "NEW LIFE IN AN OLD DISTRICT"

Eric Saderholm, Newmont Mining Corporation

Location:
The Phoenix Mine is located in the Battle Mountain mining District in Lander County, Nevada, approximately 13 miles southwest of the town of Battle Mountain.

Brief Mining History:
Mining began in the Battle Mountain district in the 1860's. Initially silver-bearing galena veins were mined north of the current Phoenix Mine. High-grade copper was mined in the 1920's from the Glory Hole, in the central project area. Duvall mined open-pit copper resources in the 1960's and began open-cut gold mining in the mid 1970's. Battle Mountain Gold Company mined gold from open pits in the 1980's and 90's. Newmont Mining Corporation, the current owner/operator, bought the property in 2001 and mining resumed in 2004 with the production of leachable gold ores. A large multi-metal processing facility is currently under construction and sulfide ore production will begin in early 2006.

General Geology and Ore Controlling Features:
Lithologically and structurally-controlled Copper Canyon ores are part of a large porphyry-skarn Au-Cu-Ag system developed around the 38 Ma Copper Canyon granodiorite porphyry stock. A 3-mile long north-south zone of Au-Cu-Ag is centered on several known and inferred stocks that are part of a larger buried pluton based on hornfelsing, dike swarms, metal zoning and a broad aeromagnetic anomaly. High-angle, west-dipping NS-striking normal faults served as the primary hydrothermal fluid conduits, particularly the Virgin fault zone (currently referred to as the Master fault). Stratabound mineralization is hosted predominantly by carbonate-rich sedimentary rocks of the Pennsylvanian/Permian Antler sequence, including the Antler Peak, Edna Mountain and Battle Formations. The fractured and deeply oxidized siliciclastic Cambrian Harmony Formation and Pennsylvanian Havallah Sequence are locally mineralized where strongly structurally broken.

Production Information:

Mining of ROM oxide ores began in November, 2004.

When completed, the large mill will consist of a crushing and grinding circuit, gravity and flotation followed by CIL gold recovery and the production of a copper concentrate to be shipped off-site for smelting.

The 2004 reserves are 8.5 million ounces gold, 45 million ounces silver and 660 million pounds copper. Final 2005 reserves have yet to be released.

The current mine life is 20 years (2024) with significant upside potential for increase.

The average mining rate will be 150K tons/day (54 million tons/year) yielding 430K ounces gold/year, 30 million pounds copper/year and 3 million ounces silver/year.

Cash costs are estimated to be $200 to $225/ounce.

Eric is a 1984 graduate of Utah State University. From 1982 to 1993, he did grassroots exploration for various companies as a contract geologist. Beginning in 1994, Eric has worked for Newmont mining doing a combination of exploration, development and mining geology. He has extensive experience in sediment-hosted and low and high sulfidation volcanic-hosted systems. Eric is currently supervising Carlin Trend surface and underground exploration, ore control and development projects for Newmont.

A little note from a package of Roquefort cheese gives a geology lesson:

"Societe Brand Roquefort is made in the tiny village of Roquefort-sur-Soulzon in the south of France. Setting free its anger several million years ago, the Earth tore apart and with an appalling crash, the Combalou Mountains collapsed. This is how the Roquefort caves were born."

ACTIVITY UPDATE

Mike Brady, December 2005
www.activityupdate.com

NEVADA

Newcrest Mining Ltd.(65%) announced that recent drill results at the Redlich Project include 41.15-105.15 meters @ 0.019 opt Au (R-56) and 172.2-175.3 meters @ 1.042 opt Au (R-73). *M.J.:* November 11

Atna Resources Ltd. announced that recent drill results at the Pinson Project include 710.9-713.5 feet @ 0.143 opt Au (APRF-232); 605-615 feet @ 0.304 opt Au (APRF-237); 716.5-717.7 feet @ 0.524 opt Au (APRF-238); 698-725 feet @ 0.738 opt Au (APRF-239); 581.3-592 feet @ 0.141 opt Au (APRF-246); 600-609 feet @ 0.401 opt Au (APRF-248); 686-692.4 feet @ 0.519 opt Au (APRF-252) and 645-655 feet @ 0.563 opt Au (APRF-256). (resource = 1,760,000 tons @ 0.302 opt Au measured+indicated)
Press Release: November 28

