Nevada’s Mining Sector Outlook

Society for Mining, Metallurgy and Exploration
Northern Nevada Section
April 11, 2022

Michael Visher, Administrator
Nevada Division of Minerals
Nevada Mining Summary

- In 2020 Nevada Mining provided 31,318 Nevada Jobs.
- $2.4 Billion in total paid salary
- In 2020, 4th leading producer of GOLD in the WORLD! (Behind China, Australia, and Russia)
- 20+ minerals are produced in Nevada at over 100 mines
- $13.5B impact to Nevada’s economy
- For 2020, Nevada ranked as #1 mining jurisdiction in the world (Fraser Institute, 2021)
- Lots of interest in new lithium (and other critical minerals)

In 2020 Nevada Mining produced 10% of all U.S. mineral production

Mines operate on less than ¼ of 1% of Nevada’s 70,722,119 acres
2020 = $9.5B in total value of all mineral commodities
Nevada Gold

2020 Production
4.63 Moz, -5% vs. '19
32 mining operations
21 operators
2021 est. down ~5%

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4.63 Moz, -5% vs. '19
32 mining operations
21 operators
2021 est. down ~5%

Gold production, millions of troy ounces
Gold price, $/troy ounce

Price
Production

Gold price, $/troy ounce
Gold production, millions of troy ounces
## 2020 NEVADA METAL PRODUCTION, BY PRODUCER - Final

**Ranked by gold production**

<table>
<thead>
<tr>
<th>Operator</th>
<th>Gold (ozs)</th>
<th>Silver (ozs)</th>
<th>Copper (lbs)</th>
<th>Moly (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevada Gold Mines</td>
<td>3,469,998</td>
<td>1,289,700</td>
<td>41,957,856</td>
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</tr>
<tr>
<td>Kinross Gold</td>
<td>503,950</td>
<td>998,257</td>
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<tr>
<td>SSR Mining</td>
<td>234,443</td>
<td>3,329</td>
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<tr>
<td>Jerritt Canyon Gold LLC</td>
<td>112,749</td>
<td>0</td>
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<tr>
<td>Florida Canyon Mining</td>
<td>46,866</td>
<td>27,490</td>
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<tr>
<td>Fiore Gold</td>
<td>46,516</td>
<td>0</td>
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<tr>
<td>KGHM International</td>
<td>38,801</td>
<td>199,382</td>
<td>109,639,248</td>
<td>426,538</td>
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<tr>
<td>Hecla (Klondex)</td>
<td>31,800</td>
<td>37,400</td>
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<tr>
<td>Gold Resource Corp.</td>
<td>28,542</td>
<td>26,961</td>
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<tr>
<td>McEwen Mining</td>
<td>27,910</td>
<td>0</td>
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<tr>
<td>Hycroft Mining</td>
<td>27,392</td>
<td>178,836</td>
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<td>Coeur Rochester</td>
<td>27,147</td>
<td>3,174,529</td>
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<tr>
<td>Rawhide Mining</td>
<td>24,078</td>
<td>159,049</td>
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<td>Gold Aquizition</td>
<td>5,072</td>
<td>14,330</td>
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<td>Ruby Hill Mining</td>
<td>3,252</td>
<td>5,153</td>
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<tr>
<td>Mineral Ridge Gold</td>
<td>2,800</td>
<td>1,358</td>
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<tr>
<td>Manhattan Gulch LLC</td>
<td>745</td>
<td>0</td>
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<tr>
<td>Borealis Mining</td>
<td>310</td>
<td>896</td>
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<tr>
<td>Nevada Copper</td>
<td>293</td>
<td>10,757</td>
<td>2,667,827</td>
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<tr>
<td>Geo-Nevada</td>
<td>18</td>
<td>11</td>
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<tr>
<td>Toquima Gold</td>
<td>8</td>
<td>0</td>
<td></td>
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</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>4,632,690</strong></td>
<td><strong>6,127,438</strong></td>
<td><strong>154,264,931</strong></td>
<td><strong>426,538</strong></td>
</tr>
</tbody>
</table>
New Mining Operation for 2020
Americas Gold and Silver – Relief Canyon, Pershing County

