# GEOLOGICAL SOCIETY OF NEVADA
# NEWSLETTER

Geological Society of Nevada, 2175 Raggio Parkway, Room 107, Reno, NV 89512
(775) 323-3500 - Hours Tuesday -- Friday, 9 a.m. to 4 p.m. Monday by appointment.
Website: www.gsnv.org • E-mail: gsn@gsnv.org

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## CALENDAR OF GSN EVENTS

**Mar. 5, 2020 THURSDAY**

**SO. NEVADA CHAPTER MEETING (1ST THURSDAYS)**
The Southern Nevada Chapter meeting will be held at the Las Vegas Natural History Museum, 900 N. Las Vegas Blvd. Beer/Pizza @ 5:30 pm, Talk at 6:15 pm. **Speaker: Dalton McCaffrey, Ph.D. Student - Geology, UNLV. Title: "Granitic Pegmatites: An Overview with Examples from Nevada and California".** **Pizza & Beer Sponsored by: GSN FOR SPONSOR APPRECIATION!** Contact President, Joshua Bonde for more information: paleo@lvnhm.org. Details on pg. 6.

**Mar. 18, 2020 WEDNESDAY (3rd Wed.!!)**

**WINNEMUCCA CHAPTER MEETING—Note 3RD WED THIS MONTH!**
The meeting will be held at the Martin Hotel, 94 W. Railroad St. Drinks at 6:00 pm, Appetizers at 6:30 pm, Talk at 7:00 pm. **Speaker: Steve Wesnousky, Professor of Geology and Seismology, UNR. Title: "The 1915 Pleasant Valley Earthquakes of Nevada - an ongoing collaborative paleoearthquake study, and other aspects of earthquakes in Nevada ".** **Food and Drinks Sponsored by: JUST REFINERS USA!** For more information, please contact President, Robbie Anderson at: Robbie.agau@gmail.com. Details on pg. 7.

**Mar. 19, 2020 THURSDAY**

**ELKO CHAPTER MEETING (3RD THURSDAYS)**
The monthly meeting will be held at the Western Folklife Center, 501 Railroad St. Drinks & Appetizers at 6:00 pm, Talk at 7:00 pm. **Speaker: Nick Hillemeyer, UNR MS Student. Title: "Controls on Epithermal Gold-Silver Mineralization and Alteration at the Gravel Creek Deposit, Elko County, Nevada".** **Food and Drinks Sponsored by: BOART LONGYEAR!** For more info please contact President, Diane Cheung-Harris at: **dianehcheung@gmail.com**. Details on pg. 7.

**Mar. 20, 2020 FRIDAY**

**GSN MEMBERSHIP MEETING (3RD FRIDAYS)**
The GSN's monthly meeting will be held at Taps & Tanks, 1155 So. Rock Blvd., Reno, NV. Drinks at 6:00 pm; Dinner at 6:30 pm; Talk at 7:30pm.**Speaker: Fred Holabird, SME. Title, "Nome Offshore Gold Deposit May Represent the Future of Mining".** **Drinks Sponsored by: GSN FOR SPONSOR APPRECIATION NIGHT!** Dinner cost is $30 Please buy dinner online: https://www.gsnv.org/dinner-reservations/. **RSVP no later than Tuesday, March 17th online or by email: gsn@gsnv.org.** Details on page 3.

**MARCH IS SPONSOR APPRECIATION MONTH!**
**Please say thanks to your GSN sponsors when you can!**

The GSN will be buying the drinks and recognizing our current year's sponsors at the Reno meeting this month!!

## *FROM THE PRESIDENT*
## *Dennis Bryan, GSN President 2019-2020*
## *MARCH 2020*

I attended the Annual Conference of the Society for Mining, Metallurgy & Exploration (SME) this past week in Phoenix. The weather was perfect, as you might expect for this time of year down there, and the program was timely.

The mining industry has had some challenges in the last few years with tailings dam failures, most notably being the Brumadinho dam disaster which occurred in January of 2019 when a tailings dam at the Córrego do Feijão iron ore mine in Brazil, suffered a catastrophic failure. Over 250 people died. The other notable failure closer to home was the Mount Polley tailings dam collapse in 2014, which sent 24 million cubic metres of mine waste into Quesnel Lake and adjacent waterways. An environmental disaster of historical proportions. These events have helped propel the hazards attributable to the mining industry into public view and scrutiny on a worldwide basis as perhaps never before. The SME Keynote session dwelt on the topic, with representatives from several of the major mining companies that have global footprints relating how they are proactively addressing the issue. Increased monitoring and re-evaluation are now common, and in some cases, dams are being reinforced or even decommissioned. Timely action by the industry to mitigate this potential problem will not only lead to better environmental stewardship and personal safety, but will also reinforce us personally, that the industry of our choosing is not only relevant to society's needs, but also cares.

And on a lighter (if not a more serious) note...I ran into the newest business development buzzword lately.... **Thought Leadership**. This supposedly utilizes the voice of someone inside an organization to speak to the big questions facing that particular industry. Wow, a totally new concept that should enlighten all. My first thought was maybe this is the person leading the thought police, or those who not only want to curtail our disgraceful actions which may be contrary to their particular social views but also who want to reach into our little pea brains to curtail our neurons from even formulating a pre-embryo of such salacious intentions. Or, perhaps, the **Thought Leader** should be someone in an organization to monitor other's tweets and to review media news (or fake news) for pertinent issues that the general membership could then regurgitate for the betterment of the organization's drivel without subjecting the general population of the group from actually having to waste their time by thinking on their own. Perhaps GSN should canvass our own organization for likely candidates for our own **Thought Leadership** position. Any nominations?

See you at the next GSN meeting on March 20th. Maybe we can nominate some worthy **Thought Leader** candidates at that time. Actually, I have someone in mind. It's about time we all got on the same page!