Miranda Gold Corp.(40%) announced that recent drill results at the Horse Mountain Project include 926.2-1,024.4 feet @ 0.023 opt Au (BHM-001).
Press Release: December 15

Aberdene Mines Ltd. announced that recent drill results at the New York Canyon/Longshot Ridge Project include 135-165 feet @ 0.23% Cu (05-31); 0-40 feet @ 0.45% Cu (05-32); 130-155 feet @ 0.37% Cu (05-32); 225-265 feet @ 1.03% Cu (05-32); 9-220 feet @ 0.65% Cu (05-33C); 0-150 feet @ 0.52% Cu (05-35) and 0-105 feet @ 0.44% Cu (05-37). (resource = 16,100,000 tons @ 0.55% Cu)
Press Release: December 14

American Bonanza Gold Corp.(95%) announced that recent drill results at the Gold Bar Project include 380-395 feet @ 0.019 opt Au (BZGB-2); 630-725 feet @ 0.017 opt Au (BZGB-4); 690-720 feet @ 0.046 opt Au (BZGB-7) and 615-695 feet @ 0.071 opt Au (BZGB-8).
Press Release: December 1

Castleworth Ventures Inc. announced that it acquired an option to earn a 100% interest in the Jessup Property from Sunrise Land + Minerals Inc. for $250,000 cash over 2 years. (resource = 8,370,000 tons @ 0.024 opt Au, 0.25 opt Ag inferred) *Press Release:* November 29

Great Basin Gold Ltd.(50%) announced that the access decline at the Ivanhoe Project has now intersected the Gweniver Vein system at a depth of roughly 2,720 feet from the portal. (resource = 717,200 tons @ 1.295 opt Au, 7.03 opt Ag) *Press Release:* December 12

Klondex Mines Ltd. announced that recent drill results at the Fire Creek Project include 690-700 feet @ 1.732 opt Au, 3.71 opt Ag (FC0515); 925-935 feet @ 2.573 opt Au, 1.13 opt Ag (FC0515); 760-765 feet @ 0.239 opt Au, 0.18 opt Ag (FC0516); 857.5-860 feet @ 0.453 opt Au, 0.11 opt Ag (FC0517) and 672.5-675 feet @ 0.248 opt Au, 0.08 opt Ag (FC0519). (resource = 1,779,200 tons @ 0.328 opt Au)
Press Release: December 13

Midway Gold Corp. announced that recent drill results at the Spring Valley Project include 95-175 feet @ 0.096 opt Au (SV05-144); 540-590 feet @ 0.136 opt Au (SV05-153); 70-115 feet @ 0.098 opt Au (SV05-159); 75-160 feet @ 0.052 opt Au (SV05-161) and 540-580 feet @ 0.044 opt Au (SV05-163). *Press Release:* December 6

Vista Gold Corp. announced that it purchased 55 individual properties and a 5% NSR on the Hycroft Property held by F.W. Lewis Inc. from Century Gold LLC for $400,000 cash now and future considerations of 250,000 shares and $4,700,000 cash. (reserve @ Hycroft = 32,400,000 tons @ 0.017 opt Au proven+probable)
Press Release: December 13

Placer Dome Inc. announced that reserves at the Bald Mountain Mine aggregate 19,140,000 tons @ 0.047 opt Au proven+probable and resources 97,680,000 tons @ 0.029 opt Au measured+indicated. (was 21,485,200 tons @ 0.044 opt Au proven+probable and 85,743,900 tons @ 0.030 opt Au as a total resource) *Press Release:* November 29

Barrick Gold Corp. announced that it increased its takeover offer for Placer Dome Inc. to 0.7216 Barrick share + $2.91/share cash for each Placer share (roughly $22.48/share) for a total value of $10,400,000,000.
W.S.J: December 23

Placer Dome Inc. announced that it accepted the recent increased takeover offer from Barrick Gold Corp.
W.S.J.: December 23