- Past production – 1986 to 1990
- New construction began – May 2019
- Stockpiled ore placed on heap leach – December 2019
- First gold pour – February 2020
- Full mine production by Q2 2021
- Production target – 80-100 koz/yr
- Avg. Au grade - 0.8 g/t
- Current mine life – 6 years

Mining ops suspended in August 2021
Metallurgical testing program to be completed by mid-2022
Silver price, $/troy ounces

Nevada Silver

2020 Production
6.13 Moz, -2.5% vs. '19
23 mining operations
16 operators

Price

Production

Silver production, millions of troy ounces

2020 Production
6.13 Moz, -2.5% vs. '19
23 mining operations
16 operators

Silver price, $/troy ounces

Silver production, millions of troy ounces

2020 production
154.3M lbs, +7% vs. '19
3 mining operations
3 operators
Nevada Copper’s Pumpkin Hollow Mine, Lyon County

- 2 deposits with 6 billion contained pounds of Cu
  - Higher grade eastern deposit; underground
  - Shallower western deposit; open-pit
- Main shaft and materials handling system completed Dec. 2020
- First copper production occurred in Q4 2019 with temporary suspension from April to August 2020 due to the pandemic
- Production ramping up (3k tpd hoisting), anticipating steady state by H2 2022
- 13.5-year mine-life (underground) and 19-year mine-life (open pit)
- Becomes Nevada’s 3\textsuperscript{rd} copper producer in past 20 years
2020 Production
166,136 tons shipped
-61% vs. '19
3 producers
#1 producer in US
### Nevada Limestone

Production largely tied to construction activity

<table>
<thead>
<tr>
<th>Year</th>
<th># of Mines Reporting</th>
<th>Amount Mined (Tons)</th>
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<tbody>
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<td>1991</td>
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<td>2020</td>
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Nevada Limestone Production largely tied to construction activity.
Nevada Gypsum

2020 Production
2.4 M tons
4 producers
Largely tied to demand for sheetrock
Other Industrial Minerals Produced in 2020

- 6,900,000 lbs of lithium compounds*
- 570,000 tons of silica sand
- 124,000 tons of magnesium compounds*
- 420,000 tons of diatomite
- 426,000 pounds of molybdenite
- 15,000 tons of salt
- 2,700 tons of perlite
- 192,000 tons of specialty clays

* Only producer in US
Nevada Aggregate
Demand is closely linked to construction activity in, and adjacent to, Nevada.
Nevada Aggregates

- 4th highest valued commodity in NV
  - Includes:
    - Crushed rock
    - Sand and gravel
  - Used primarily for construction but also for landscaping material and products
  - 100s of former and current borrow pits
    - NDOT and county road maintenance
  - BLM Mineral Materials sales of $10M in FY20
  - Unlike most commodities, cost is determined largely by distance needed to transport
  - Creates NIMBY challenges in urban areas
NEVADA MINING CLAIMS

- 244,492 Active Mining Claims in Nevada as of 3/29/2022
- Increase of 11% from April 2021
- >50% of all US mining claims
- Claims are ~20 acres in size
- Annual maintenance payments of $165/claim to BLM and $12/claim to county recorder
  - ~$39M to BLM (2021 AY)
  - ~$2.8M to Nevada counties
- The trend in claims is an indicator for exploration interest and price of gold
- >$643M spent on exploration in NV in 2019 and 2020
- Nevada named as #1 mining jurisdiction in the world (Fraser Institute, 2021)
NDOM has been gathering active claim data from LR2000/MLRS at the end of October for the last eight years. The purpose of this graph is to show claims data and statistics from the same snapshot in time.
The Demand for Lithium

The Tesla/Panasonic battery factory alone needs 5X the amount of lithium mined annually in Nevada.
Lithium in Brine vs. Lithium in Clay/Rock

**Lithium Brine**
- Albemarle’s Silver Peak mine is the only active lithium mine in US, operating since 1966.
- Solar evaporation in ponds over 18-24 months increases concentration of lithium chloride prior to processing into lithium carbonate.
- Cheaper processing costs but lower recovery %s.
- Requires placer mining claims and significant water rights.
- Newer technologies may not require same timeframe or consumptive water use.
- 17 other playa basins in Nevada being explored (>21 projects).