Dennis

***The G.S.N. wishes to thank EM STRATEGIES for sponsoring the GSN's meeting in Reno on February 21st!***

# GSN MEMBERSHIP MEETING—MARCH 20, 2020

## Speaker: Fred Holabird
## Title: "Nome Offshore Gold Deposit May Represent the Future of Mining"

**Drinks @ 6:00 pm; Dinner @ 6:30 pm; Talk @ 7:30 pm**

**Location: Great Basin's Taps & Tanks, 1155 So. Rock Blvd., Reno, Nevada**

**DINNER COST—$30.00 per person.**

**(You will be invoiced $30 if you do not cancel your reservation by Tuesday, February 18, 2020)**

For dinner reservations, please e-mail gsn@gsnv.org or call 775-323-3500

**Reservations required. Please click on the link to prepay for dinner:**

**https://www.gsnv.org/dinner-reservations/**

**Reservations due by 5 p.m. on TUESDAY, MARCH 17, 2020!!!**

**GREAT NEWS!! Taps & Tanks has upgraded the AV configuration and ironed out some of the issues we have had in past meetings. Thank you for your patience.**

## Nome Offshore Gold Deposit May Represent the Future of Mining

**Fred N. Holabird, SME**

Offshore placer gold deposits at Nome, Alaska may represent a new frontier for future exploration and mining of previously unknown gold deposits. Operations in offshore marine mining have significant technological challenges; however, professional marine mining operators at Nome are using new techniques and technology to exploit this new world of marine mining.

At Nome, Placer Marine Mining Co. (PMMC) owns mineral rights to 16,579 acres of offshore gold leases, representing approximately 65% of the total offshore gold leases let to date by the State of Alaska. These properties range from depths of 25 feet to ~70 feet covering an area approximately three miles wide by ten miles long. Here, near shore gold leases and areas in the public domain are operated by small miners, such as those seen on "Bearing Sea Gold."

Prior leaseholder WestGold mined several small sections of the leases from 1987-1990 totaling about 550 acres using the BIMA bucket-line dredge. Created in Singapore in 1978-1979 to mine tin ore from the seas off Indonesia, the dredge was not constructed to withstand Alaska waters and broke down permanently after four seasons. Reports of recovered gold approximate 188,000 ounces.

Anglo Ashanti and WestGold spent approximately $25 million evaluating portions of the property—with more than 3,500 drill holes— developing resources on approximately 22% of the entire property. Exploration efforts centered on understanding a complex geologic past involving transgressive and regressive erosional sequences emplaced over the top of a long-term eroding gold source. This, in turn, was covered subsequently by at least two periods of glaciation.

Several large blocks were chosen to further investigate geologic complexities and ore controls. More detailed exploration and development work inside these blocks helped bring understanding to ore controls and grades, delineating potentially minable sections. Development drilling delineated numerous high-grade zones with approximately 200,000 ounces of drill proven resource. It also indicated an immediate target of 1,000,000 ounces within the target zones and an on-property global target of 6 million ounces.

Marine mining at Nome can only take place when the ice shield is gone—approximately June 1 to November 15. During that period, the turbidity is very high and the crab and fish are not in this part of the Bearing Sea. Normal environmental restrictions apply; however, permit time is short—less than one year. A small operation can be had for as little as $8 million. The smallest current operator on these leases operates an underwater ROV mining device with an 18 inch piping system in 60 feet of water. This operation mines at a rate of about 20 cubic yards per hour over about three months and has consistently produced about $5 million per year—about four times the best operator on the Bearing Sea Gold program.

PMMC is seeking mining partners who understand bulk marine aggregate mining concepts with gold as a byproduct. This presentation will be the first time exploration data has been released publicly.

# "FACES OF GSN"
# Sergey Konyshev, Reno, NV

As most of these stories go, I have always loved the outdoors. Whether it was fishing, hunting, hiking, or camping, just get me outside and I'll be happy. I will keep this brief without diving into too many details. I was born at 11:46 pm on a partially cloudy Monday evening…just kidding.

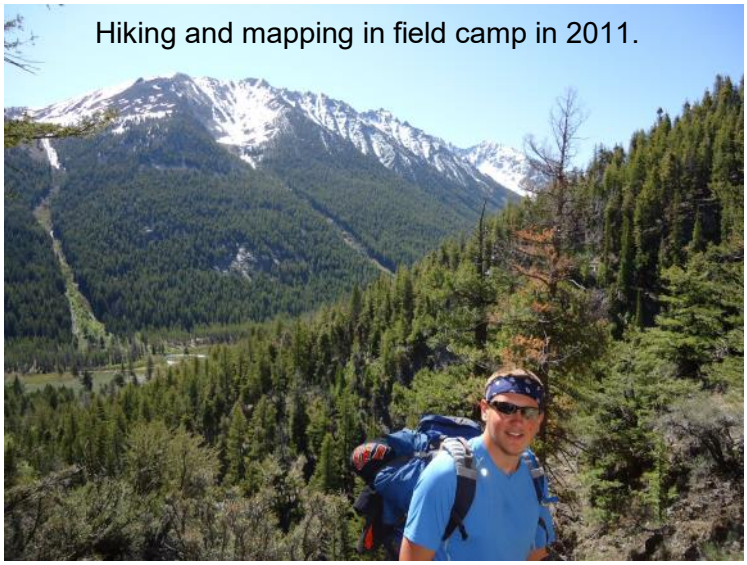
Actually, I was born in Yuzhno-Sakhalinsk, on Sakhalin Island, Russia and lived there until the age of 10, when I moved to the States. I still remember thinking it would be like Los Angeles or San Francisco, but instead we moved from Russia to Alaska. While in school, I was on the bowling team (4x State Champs!), tennis team, and I started playing hockey toward the end of high school – as my wife likes to tease – I was super nerd status. And in my free time I was always outside. My parents didn't care for video games and I never was a book reader, so I spent a lot of free time fishing, hiking, and more recently hunting.

Trip to the Grand Canyon during a Southwest geology field class in 2010.

My rocky relationship with geology started before my freshman year of high school, when my parents sent me to University of Alaska, Fairbanks (UAF) summer "nerd camp" as I called it. I really wanted to get into the forensic portion of the camp, because CSI was a great TV show, but it filled quickly, and I was stuck with the geology camp. It turned out to be an absolute blast. We toured the Usibelli coal mine, learned about erosion, even made drill holes out of straws in a strangely-layered cake that professors made and attempted cross-sections. Most high schools in Alaska do not offer geology so that brief interaction with rocks was long forgotten by the time I started college at the University of Alaska, Anchorage (UAA). I began college wanting to become a Physician's Assistant, but after a couple years I did some re-evaluating. That's when I re-discovered geology.

Between the field trips, field classes, and laid-back attitude of most professors, I could tell I was in my element surrounded by my kind of people. Since UAA is a relatively small school, I went to field camp through Idaho State University, starting an almost decade long connection with that beautiful state.

Hiking and mapping in field camp in 2011.