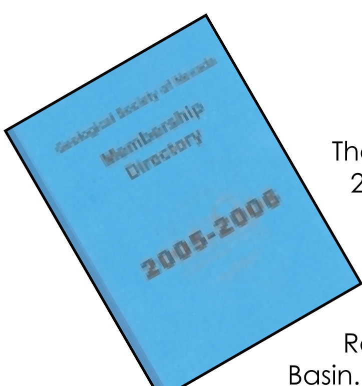
GSN MEMBERS' PERSONAL NOTES & NEWS

Career Related Moves

◗ Steve Craig has been appointed to the position of Vice President, Exploration for Gryphon Gold Corporation based out of Lakewood, Colorado. Steve will be responsible for the definition drilling and the broader scale district exploration program on the Borealis project in Nevada. Donald Ranta will continue as a Director of Gryphon Gold with responsibility for resource expansion, providing guidance and oversight to the evolving Borealis project as a member of the Project Development, Environmental and Sustainability Committee of the Board, and as the senior Consulting Geologist to the Company.

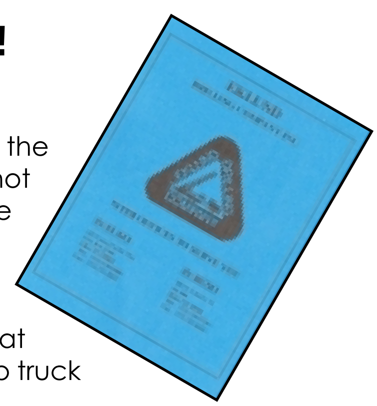
Members are encouraged to keep us informed about their own career related moves and awards, and deaths of GSN colleagues. Your information needs to be received by Laura at gsn@mines.unr.edu by the 21st of each month.

2005/2006 DIRECTORY IS AVAILABLE!



Greg French, *GSN Membership Chair*

The GSN wishes to thank all the advertising supporters of the 2005-2006 Membership Directory. The Directory could not have been possible without the hard work of Raye Buckley and Laura Ruud. We also wish to thank Sir Speedy for printing the directory.



Remember the Directory is the "Who's Who" in the Great Basin. Purchase an extra copy for your home, office, or pickup truck for $10/each. Don't leave for the field without one!

SOUTHERN NEVADA CHAPTER FEBRUARY 16TH MEETING

Using Thermal Infrared Imagery in Geologic Studies

Maxwell Blanchard, Planetary Scientist
Retired from NASA - Ames Research Center & Johnson Space Center
Currently: Astronomy Instructor, CCSN

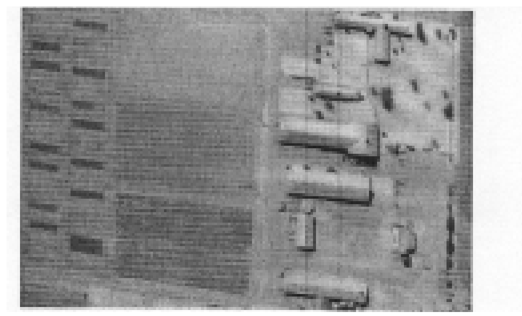
ABSTRACT

This lecture will discuss the principles of interpreting thermal infrared imagery and explain some common infrared scanning systems.

The portion of the electromagnetic spectrum that is commonly used for thermal infrared imagery is 8 - 14 microns wavelength. Because this wavelength range is beyond the visible spectrum (i.e. 0.4 - 0.7 microns), it is not possible for humans to see objects that are emitting energy in the infrared wavelengths. Fortunately, there are many sensors, used in astronomy and planetary science, that are sensitive to energy in this part of the electromagnetic spectrum and it is possible to use a scanning system to detect the incoming infrared energy from the object and produce images. These images are essentially temperature maps of the object and reveal small temperature differences across the object's surface. The energy is converted into temperature using the Stefan-Boltzman relationship.

Thermal infrared scanners have been used in spacecraft, aircraft, and ground equipment to produce images of surface features observed on Earth, planets, moons, asteroids and comets. In order to interpret a thermal infrared image, it is necessary to understand those characteristics of the object that influence the surface temperature of the object at the time of image acquisition.