**Lithium in Clay/Hard Rock**
- No current mines, but 3 projects are in various stages of permitting:
  - Thacker Pass, Humboldt Cty
  - Rhyolite Ridge, Esmeralda Cty
  - TLC Project, Nye Cty
- Resources typically very large with long mine-life.
- Processing is more expensive but yields higher recovery %s.
- Requires location of lode mining claims.
- Much less water consumption but high sulfuric acid consumption.
- At least five additional exploration projects in Nevada.
Lithium Americas – Thacker Pass Project

- Reserves – 3.1M tonnes LCE at 2,358 ppm Li
- Strip ratio – 1.6:1
- Mine life – 46 years
- Processing time - <24 hours
- Lithium recovery – 83%
- Pilot plant operational in Reno
- BLM issued Record of Decision on 1/15/2021
- ROD appeal expected to be complete by Q3/2022
- NDEP permits issued 2/25/2022, appealed by GBRW, to be heard by SEC end of June
ioneer’s Rhyolite Ridge Project

Project overview

A searlesite resource that is different to other sedimentary lithium deposits - it is suitable for a simple acid leach process

- Total Resource\(^1\) of 4.1 million tonnes lithium carbonate & 10.9 million tonnes boric acid
- Including 121 million tonnes of lithium-boron ore containing:
  - 1.1 million tonnes lithium carbonate
  - 8.6 million tonnes boric acid
- Lithium only clay mineralisation to be stockpiled
- Measured and indicated resource of 5.4 Mt lithium carbonate equivalent
- Lithium ore at the surface
- Preliminary metallurgical tests indicate >90% recovery in <10 minutes using sulfuric acid leach
- Large drilling program permitted and economic analysis is underway
Critical Minerals

A “critical mineral,” as defined by the E.O. 13817, is a mineral:

1. identified to be a nonfuel mineral or mineral material essential to the economic and national security of the United States
2. from a supply chain that is vulnerable to disruption
3. that serves an essential function in the manufacturing of a product, the absence of which would have substantial consequences for the U.S. economy or national security.

- In May of 2018, D.O.I. published a final list of 35 critical minerals
- The same list was published as final by USGS in Feb. 2022
- 21 of the 35 occur in Nevada

<table>
<thead>
<tr>
<th>Aluminum</th>
<th>Graphite</th>
<th>Rubidium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony*</td>
<td>Hafnium</td>
<td>Scandium</td>
</tr>
<tr>
<td>Arsenic*</td>
<td>Helium</td>
<td>Strontium</td>
</tr>
<tr>
<td>Barite*</td>
<td>Indium</td>
<td>Tantalum</td>
</tr>
<tr>
<td>Beryllium*</td>
<td>Lithium*</td>
<td>Tellurium</td>
</tr>
<tr>
<td>Bismuth</td>
<td>Magnesium*</td>
<td>Tin</td>
</tr>
<tr>
<td>Cesium</td>
<td>Manganese*</td>
<td>Titanium</td>
</tr>
<tr>
<td>Chromium</td>
<td>Niobium</td>
<td>Tungsten*</td>
</tr>
<tr>
<td>Cobalt</td>
<td>PGM</td>
<td>Uranium*</td>
</tr>
<tr>
<td>Fluorspar*</td>
<td>Potash</td>
<td>Vanadium</td>
</tr>
<tr>
<td>Gallium</td>
<td>REE</td>
<td>Zirconium</td>
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<tr>
<td>Germanium</td>
<td>Rhenium</td>
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</tr>
</tbody>
</table>

Bold indicates known occurrences
* indicates past or present production in Nevada
Nevada is uniquely positioned to lead the US in transitioning away from fossil fuels so long as federal land is available for the environmentally responsible extraction of the commodities needed to electrify the nation.
Renewed exploration in NV for cobalt, copper, graphite, lithium, REE, tungsten, vanadium, and zinc while conservation efforts continue to remove land from development.