After finishing my undergraduate degree, going back to school was barely on my mind. Instead, I immediately began working for Kiska Metals on the Whistler deposit northwest of Anchorage. That was my first true exposure to exploration geology, and I loved it. I was mostly a geo-technician on the project. Whatever core they let me log, I can now confidently say that I had no clue what I was doing, which put grad school on the table – I wanted to get better at this line of work. During the winter, work slowed down and I started looking for another gig, which landed me at Greens Creek. It sure seems like half the geos I talk to nowadays worked at that mine in some capacity. During my stint there (cont. on page 5)

I studied for the GRE and started applying to graduate school. My girlfriend at the time, now wife, is a UNR alum and encouraged me to check out the Mackay School of Mines.

Staying dry while looking for drill pads at the Whistler deposit in Alaska, 2011.

Flash forward to 2012, I started at UNR without a project or funding, but Tommy Thompson must have seen some potential and within a semester I picked up a project at the Beartrack Mine outside of Salmon, ID. I still can't thank Tommy enough for everything he's done. It was a fun and informational project that exposed me to many aspects of exploration and economic geology. Tommy also encouraged all of his students to get involved with GSN, which was a no-brainer. What student would pass on free field trips, scholarships, and networking opportunities with folks tied directly to our industry? Can't forget free beer and food for students.

This was also the time when I met John Muntean and got to know him a bit during his Yerington mapping course. One day I walked into his office to ask for a letter of recommendation for a doctoral program at Oregon State (Go Beavs), and he happened to mention a project in central Idaho run by Midas Gold having to do with the Stibnite area. Fast forward five years and I'm now wrapping up said project. If some of you haven't been to central Idaho, I highly recommend it, even for a short visit. Working with John has also been an incredible opportunity. I don't think I will ever meet another geologist more passionate about his work. He has been incredibly helpful and patient with me. The project has had its highs and lows, but the amount I learned about approaching research, even after mucking through a few hard lessons, is something I would not trade and would do it all over again.

Working extra hard while logging core at Greens Creek, 2012.

I recently decided to re-enter the industry. First, I applied for the opportunity to run geophysics lines for Chet Lide with Zonge. Boy did that give me appreciation for the work they do. It is a really fun, but physically demanding job. You'll bust your behind and be in great physical shape. Shortly after my geophysics career, I was hired by John Schaff with Coeur Explorations to work on a project down in Beatty, NV. In July 2019 I started working in Beatty and have enjoyed the work I've been doing that ever since and look forward to additional opportunities. We are surrounded by colorful mountains full of complicated rocks, colorful people, and burros. I'm thinking of adopting a field burro and becoming a real exploration geologist.

That quickly sums up my geologic life story to date. Now I just need to wrap up the last of my writing for school and continue my career in the industry. (cont. on page 6)

Konyshev, S., Face of GSN (cont. from page 5)

Also, a big 'thank you' to Patty Capistrant and Kelsey Sherrard for asking me to be the Face of GSN for this month.

**Hanging out with the locals in Beatty, NV in 2019.**

**Slayin' sockeyes with my future wife, Leilani, in 2013.**

## GSN SOUTHERN NEVADA CHAPTER MEETING

### THURSDAY, MARCH 5, 2020

**Location:** Las Vegas Natural History Museum, 900 Las Vegas Blvd. North

**Time:** Pizza & Beer @ 5:30 p.m; Talk @ 6:15 p.m.

**Speaker:** Dalton McCaffrey, Ph.D. Student - Geology, UNLV

**Title:** Granitic Pegmatites: An Overview with Examples from Nevada and California

**Food & Drinks Sponsored by:** The Geological Society of Nevada

**In APPRECIATION OF OUR DEDICATED & GENEROUS SPONSORS!!**

**Abstract:**

Granitic pegmatites have the unique ability amongst other geologic systems to concentrate rare and critical metals such as Li, Be, Cs, Ta, and REE, vital to modern technology into mineable deposits, but even with the plethora of available research on these systems, their petrogenesis remains enigmatic. There are two competing hypotheses for rare metal pegmatite petrogenesis: extensive fractional crystallization of a large (pluton-scale) volume of magma and low-degree direct anatexis involving a large volume of source rock. While barren pegmatites have been shown to be generated via either fractional crystallization or anatexis, only pluton-scale fractional crystallization has been adequately proven to produce rare metal pegmatites. This talk will briefly overview granitic pegmatite petrogenesis, and use examples from both Nevada and California to demonstrate that either type of petrogenesis may be possible.

Please contact Southern Nevada Chapter Officer, Rebecca Humphrey <humphr1@unlv.nevada.edu> for more information.

# GSN WINNEMUCCA CHAPTER MEETING

## WEDNESDAY, MARCH 18, 2020

**Location: The MARTIN HOTEL, 94 Railroad St., Winnemucca NV**

**Time: Drinks @ 6:00 p.m; Appetizers @ 6:30 p.m.; Talk @ 7:00 p.m.**

**Speaker: Steve Wesnousky, UNR Professor of Geology & Seismology**

**Title: "The 1915 Pleasant Valley Earthquakes of Nevada - an ongoing collaborative paleoearthquake study, and other aspects of earthquakes in NV"**


**Food & Drinks Sponsored by: JUST REFINERS, USA**

Abstract: Scarps produced by the Pleasant Valley M7.3 earthquake extended ~60 km along four rangefronts south of Winnemucca. The earthquake is the largest of its kind (continental normal) that has occurred in the United States, and arguably the world. The purpose of the project is to understand whether or not previous earthquakes here repeatedly rupture the same length of rangefront or, rather, ruptures are sometimes limited to individual rangefronts, and how often large surface ruptures occur here. The anticipated results should also provide a measure of how fast the ranges are rising due to the repeated occurrence of earthquakes. Trenches have been excavated across the 1915 Pleasant Valley ruptures at five sites to provide exposures of sediments displaced in 1915 and prehistoric ruptures. Interpretation of the size and number of past earthquakes is achieved by application of structural geologic and stratigraphic and soil analysis principles to the faulted sediments. The actual age of past displacements is ultimately gained by application of Optical Stimulated Luminescence (OSL) and Terrestrial Cosmogenic Nuclide (TCN) dating methods to sediments in the trenches.