If a geologist is observing soil or rock in a stratigraphic, structural, or hydrologic setting, the surface temperature is mostly determined by: (1) albedo in the day time, when heat flows into the soil or rock due to the incident solar radiation, and (2) thermal diffusivity in the night time, when heat flows outward to the night sky. Whether an image is acquired during the day or night, the parameters that effect the object's albedo and thermal diffusivity must be understood before a geologist can make a meaningful interpretation. Because thermal diffusivity varies with an object's thermal conductivity, specific heat and density, it is possible under some conditions to correlate surface temperatures with soil moisture.



Thermal infrared image of plowed fields & farm buildings.

Dear Mr. Krewedl,

I would like to thank you for your support of my education and development outside of the University system. The monthly GSN meetings have both inspired me and introduced me to new material which I have not had in school.

I plan to graduate in six weeks! After that, I will continue to be a part of GSN. My career will probably be in minerals exploration.

Thank you again.

Respectfully,

Keith W. Cox

WINNEMUCCA CHAPTER FEBRUARY 8TH MEETING

Carbonate Sequence Stratigraphy: An Exploration Tool for Sediment-Hosted, Disseminated Gold Deposits in the Great Basin

Cook, Harry, E., Emeritus, U.S. Geological Survey

ABSTRACT

Sequence stratigraphy is commonly used in the petroleum industry to develop predictive reservoir models. It is herein proposed that sequence stratigraphy can also assist in the exploration and production of sediment-hosted, disseminated gold deposits in the Great Basin.

Sequence stratigraphy is the study of rock relationships within a chronostratigraphic framework of repetitive, geometrically related strata bounded by surfaces of erosion or non-deposition, or their correlative conformities. The basic units of sequence stratigraphy are *depositional sequences* (packages of relatively conformable, genetically related strata bounded by unconformities and their correlative conformities) and *systems tracts* (subdivisions of depositional sequences, consisting of strata defined by their stratigraphic position within the *sequence* [i.e., *lowstand systems tract, transgressive systems tract,* and *highstand systems tract*]).

The pre-Antler Orogeny carbonate platform (~3,500-5,000 m-thick) evolved through several stages of platform margin architecture: (1) from distally-steepened ramps with submarine fans (Late Cambrian–Early Ordovician) (2) to low-angle homoclinal ramps (Late Ordovician–Early Silurian) (3) to rimmed platforms with slope debris aprons that formed on low angle slopes (Silurian–Early Devonian) and (4) to rimmed margins with base-of-slope debris aprons that formed on steeper angle slopes (Early Devonian–Late Devonian). The platform underwent subsidence as well as relative sea-level rises and falls each of which had significant effects on the geometric patterns of its carbonate facies.

The Great Basin carbonate platform is interpreted to comprise ten depositional sequences. Facies representing lowstand, transgressive and highstand systems tracts can be recognized within most of these depositional sequences. Lowstand systems tracts formed during relative sea-level lowering that resulted in platform margin collapse and lowstand shedding of shoal-water derived carbonate debris transported basinward as debris flows and turbidites. Platform margin and platform interior karsting occurred during many lowstands. Transgressive systems tracts developed during rapid, relative sea-level rises. Such rises resulted in platform margin backstepping and/or retrogradation. Highstand systems tracts formed during times of sustained high relative sea level, which resulted in aggradational (upbuilding) and progradational carbonate platform architectures. At highstand times sedimentation rates were high on the platform resulting in abundant carbonate sediments shedding off the platform to form slope and base-of-slope debris flow and turbidite aprons.

Sediment-hosted, disseminated gold deposits occur in numerous stratigraphic units in the Great Basin: For example, within the Windfall (Cambrian), Hanson Creek (Ordovician), Roberts Mountains (Silurian–Devonian), Denay, Wenban, Popovich, Devils Gate, (Devonian), Pilot (Devonian–Mississippian), Webb (Mississippian), and Joanna (Mississippian) Formations. One example of how sequence stratigraphy can be of predictive value relates to gold in the Hanson Creek and Roberts Mountains Formations. The contact between the Hanson Creek and Roberts Mountains Formations is a sequence boundary that developed during a relative sea-level lowering followed by a relative sea-level rise. The Hanson Creek–Roberts Mountains contact is an erosional surface that separates the shoal-water Hanson Creek Formation (lowstand systems tract) from the deeper water Roberts Mountains Formation (transgressive systems tract and highstand systems tract). Gold in the Hanson Creek lowstand systems tract likely is hosted in facies that underwent diagenesis during a relative sea-level lowering whereas gold in the Roberts Mountains transgressive systems tract and highstand systems tract likely is hosted in coarse-grained turbidite and debris flow facies.