~177,000 acres withdrawn in Nevada per year since 1930
Critical Minerals Occur in over 60% of Nevada’s Mining Districts
Global Production (Last 10-15 yrs): Stable, China is the leading producer followed by Russia, though China’s production has been decreasing in the last 10 years.
Supply Options: Domestic recycling of scrap and further research on deposit models to assist in exploration.

Uses: Ammunition, lead-acid batteries, other lead alloys, ceramics, glass, rubber products, and in flame retardants (in mattresses among other household items).

Investment Attractiveness Ranking 2020
- 1-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-77

US Supply Source

5 Year Average Net Import Reliance: 83%
Domestic Mining (2018-2019): Some US production, which only meets a small fraction of total demand.


Global Production (Last 10-15 yrs): Varies based off demand, mainly from the oil and gas industry.


Supply Options: Substitution, further deposit model research, or new processing methods for the economic extraction of barite as a coproduct.

Investment Attractiveness Ranking 2020
- 1-10
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- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-77

US Supply Source

Uses: Weighting agent and filler in drilling fluids, along with production of plastics, rubbers, glass, and paint.
Beryllium
Beryl, oxide, metal, Be-Cu master alloy

**Domestic Mining (2018-2019):**
The US is world’s leading producer. Production comes from a single mining company. That company processes domestic and foreign ores.

**Secondary Production (2018-2019):**
Recycling of scrap.

**Global Production (Last 10-15 yrs):**
US is a net exporter and production has been consistent. Chinese production has doubled.

**Import Sources (2016-2019):**
Kazakhstan, Japan, Brazil, and Latvia.

**Supply Options:** Developing assessment models for new deposits, and more efficient extraction methodologies.

**Uses:** Crucial for defense (radar, electric countermeasures systems, telecommunications satellites, infrared target acquisition systems, and surveillance systems), alloys for underwater pressure vessels, aircraft landing gear, telecommunications, shielding, and electronic connectors.

5 Year Average Net Import Reliance: 13%


Global Production (Last 10-15 yrs): D.R. Congo is largest global source where China dominates refinery production.


Supply Options: Recycling, better geologic models to aid in exploration, new methods for increased recovery and processing.

Uses: Rechargeable batteries (electronics & electric vehicles), superalloys (gas turbine engines, cemented carbides, magnets, steels, chemical applications).

Investment Attractiveness Ranking 2020

US Supply Source

5 Year Average Net Import Reliance: 73%


Global Production (Last 10-15 yrs): More than 50% of global fluorspar production comes from China. In general, global production is stable.


Supply Options: Extraction from brines and discovery of new conformable fluorspar deposits.

Uses: Used to produce many common materials (aluminum, steel, glass, and cement), and chemicals (fluorocarbons and fluoropolymers).

Investment Attractiveness Ranking 2020
- US Supply Source
- 5 Year Average Net Import Reliance: 100%
Gallium

Metal, gallium arsenide wafers

**Domestic Mining (2018-2019):** None.

**Secondary Production (2018-2019):** Refining of imported crude gallium.

**Global Production (Last 10-15 yrs):** Refining concentrated in China.

**Import Sources (2016-2019):** China, Canada, Germany, and Japan.

**Supply Options:** Research to understand future impacts on supply, development of improved assessment models, new more efficient extraction and recycling technologies, and domestic refining of crude gallium and recycling.

**Uses:** Crucial to the functionality of many electronic applications.
Domestic Mining (2018-2019): None (some resources in development).


Global Production (Last 10-15 yrs): China mines 75% of the world's graphite, other locations include Madagascar, Mozambique, and Tanzania.

Import Sources (2016-2019): China, Mexico, Canada, and India.

Supply Options: Exploration for new flake graphite deposits, further research into the occurrence and distribution of high-grade flake graphite deposits and recycling refractory graphite.