# GSN ELKO CHAPTER MEETING

## THURSDAY, MARCH 19, 2020

**Location: The WESTERN FOLKLIFE CENTER, 501 Railroad St., Elko**

**Time: Refreshments @ 6:00 p.m., Talk @ 7:00 p.m.**

**Speaker: Nick Hillemeyer, UNR Graduate Student**

**Title: Controls on Epithermal Gold-Silver Mineralization and Alteration at the Gravel Creek Deposit, Elko County, Nevada**

**Food & Drinks Sponsored by:** BOART LONGYEAR™

Abstract:

Western Exploration's Gravel Creek project is a recently discovered Miocene low-sulfidation epithermal Au-Ag deposit in northern Elko County, Nevada. The deposit is primarily hosted by stratabound mineralization with intervals of high-grade veins within an Eocene ash flow tuff known as the Frost Creek volcanics. Mineralization is primarily controlled by the thickness and permeability of the Frost Creek as well as two major structural trends: north-northwest striking normal faults that dip steeply to the east and a more indiscreet set of northeast-trending, near vertical strike-slip structures. Alteration proximal to high-grade zones is quartz-sericite-pyrite grading out to intense silicification of the Paleozoic basement stratigraphy (Schoonover Sequence) below and strong smectite and illite bearing clay alteration of the overlying Eocene Mori Road Formation and the Miocene Jarbidge Rhyolite with illitic alteration extending to the surface on the hanging-wall of the north-northwest striking normal faults. Gold in high grade intervals occurs in chaotic quartz-sulfide breccias and banded quartz-sulfide veins as fine-grained high-silver electrum commonly enclosed in pyrite±marcasite and arsenopyrite overgrowths. Silver mineralization is associated with coarse pyrargyrite, naumannite, and a selenium bearing phase of stephanite. Although mineralization is focused in the Eocene volcanic strata, significant portions of mineralization occur in the underlying Schoonover as well as within the overlying Jarbidge Rhyolite. Mineralization in the Schoonover is hosted as chaotic breccias like those found in the Frost Creek with fewer banded veins. Jarbidge Rhyolite mineralization is hosted as both high and low angle veins primarily in the hanging-wall of the major normal faults but situated along the pervasive N-E trending strike-slip structural corridor. Mineralization that occurs within the bulk of the deposit is located approximately 1,500 feet below the surface and extending down beyond 3,200 feet at the deepest core holes. The most striking feature throughout the deposit is the pervasive nature of marcasite throughout the majority of the mineralized zones. Surficial exposure of hydrothermal breccia veins within the Jarbidge Rhyolite is similar texturally, geochemically, and mineralogically to those that have been (cont. on page 19)

# NEWS FROM THE GSN FOUNDATION

By Cami Prenn, GSN Foundation Chair

I hope you all have registered early for the Symposium 2020 and taken advantage of the reduced rate. One of the events you can purchase a ticket for is the **LANDSHARK LOUNGE,** taking place on Wednesday of the Symposium. It will be in the Nugget 1 room and will start after the talks are finished for the day. This is a fundraiser for the Foundation and we would greatly appreciate you buying a $25 ticket for the party!

We will have food and drinks, entertainment and a raffle – NOT the normal raffle we have at Christmas. We'll have a different variety of items and will sell raffle tickets throughout the Symposium. Tickets for the Landshark Lounge will also be available to purchase at Registration at Symposium, but they're available now online too. If you've already registered you can go back to the website and purchase a ticket. If you bring a guest you DO NOT need to purchase a guest pass for them to attend the party. We hope all the exhibitors will attend too, but everyone must have a ticket.

We will do our best to make this a memorable evening and the most fun you'll have at Symposium 2020! Please help us make it a successful fundraising event for the Foundation also.

## Calling all students!

## The GSN Student Poster Competition needs you!

**When: Friday, April 17, 2020**

**Where: Taps & Tanks, Reno**

**Who: Any Undergrad or Grad student who has a Geoscience poster**

**CASH PRIZES AWARDED TO TOP 3 WINNERS!!**

**Free dinner and drinks for all competitors too!**

**Please send abstract/title to Steve Weiss to enter: siraweiss@outlook.com**

## ATTENTION STUDENTS GOING TO FIELD CAMP THIS SUMMER!!

Any GSN Student Member who is signed up for 6 credits of Summer Field Camp in Nevada is eligible to apply for a cash grant to help with your tuition! You can find the application on the GSN website at: https://www.gsnv.org/wp-content/uploads/Field-Camp-Application-2020.pdf.

**Applications due by Friday, March 20, 2020!**

*Thank you to our food & drinks sponsor for the FEBRUARY 2020 Southern Nevada Chapter Meeting!*

Geosyntec consultants

engineers | scientists | innovators

*Thank you to our food & drinks sponsor for the FEBRUARY 2020 Winnemucca Chapter Meeting!*

JENTECH Drilling Supply

*Thank you to our food & drinks sponsor for the FEBRUARY 2020 Elko Chapter Meeting!*

MAJOR Drilling

*Thank you to our generous Foundation donors in February!*

***G.S.N. FOUNDATION***

***STUDENT DINNER FUND***

***Sam Arentz***

***Tom Gesick***

**REGISTER TODAY FOR THE GSN 2020 SYMPOSIUM!**
**(see pg. 20 for Keynote Speakers)**

**Geological Society of Nevada SYMPOSIUM 2020**
May 14 – 24th, 2020

VISION FOR DISCOVERY

Some field trips are filling up!!!

**Field Trips!**

Pre-Meeting (May 14-17)

***FT#1:*** **Epithermal Deposits of Northern Nevada & Southwestern Idaho**
*DeLamar (Idaho), Fire Creek, Mule Canyon, Hollister, Midas (?)*

***FT#2:*** **Structural Controls of Geothermal Systems**
*Hot Springs Mtns., Brady's Hot Springs, Desert Peak, San Emidio-Wind Mountain, Gerlach, Blue Mountain, Florida Canyon*

***FT#3:*** **The Famous Comstock Gold & Silver District**
*Virginia City Epithermal District*

***FT#4:*** **Seismic Hazards & Evolving Landscapes, Reno-Carson-Tahoe Area**
*Peterson Mountain Fault along Red Rock Road*
*Warm Springs Valley Fault in Southern Honey Lake Basin*

Post-Meeting (May 21-24)

***FT#5:*** **Epithermal Deposits of the Walker Lane, Nevada**
*Secret Canyon and Daisy Pits, Motherlode, Silicon, Sterling, North Bullfrog, Isabella-Pearl, Gemfield/Goldfield*