The role of sequence stratigraphy in the development of predictive models for sediment-hosted, disseminated gold deposits is encouraging and warrants further study and rigorous testing. Sequence stratigraphic concepts are important tools to use in conjunction with other exploration and production techniques for better understanding the origin, stratigraphic occurrence, and geometry of these types of gold deposits.

Nevada Bureau of Mines and Geology

NEW PUBLICATIONS

MI-2004 - The Nevada mineral industry 2004 **$5.00** Starting in 1979, NBMG has issued annual reports that describe mineral and geothermal activities and accomplishments in Nevada, and include statistics of known gold and silver deposits.

OF05-12 - Active metal and industrial mineral mines in Nevada - 2004 by David A. Davis, scale 1:1,000,000, **$10.50** for B&W, **$16.00** for color (OF05-12c), *available rolled or folded.*

M152 - Geologic map of the Nixon area, Washoe County, Nevada by John W. Bell, P. Kyle House, and Richard W. Briggs, 2005, 1:24,000, **$16.00,** *available folded or rolled.*

M153 - Geologic map of the Wadsworth Quadrangle, Washoe County, Nevada by John W. Bell, Larry J. Garside, and P. Kyle House, 2005, 1:24,000, **$15.00**, *available folded or rolled.*

E-44 – The Great Highway 50 rock tour by DD LaPointe, David Davis, Jon Price, and Beth Price (2005 Earth Science Week field trip, October 22 or 23, 2005), 10 pages, B&W **$3.00**, color **$6.00.**

R51 – Preliminary assessment of the potential for carbon dioxide disposal by sequestration in geological settings in Nevada by Jonathan G. Price, Ronald H. Hess, Shane Fitch, James E. Faulds, Larry J. Garside, Lisa Shevenell, and Sean Warren, 2005, 37 pages, CD-ROM for **$15.00** or printed version (R51p) for **$15.00.**

USGS Fact Sheet FS-2005-3053 – Assessment of undiscovered oil and gas resources of the eastern Great Basin Province, 2005 (May 2005) is available free on the Web at: http://pubs.usgs.gov/fs/2005/3053/.

OF05-4 - Preliminary geologic map of the of the west half of the Flowery Peak Quadrangle, Storey and Lyon Counties, Nevada by by Stephen B. Castor, P. Kyle House, and Donald M. Hudson, 1:24,000, *folded or rolled,* **$16.00** .

OF05-5 - Preliminary surficial geologic map of the Hidden Valley Quadrangle (Clark County), Nevada by Brien K. Park, P. Kyle House, Alan R. Ramelli, and Brenda J. Buck, 1:24,000, *folded or rolled*, **$15.00.**

OF05-6 - Preliminary surficial geologic map of the Ivanpah Valley part of the Goodsprings Quadrangle (Clark County), Nevada by P. Kyle House, Brien K. Park, Alan R. Ramelli, and Brenda J. Buck, 1:24,000, *folded or rolled*, **$15.00**.

OF05-7 - Preliminary surficial geologic map of the Bird Spring Quadrangle (Clark County), Nevada by P. Kyle House, Alan R. Ramelli, Brenda J. Buck, and Brien K. Park, 1:24,000, folded or rolled, **$15.00.**

OF05-8 - Preliminary geologic map of late Cenozoic alluvium in the west half of the Spirit Mountain SE Quadrangle, (Clark County) Nevada and (Mohave County) Arizona, by P. Kyle House, Amy L. Brock, and Philip A. Pearthree, 1:24,000, *folded or rolled*, **$15.00**.

OF05-9 - Preliminary geologic map of the Fernley East Quadrangle, Lyon and Washoe Counties, Nevada by James E. Faulds and Alan R. Ramelli, 1:24,000, *folded or rolled*, **$16.00**.