Uses: High technology applications (battery anodes, fuel cells, solar cells, pebble-bed nuclear reactors), electrodes, refractories, and foundries.
**Investment Attractiveness Ranking 2020**

**US Supply Source**

**Domestic Mining (2018-2019):**
One mine, two producers of lithium compounds and other projects in development.

**Secondary Production (2018-2019):**
Recycling of lithium-ion batteries.

**Global Production (Last 10-15 yrs):**
Australia has significantly expanded lithium mine production along with China.

**Import Sources (2016-2019):** Argentina, Chile, China, and Russia.

**Supply Options:** Further research on deposit models, recycling and establishment of the domestic lithium-ion battery supply chain.

**Uses:** Batteries, ceramics, glass, and lubricating greases.
Manganese
Metal, alloy, ferromanganese, silicomanganese, oxides, manganates and other compounds

Domestic Mining (2018-2019): None
Global Production (Last 10-15 yrs): Global production has increased in the past decade, electrolytic Mn only supplied by China and South Africa.
Import Sources (2016-2019): Australia, Brazil, China, Gabon, Ghana, India, Mexico, Korea, Georgia, and South Africa.
Supply Options: Increasing efficiency of mining and processing, discovery of higher-grade deposits in the US.

Uses: Steel production, rechargeable lithium-ion batteries, alkaline batteries and Li-Mn-O₂ batteries, aerospace and other transportation applications.

5 Year Average Net Import Reliance: 100%
Investment Attractiveness Ranking 2020

Domestic Mining (2018-2019): The Mountain Pass Mine is an active producer and other projects are in development. All ore is exported for processing.


Global Production (Last 10-15 yrs): China has dominated processing of REEs globally.


Supply Options: Diversify production, reduce waste, develop substitutes, recycling programs, develop economic extraction methods, further research on deposit models.

Uses: Glass manufacturing (polishing, optical properties and colorant/de-colorant), petroleum refining, catalytic converters, magnets, battery anodes, steelmaking, display screens, synthetic gems, lasers, nuclear control rods, cry-coolers, and fertilizers.

5 Year Average Net Import Reliance (Compounds & Metals): 100%
**Tellurium**

**Metal**

**Domestic Mining (2018-2019):** Mined with copper and recovered during refining.

**Secondary Production (2018-2019):** Very limited recycling.

**Global Production (Last 10-15 yrs):** China leads global production, but US imports most tellurium from Canada.

**Import Sources (2016-2019):** Canada, China, Germany, and the Philippines.

**Supply Options:** Recovery from new sources.

**Uses:** Solar photovoltaic cells, thermoelectric devices, additives to copper and lead alloys, cast iron, and production of rubbers.

**Investment Attractiveness Ranking 2020**

- 1-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-77

**US Supply Source**

**5 Year Average Net Import Reliance:** >95%
Tungsten

Ammonium para-tungstate, oxides, chlorides, tungstates, tungsten carbide, metal, ferrotungsten


Global Production (Last 10-15 yrs): Has long been a crucial mineral. China leads global production.

Import Sources (2016-2019): China, European Union countries, Bolivia, Germany, Austria, Canada, and Vietnam.

Supply Options: Increased domestic recycling.

Uses: Aerospace, energy, telecommunications, defense industries, wear-resistant tools, munitions, oil and gas drilling equipment, jet engines, land-based turbines, and lighting.

Investment Attractiveness Ranking 2020
- 1-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-77

US Supply Source

5 Year Average Net Import Reliance: >50%
Vanadium
Vanadium pentoxide, other compounds, metal, ferrovanadium, special alloys


Global Production (Last 10-15 yrs): Just over 50% of the world’s mined vanadium comes from China.

Import Sources (2016-2019): Austria, Canada, Brazil, China, Russia, Japan, and South Africa.

Supply Options: Optimize extraction methods, and increased recycling.