***FT#6:*** **Introduction to Carlin Gold Deposits**
*Twin Creeks, Turquoise Ridge, Goldstrike, Goldrush, Fourmile, Overview Cortex Hills or Pediment*

**REGISTRATION OPEN!**
https://www.gsnsymposium.org/

**Geological Society of Nevada SYMPOSIUM 2020**
May 14 – 24th, 2020

VISION FOR DISCOVERY

**SHORT COURSES!**

Pre-Meeting (May 14-17)

***SC1:*** **Best practices in mineral resource estimation: a two-day refresher course**

***SC2:*** **Analytical data management, quality assurance, and reporting**

***SC3:*** **Introduction to US Mining Law**

***SC4:*** **Carlin Type Mineral Deposits**

***SC5:*** **Spectral Geology: Remote Sensing to Spectral Petrology, Exploration through Life of Mine**

***SC6:*** **NEPA for Mining Geologists**

Post-Meeting (May 21-24)

***SC7:*** **Geologic and Resource Modeling in Leapfrog**

***SC8:*** **Geometallurgy for Geologists and Metallurgists**

**SC9: Wilderness Advanced First Aid**

***S10:*** **Nevada Bureau of Mines and Geology Mineral Resource Database Project**

***SC11:*** **Geophysical Exploration and Structural Analysis Applied to Gold and Silver Exploration in the Western and Northern Cordillera**

**REGISTRATION OPEN!**
https://www.gsnsymposium.org/

# How good is earthquake early warning?

Posted on February 12, 2020 by Temblor

By **Elisabeth Nadin**, Ph.D., Associate Professor, University of Alaska Fairbanks

*New research reveals that Earthquake Early Warning networks provide a timely warning of impending shaking more often than not.*

Scientists can't predict when earthquakes will occur. They can however, with reasonable certainty, identify regions at elevated risk for damaging earthquakes. A recent magnitude-6.7 earthquake in Turkey and subsequent recovery efforts prompted the country's interior minister to warn citizens of the potential for an even larger event in the region.

How many lives could be spared or injuries prevented during such an event if people were alerted to imminent shaking, even just seconds before seismic waves hit? Researchers have exactly this question in mind when designing Earthquake Early Warning systems. Early warning systems utilize local or regional seismic networks to detect initial shaking from an earthquake. Alerts are then sent to the public through television or radio broadcasts and increasingly through mobile phones. Several such systems exist around the world, including ShakeAlert, a U.S. West Coast-wide system that became public in California last October, but exactly how effective they are has not been well quantified. New results from a test of existing warning algorithms tells us that alerts are received in a timely manner in a large number of cases.

In the San Francisco Bay Area, the Bay Area Rapid Transport System, or BART, will automatically brake its trains when an earthquake is detected, according to the Incorporated Research Institutions for Seismology (IRIS). Photo Credit: Pi.1415926535 [CC BY -SA 3.0]

**An amazing tool or too slow?**

Significant resources have gone towards developing these systems and researchers have touted the injury and death prevention and economic benefits of early earthquake warnings. But is this money and time well spent?

"There's a debate about the potential usefulness of early warnings," says Men-Andrin Meier, a seismologist at Caltech and the lead author of a recent study published in the Journal of Geophysical Research focused on this subject. "In our community, proponents say this is an amazing tool; we can reduce risk by a lot with this technology. Critics say it's too slow for the close sites that have the most damage."

This is why Meier wanted to test how well early warning systems perform where the shaking is greatest. "The biggest potential for early warning is in vulnerable situations, for example a construction site. So many things can collapse on a construction site. You don't need a lot of warning to take a step back and put yourself in a safe situation," he notes. Or to "drop, cover and hold on" as the U.S. Geological Survey (USGS) advises.

**Who benefits from an early warning?**

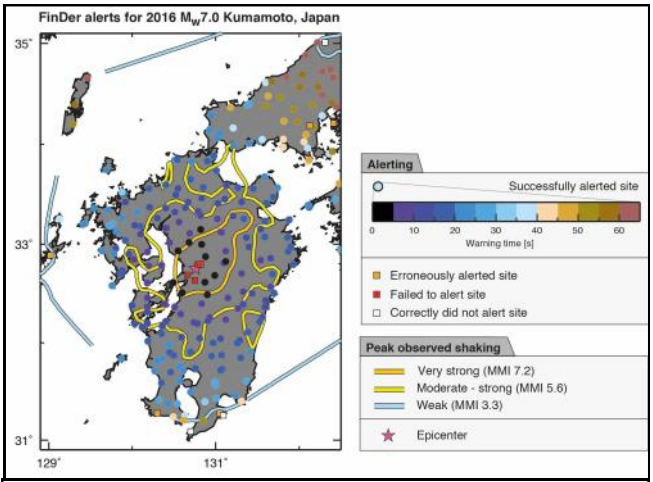
The intensity of an earthquake varies with location—the area around the epicenter is the first to feel an earthquake and will often experience the most intense shaking. For Earthquake Early Warning systems, this is usually a "late alert zone" because seismic waves arrive before an alert. Unfortunately, this is the area that needs the alert the most. In contrast, sites with moderate and weak shaking, which are much farther away, are successfully alerted before shaking but may not have been at risk of significant damage anyway.

Herein lies the debate about early warning utility: Is it really useful in the places that need it the most? Meier and his colleagues decided to test exactly that. Using data from more than 200 earthquakes in Japan that occurred over the last 20 years, the group compared observed ground motion to the ground motion predicted by three different early warning algorithms. They evaluated who would have gotten an alert and when. Similar previous tests used synthetic data or hypothetical early warning algorithms.

"We should have done this type of study 10 years ago, but we were busy developing the algorithms," says Meier.

The team used the Japanese data because "they have amazing networks. And they make the data freely available," Meier says. Meier and his team discovered that about 50 percent of all sites with the strongest shaking levels receive timely alerts. That is, they receive alerts at least five seconds before the shaking becomes noticeable. The other half are in the late alert zone. This means that currently existing early warning algorithms can alert about half of all sites that are at greatest risk from damaging seismic waves. In detail, the number of sites that can be successfully alerted varies depending on how large the earthquake is and how deep it occurs. For sites with medium and lower shaking intensities, the current algorithms can alert up to 90 percent of sites before shaking is felt.