OF05-10 - Preliminary surficial geologic map of the south half of the Seven Lakes Mountain Quadrangle, Washoe County, Nevada, and Lassen County, California by Christopher D. Henry, Alan R. Ramelli, and James E. Faulds, 1:24,000-scale map plus B&W text (text to be posted soon)*, folded or rolled*, **price TBA** (approx. $18.00)

OF05-11 - Reconnaissance geologic map of the Granite Range Fault Zone and adjacent areas, Washoe County, Nevada by James E. Faulds and Alan R. Ramelli, 1:50,000 map plus 6-page text which includes some color, **$18.00.**

All of the publications listed above are ***also free on the Web*** at: http://www.nbmg.unr.edu/dox/dox.htm.

You may **place an order** or check for shipping charges through our shopping cart at:

http://www.nbmg.unr.edu/sales.htm
or by calling Charlotte Stock at 775/784-6691 x2

UPCOMING EVENTS

Feb 2 — NEVADA PETROLEUM SOCIETY – David Blackwell, Southern Methodist University. “Unconventional Geothermal Potential of Nevada-Use of Oil and Gas Wells.” Austin’s Restaurant, 7671 South Virginia Street in Reno, NV. Cocktails at 6:30 pm. Dinner is served at 7:00. The talk immediately follows dinner, 7:45 or 8:00 pm. Reservations are required; please contact Terri Garside at tgarside@unr.edu or 775/784-6691 x126.

Feb 3 — MACKAY SEMINARS IN ECONOMIC GEOLOGY – David Blackwell, Southern Methodist University. “Longevity and Patterns of Permeability in Basin and Range Crust.” Room 215, Mackay Science Building (on the SE side of the quad) University of NV, Reno campus, 3:00 pm.

Feb 3 — ARIZONA GEOLOGICAL SOCIETY MONTHLY MEETING – Jon Patchett, University of Arizona. Topic: to be determined. InnSuites Hotel, 475 N Granada Ave, Tucson, AZ. For reservations, please call 520/663-5295 by the Friday before the meeting.

Feb 7-9 — 108th NATIONAL WESTERN MINING CONFERENCE & EXHIBITION, Colorado Mining Association, Hyatt Regency Denver, Denver, CO. For information contact Stuart Sanderson @ 303/575-9199 or email: colomine@coloradomining.org, or visit www.coloradomining.org.

Feb 17 — MACKAY SEMINARS IN ECONOMIC GEOLOGY – John Dilles, Oregon State University, title of talk to be determined. Room 215, Mackay Science Building (on the SE side of the quad) University of NV, Reno campus, 3:00 pm.

March 5-8 — PDAC 2006, INTERNATIONAL CONVENTION, TRADE SHOW & INVESTORS EXCHANGE, Toronto, ON, Canada. Phone: 416/362-1969 or visit www.pdac.ca. **GSN BOOTH #833.**

March 13-16 — ALASKA MINERS ASSOCIATION 20th FAIRBANKS BIENNIAL CONFERENCE, Arctic International Mining Symposium, Westmark Fairbanks Hotel & Conference Center, Fairbanks, AK. Phone 907/374-0858 or email: wonderwoman1@gci.net.

March 26-29 — SME ANNUAL MEETING AND EXHIBIT AND 7th ICARD, St. Louis, MO. Visit the Society of Mining & Metallurgical Engineering Website for more information – www.smenet.org.

ELKO CHAPTER FEBRUARY 16TH MEETING

The Porphyry-Epithermal Transition: Examples from the Maricunga Belt, Northern Chile

John L. Muntean
Nevada Bureau of Mines and Geology

ABSTRACT

The Refugio, Aldebarán, and La Pepa districts in the Maricunga belt of northern Chile have advanced argillic alteration zones that locally host high-sulfidation epithermal gold deposits in close proximity to porphyry gold (±copper) deposits. The spatial association is suggestive of a genetic link. Mineralized zones are characterized by four main vein types that formed at different times and have specific zonal relationships.