Uses: Alloying element (turbine blades for jet engines and power generating turbines), batteries, catalyst to produce chemicals.
Of the top 10 jurisdictions, we ranked them based on the count of critical minerals per acre: NV, ID, AZ
Of the top 10 jurisdictions, we ranked them based on critical minerals deposits per acre: Finland (29 Pt group deposits), NV, AZ, ID
EXPLORATION FOR CRITICAL MINERALS

As of September 27, 2021, there have been no fewer than:

- 323 BLM Notices for Critical Minerals in NV since 1981 with
  - 27 currently Authorized/Pending

- 41 Plans of Exploration or Operation with
  - 23 currently Authorized/Pending

Explorers

- 1067323 NEVADA CORP
- 1074654 NEVADA CORP
- ACREX MINERALS US INC
- ALBEMARLE US INC
- ARIZONA LITHIUM CO LTD
- BAKER HUGHES DRILLING FLUIDS
- BAKER HUGHES INTEQ
- BAMCO EXPL INC
- BATTERY MINERAL RESOURCES NEVADA INC
- BIG CASINO CORP
- BONAVENTURE NEVADA INC.
- BROWNSTONE VENTURES (US) INC
- CENTERSTONE RESOURCES LLC
- COPPER ONE USA INC
- DAJIN RESOURCES US CORP
- DRESSER MAGCOBAR MINERALS
- FIRST LIBERTY POWER CORP
- GALWAY RESOURCES US INC
- GREEN ENERGY RESOURCES INC
- GRR OPERATING LLC
- HALIBURTON ENERGY SERVICES
- HERRON DAVID
- INTOR RESOURCES CORPORATION
- IONENER USA CORPORATION
- LITHIUM ORE CORP
- LITHIUM NEVADA CORPORATION
- M-I LLC
- NATIONAL OILWELL VARCO
- NUTRITIONAL ADDITIVES CORP
- PCI
- PURE ENERGY MINERALS LTD
- RUBICON EXPLORER CORPORATION
- STINA RESOURCES LTD
- WOODS BRUCE
- ZENOLITH USA, LLC
23,377 mining claims have been staked in mining districts with critical mineral occurrences/deposits since December of 2017.
New Open Data Services

- **Claims Location Array Interactive Map Service (C.L.A.I.M.S.)**
  - A platform for exploring and downloading mining claims, BLM Plan and Notice GIS data
  - Includes both historic and current data for: AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA and WY
  - [https://claims-nvdataminer.hub.arcgis.com/](https://claims-nvdataminer.hub.arcgis.com/)

- **Claim Residency Interactive Map Experience (C.R.I.M.E.)**
  - For viewing of mining claim density and annual federal fees paid through time per section
  - View sum and average of fees per section
  - Includes same 11 western states, notice and plan data, and USGS MRDS and USMIN datasets
  - [https://data-ndom.opendata.arcgis.com/](https://data-ndom.opendata.arcgis.com/)
TRENDS & PREDICTIONS

- Metals mining is increasingly underground, >30% now
- Copper is #2 in gross value and increasing
  - Limitation is lack of downstream smelting and refining
  - Electric vehicles vs. gas require 5-8X more copper
- Industrial mineral production in NV likely to increase as it is easier to put into operation than in other western states
- Increase in # of projects being permitted largely due to increased gold price but also in relation to increased demand for commodities needed for renewable energy and batteries (Co, Li, Ni, V, Zn)
- If one or more Li clay project begins mining, NV will produce >10% of world production, would then expect vertical integration with a cathode plant built in NV.
- Successful DLE technology will dramatically increase lithium brine mining.
- Escalation in investor interest on the value of environmental, social and corporate governance (ESG)
For More Info:

- Agency Homepage: minerals.nv.gov
- “Mining” program page
  - Production summaries and stats
  - Numerous free publications and maps
- “Current Information”
  - Links to our Distance Learning Educational Videos
  - Recent Presentations
- “Important Links - Open Data Site”
  - Interactive web mapping application to display and download information related to the minerals industry.
  - Location of mining claims, current and historical exploration activity and mineral production.
  - Public lands issues
  - New “Mining in Nevada” page