(Continued on page 11)




Map of 2016 Kumamoto earthquake alert region. Dots display warning times (time between when the alert arrives and noticeable shaking starts) for different sites from the FinDer EEW algorithm. Contour lines show the maximum strength of ground shaking as measured on the Modified Mercalli Intensity (MMI) scale. Inside the orange line around the epicenter (pink star), shaking exceeded an MMI of 7.2. Warning times in these areas are generally short, often less than five seconds, but in some sites to the northeast warning times reach 10 seconds or more. Inside the yellow line, shaking exceeded an MMI of 5.6, causing windows to break and objects to fall off shelves. A five to fifteen -second warning is sufficient time to "drop, cover, hold on," as recommended by the U.S. Geological Survey. Credit: Men-Andrin Meier

NEVADA

Contact Gold Corp. announced that recent drill results at the Green Springs Project include 25.91-83.82 meters @ 0.52 gpt Au (GS1901); 24.38-53.34 meters @ 1.34 gpt Au (GS1902); 27.43-62.48 meters @ 1.68 gpt Au (GS1903) and 16.76-62.48 meters @ 0.86 gpt Au (GS1905). (resource = 754,000 tonnes @ 2.05 gpt Au inferred) *Press Release:* January 14

Nevada Copper Corp. announced that recent drill results at the Pumpkin Hollow Project include 1.5-10.6 meters @ 0.39% Cu (TB19-02); 0-9.1 meters @ 0.93% Cu (TB19-04); 230.1-231.6 meters @ 0.11% Cu (BC19-01) and 146.3-147.8 meters @ 0.17% Cu (BC19-02). (resource @ East = 49,172,000 tonnes @ 1.39% Cu, 0.17 gpt Au measured+indicated) *Press Release:* December 30

American Pacific Mining Corp. announced that recent drill results at the Tuscarora Project include 384.05 -385.57 meters @ 3.47 gpt Au (TUS-03); 379.48-381.0 meters @ 2.08 gpt Au (TUS-03); 85.34-86.87 meters @ 1.18 gpt Au (TUS-09) and 359.26-360.27 meters @ 1.12 gpt Au (TUS-01C). (resource = 1,186,000 tonnes @ 1.22 gpt Au inferred) *Press Release:* January 13

Corvus Gold Inc. announced that recent drill results at the Mother Lode Project include 129.54-146.3 meters @ 0.34 gpt Au (ML19-121); 99.06-106.68 meters @ 0.52 gpt Au (ML19-122) and 153.92-190.5 meters @ 2.43 gpt Au (ML19-122). (resource = 13,226,000 tonnes @ 1.72 gpt Au measured+indicated) *Press Release:* January 14

Allegiant Gold Ltd. announced that based on recent drill results at the Eastside Project, resources aggregate 57,050,000 tonnes @ 0.54 gpt Au, 4.3 gpt Ag inferred. (was 35,780,000 tonnes @ 0.57 gpt Au inferred) *Press Release:* January 27

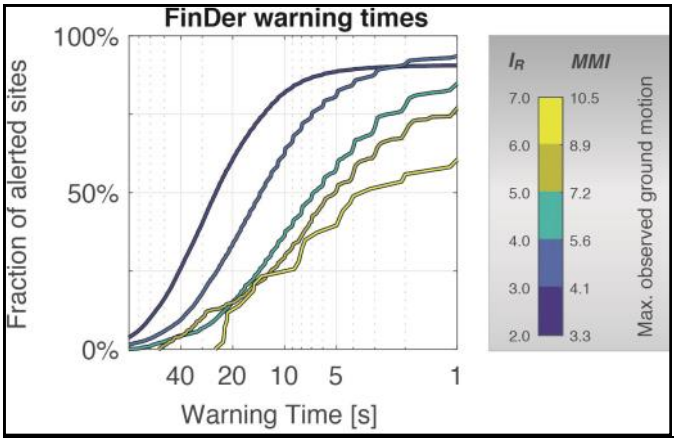
Kinross Gold Corp. announced that reserves at the Bald Mountain Mine aggregate 66,650,000 tonnes @ 0.60 gpt Au proven+probable. (was 95,216,000 tonnes @ 0.60 gpt Au proven+probable) *2018 Annual Report*

Rock Talk (continued from page 10)

**Hope for the future of Early Earthquake Warning**

Alerts may improve as algorithms improve as well, notes Meier. Also, people may have additional time to take cover, even after the shaking is already noticeable. “It can take quite some time until the really strong shaking starts.” But he points out that it will remain difficult to provide early warning for those within the first 30 to 50 kilometers (19 to 30 miles) of the epicenter. The seismic waves simply get to them too quickly. “The biggest limitation is the incredible speed with which seismic waves propagate. We’re in a race against this really fast wave,” he says. But Meier is optimistic, noting that “it turns out that it’s a race we can often win.”

This test is critical for people who live in earthquake-prone areas and might rely on early warning systems. Annemarie Baltay, a USGS scientist and member of California’s ShakeAlert team, is positive about the study’s results. “Critics will say that we can’t send early warnings to the most critical sites. But the results give us the confidence that some percent of the time we can send useful warnings.”
Studies like this help ShakeAlert managers think about how to fine-tune their system, Baltay says. For example, a surgeon might not want to interrupt a procedure in the operating room for low-level shaking but would definitely stop with high shaking, so maybe the hospital only wants alerts about higher-intensity quakes. In contrast, schools or public transportation systems might want an alert for any earthquake as a way to test their emergency responses. “We need to describe the potential performance to them,” says Baltay. “Then we’ll have a better idea of how to further develop warnings,” she says.




Warning times vary for different sites, and those with stronger shaking levels tend to receive shorter warning times. Here, lines show the distribution of warning times for sites with different observed maximum shaking levels. Of the sites that experience an MMI of 4.0 (blue lines) — which feels like a truck hitting a building— more than 80% will receive an alert five seconds or more before shaking starts. For the sites with much stronger shaking of MMI greater than 7.0 (yellow lines), where shaking will topple furniture and fixtures, about 50% of sites will receive an alert with at least five seconds of warning time. Credit: Men-Andrin Meier

**Citation**: Elisabeth Nadin (2020), How good is earthquake early warning? Temblor, http://doi.org/10.32858/temblor.071

## OTHER UPCOMING EVENTS

**March 2, 2020: DREGS (Denver Region Exploration Geologists), Speaker and Topic: To Be Announced.** Social 6 p.m., Presentation 7 p.m. at Berthoud Hall, Room 241, CO School of Mines, Golden. For more info. contact James Piper at geopros@q.com

**March 3, 2020: Arizona Geological Society meeting Speaker and Topic: To Be Announced.** 6 to 9 p.m. at the Sheraton, 5151 E Grant Rd. (& Rosemont), Tucson, AZ For more information click here: http://www.smetucson.org/events/. Dinner closes on February 28, 2020.