A-veinlets are the earliest and deepest vein type. They are restricted to potassic alteration zones in intrusive rocks. A-veinlets contain variable amounts of quartz, magnetite, biotite, and chalcopyrite and locally have K-feldspar halos. They have non-matching, irregular vein walls and lack internal symmetry. Hypersaline liquid-rich inclusions coexisting with vapor-rich inclusions in A-veinets indicate temperatures as high as nearly 700°C and pressures between 200 and 400 bars. Assuming a lithostatic load, depths of 0.8 to 1.6 km are inferred. Zones of abundant A-veinlets contain mostly <1 ppm gold and 0.1 to 0.4% hypogene copper.

Banded quartz veinlets occur mostly above A-veinlets and cut A-veinlets where they overlap. Dark gray bands, the color resulting from a high density of vapor-rich fluid inclusions and micron-sized grains of magnetite, commonly occur as symmetric pairs near the vein walls. Vein walls are parallel and slightly wavy, vuggy vein centers are common, and alteration envelopes are absent. Data from rare liquid-rich inclusions in banded quartz veinlets indicate temperatures ≤350°C at pressures between 10 and 150 bars. Assuming a hydrostatic load, depths of 0.2 to 1.5 km are inferred. Zones of abundant banded quartz veinlets generally contain 0.5 to 2 ppm gold and <0.1% hypogene copper.

D-veins are pyrite veins with quartz-sericite-pyrite halos. They are widespread and cross-cut A-veinlets and banded quartz veinlets. The brittle nature of D-veins and limited fluid inclusion data suggest temperatures <400°C. D-veins serve as important time lines. They are nowhere truncated or cross-cut by intrusions, A-veinlets or banded quartz veinlets.

Quartz-alunite replacement veins, referred to as ledges, are typical of the high-sulfidation epithermal environment. They are mostly limited to overlying volcanic rocks. They have local core zones of vuggy residual quartz, which can contain enargite or, at higher elevations, barite. Of the three districts studied, only La Pepa has mineable quartz-alunite ledges, which contain an average gold grade of about 20 ppm.

A spectrum of porphyry-style deposits exists, ranging from Cerro Casale at Aldebarán, which shares many characteristics of porphyry copper deposits worldwide, to Verde at Refugio – a true porphyry gold deposit. Potassic alteration zones and A-veinlets are strongly developed at Cerro Casale, whereas they are absent at Verde. Banded quartz veinlets predominate at Verde, whereas they only occur at the upper levels of Cerro Casale. The Pancho deposit at Refugio and the Cavancha deposit at La Pepa are telescoped systems in which banded quartz veinlets overprint potassic alteration zones and A-veinlets.

A-veinlets and banded quartz veinlets cut and are cut by intrusions indicating multiple cycles of intrusion→potassic alteration→A-veinlets→banded quartz veinlets during formation of porphyry-style mineralization. Banded quartz veinlets are thought to have formed by flashing of magmatic fluids during episodic transitions from lithostatic to hydrostatic pressure. Loss of sulfur to the vapor phase during flashing inhibited formation of copper-sulfides in banded quartz veinlets, and, therefore, resulted in high gold to copper ratios. Where rising magmatic vapors condensed into overlying meteoric water along faults, barren quartz-alunite ledges formed. This conclusion is supported by equivalent $^{40}Ar/^{39}Ar$ dates on hydrothermal biotite associated with porphyry-style ore and alunite from barren ledges at Aldebarán.

$^{40}Ar/^{39}Ar$ dates at La Pepa indicate alunite formed at least 140,000 years to as great as 900,000 years after hydrothermal biotite. As the magma-crystallization front retracted to progressively greater depths with time, the sites of porphyry mineralization cooled below the brittle-ductile transition. The development of late high-sulfidation epithermal ore is likely dependent upon the ability of gold- and sulfur-bearing vapor, coexisting with hypersaline brine below a deepening magma-crystallization front, to escape and contract a moderate-salinity liquid upon entering the one-phase liquid field. Cooling and eventual boiling of the moderate-salinity liquid results in the formation of sericite at depth and alunite near the surface that is essentially synchronous with high-sulfidation ore formation. The timing of the switch to brittle, hydrostatic conditions from lithostatic pressures, relative to the life of the hydrothermal system, might be the controlling factor on determining how much porphyry-style ore forms relative to high-sulfidation epithermal ore.

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