**March 5, 2020: Nevada Petroleum & Geothermal Society, Reno, NV monthly meeting.** Tamarack Junction , 13101 So. Virginia Street. Reno NV. *Cocktails at* 6:30 PM, Dinner at 7:00 PM. **Speaker: *Karen Loomis (NPGS Past President), will be presenting research conducted by her and Co-Author Vincent Ramirez. Her talk is titled: "Lithium in Three Easy Steps: Railroad Valley Case Study*".** *Please make reservations by Tuesday, March 2, 2020.* Click here to register online and reserve your seat.

**March 9, 2020: SME Northern Nevada Section Monthly Meeting**. Circus-Circus Mandalay Room, Reno NV. **Speaker and Topic: To Be Announced.** Happy Hour @ 6 pm, Dinner @ 7 pm. Please contact Sarah Lightner for more information at 775-746-7147 or NNevSME@gmail.com

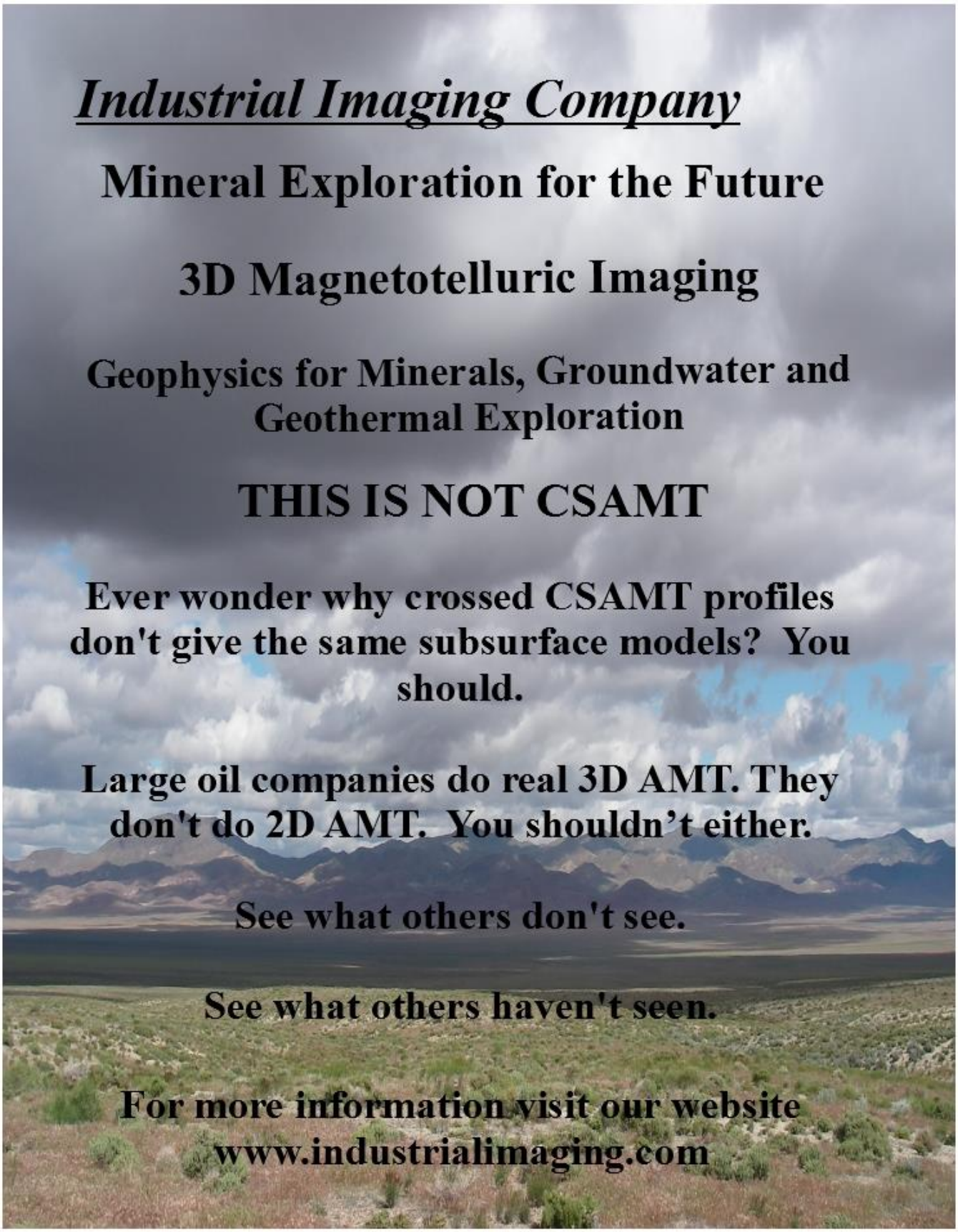
**March 9, 2020: 2020 NWRA Webinars Present – WetBar Tool for Wetland Assessment - 11:00 a.m. to 12:00 p.m.** *Dr. Ken McGwire, Associate Research Professor Geography, Desert Research Institute, will be our webinar instructor.* Go to http://www.nvwra.org/webinars for webinar information and registration. For questions or more information call Tina Triplett at 775-473-5473 or nevadawaterresources@gmail.com.

**April 2, 2020: UNR/NWRA Dinner Forum - Time: No Host Bar - 5:15 p.m. Dinner - 6:15 p.m. Presentation - 7:15 p.m. Held at the Nugget Casino Resort. Speaker is Jason King, P.E. Retired Nevada State Engineer.** Go to http://www.nvwra.org/2020unr-nwradinnerforum for event information and registration. For questions or more information call Tina Triplett at 775-473-5473 or nevadawaterresources@gmail.com.

**April 7-8, 2020: Amargosa Valley Tour - 8:00 a.m. Tuesday departure - 4:00 p.m. Wednesday return**. *Meals, Transportation & Lodging are included. There's only 6 seats left and you don't want to miss this with lots of great speakers and places to see. Go to http://www.nvwra.org/2020-amargosa-valley-tour for event information and registration. For questions or more information call Tina Triplett at 775-473-5473 or nevadawaterresources@gmail.com.

**May 14-24, 2020: GSN SYMPOSIUM 2020—VISION FOR DISCOVERY**
**with Pre- and Post-Meeting Field Trips, Nugget Casino Resort, Sparks, NV.**
**https://www.gsnsymposium.org/**

**July 19-28, 2020 Lew Kleinhans, who has led more than 10 trips through the Grand Canyon, will lead another 9 day float trip from July 19-28, 2020.** If you or anyone you know is interested, please contact Lew by email or phone. Lew 720-273-9233 or lewis.oysterclub@gmail.com. (This announcement comes from our friends at DREGS.)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Hillemeyer Elko abstract, cont. from page 7

intercepted by drilling at depth. A distinct lack of true low-sulfidation epithermal textures (e.g. colloform-crustiform banded quartz, bladed-quartz after calcite, adularia, etc.) suggests that the system never experienced intense boiling events like those corresponding with bonanza grades at Fire Creek, Midas, or Hishikari but new evidence suggests the presence of a high-grade feeder vein masked by post-mineral fault movement along the north-northwest striking normal faults. Sulfur isotope data was collected from a suite of samples representing the different mineralization styles, hosts, and various spatial relationships for 29 samples. Marcasite and Pyrite samples returned an average $\delta^{34}S_{VCDT}$ (‰) value of 9.5±1.1 excluding two extreme outliers suggesting a homogenous source for sulfur throughout the entire system likely partially contributed by disseminated diagenetic sulfur within the Schoonover Sequence. Gravel Creek offers the unique opportunity to view a nearly one-kilometer vertical section of a Nevada low-sulfidation epithermal system from silicified ash fall tuffs at the surface representing the paleosurface at the time of mineralization to beneath the mineralized zone in three dimensions. Increasing understanding of the interplay between depth, host rock physical properties, host rock geochemistry, and mineralization at Gravel Creek may prove to have importance for further mineral exploration beneath the vast Jarbidge Rhyolite in northeastern Nevada as well as a greater understanding of the role permeable host rocks can have in forming stratiform ore zones in epithermal systems.

Please contact Elko Chapter President, Diane Cheung-Harris for more information.
**dianehcheung@gmail.com**

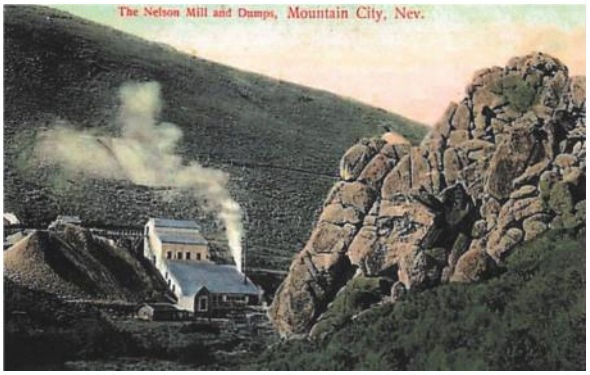
## Elko Conference - Mining History Association

The Mining History Association (MHA) is planning their 30th Annual Conference in Elko, Nevada, on June 11th through the 15th, right after the Mine Expo. The Mining History Association is a group of individuals, mainly throughout the US, who share a common interest in mining history and in documenting and recording the important role that mining has played in the North America's advancement throughout time. The group is diverse, from all over the country, and includes miners, metallurgists, and geologists (many retired) as well as people in academics or just folks interested in mining. This year's conference wants to highlight the historic and current significance of the important mining center in and around Elko. Planning and organizing for the meeting is in full swing.

The host hotel is the Red Lion. Two days of oral presentations are flanked by tours of the area mines, both active and long idle. The MHA conference committee is currently organizing a series of field trips to neighboring mining areas of interest including the Carlin Trend, Cortez and Eureka. The field trips will focus on the historic aspects of these mining areas but will also highlight the current mining activities in the districts. Dean Heitt, retired geologist with Newmont, will be the field trip leader of the proposed Carlin portion of the tour. Dean recently published "Before the Gold: Early Mining History of the Carlin Trend 1874-1961". Robert McQueen will lead the Cortez portion of the proposed tour. Robert is the Co-author of the book, "Historical Archaeology in the Cortez Mining District: Under the Nevada Giant". Richard Reid, also a retired Newmont geologist, will lead the Eureka field trip and this will focus on the historic downtown Eureka and selected historic mine sites. The MHA is anticipating up to 150 participants to this event which should bring a significant amount of commerce to the local economy.

Information about the Mining History Association's conference can be found on the Association's website: www.mininghistoryassociation.org or by contacting Richard Reid, richardreid.geo@gmail.com. The association welcomes any Elko or local folks to attend for a small attendance charge, welcomes potential vendors who may be interested in a booth during the conference and also will accept any contributions for our event. The Mining History Association is a 501C(3) non-profit public charity and any contributions are tax deductible.

Richard Reid
General Chair, Elko Conference, Mining History Association
3 Spring Creek Lane, Spring Creek, NV 89815
775-934-3948



## GEOLOGICAL SOCIETY OF NEVADA

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## GSN SYMPOSIUM 2020—VISION FOR DISCOVERY

The Geological Society of Nevada will host its 8th symposium May 14 – 24th, 2020, in the scenic Reno/Lake Tahoe region of northern Nevada. Symposia are held every 5 years and draw an international audience from the minerals industry, government, and universities. GSN symposia are the preeminent regional venue combining geology and exploration in the U.S. The 2020 theme, ***Vision for Discovery***, emphasizes the goal of science to explore and make new discoveries in the Basin and Range province.

VISION FOR DISCOVERY
GSN SYMPOSIUM 2020

### Check out this line up of Keynote Speakers!

**Monday, May 18, 2020**
**Eric Seedorff—Opening Speaker**
**Keith Meldahl—Luncheon Speaker**
**Chuck Thorman—Closing Speaker**

**Tuesday, May 19, 2020**
**Elizabeth Miller—Opening Speaker**
**Joe Mazumdar—Luncheon Speaker**

**Wednesday, May 20, 2020**
**John Prochnau—Opening Speaker 1**
**Rich Goldfarb—Opening Speaker 2**
**Quenton Hennigh—Luncheon Speaker**

**Thursday, May 21, 2020**
**Dick Sillitoe—Opening Speaker**
**Moira Smith—Closing Speaker**

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