Nevada's Mining Sector Outlook Mineral Production, New Mines, Exploration, Critical Minerals, Potential Impacts, and Trends

American Association of Professional Landmen Mining and Land Resources Institute March 2, 2022

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NEVADA DIVISION OF MINERALS

Isabella Pearl Mine, Mineral County

Nevada Mining Summary

In 2020 Nevada Mining provided 31,318 Nevada Jobs.

\$2.4 Billion in total paid salary

Nevada produced 10% of all U.S. mineral production

Mines operate on less than ½ of 1% of Nevada's 70,722,119 acres

- 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)



Production Value, \$ millions





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

Nevada Gold Mines Production Comparison



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









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
- The mine will employ ~300 people
- 13.5-year mine-life (underground) and 19-year mine-life (open pit)
- **Becomes Nevada's 3rd copper producer in past 20 years**











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

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- 2,700 tons of perlite
- 192,000 tons of specialty clays
 - * Only producer in US



Nevada Aggregate



Nevada Aggregate Production and Value



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

- 239,647 Active Mining Claims in Nevada as of 12/29/2021
- Increase of 15% from December 2020
- >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
 - ~\$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 recently named as #1 mining jurisdiction in the world (Fraser Institute, 2021)

Distribution of Mining Claims in Nevada BLM MLRS Data as of December 29, 2021

IMPORTANT NOTE: There is no mineral segregation within the boundary of the current BLM proposed SFA withdrawal.





Unpatented Mining Claims By Year



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

Electric Vehicle sales in millions



FIGURE 1. Annual Sales of Passenger EVs (Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)). Source: BloombergNEF Long-Term Electric Vehicle Outlook 2019.¹⁶

• 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
- Requires significant quicklime consumption
- Newer technologies may not require same timeframe or consumptive water use
- 17 other playa basins in Nevada being explored

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
- Many additional exploration projects

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</p>
- 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

ioneer's Rhyolite Ridge Project





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



- Total Resource¹ 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

American Lithium – TLC Project



- 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
- 21 of the 35 occur in Nevada

Aluminum	Graphite	Rubidium
Antimony*	Hafnium	Scandium
Arsenic*	Helium	Strontium
Barite*	Indium	Tantalum
Beryllium*	Lithium*	Tellurium
Bismuth	Magnesium*	Tin
Cesium	Manganese*	Titanium
Cesium Chromium	Manganese* Niobium	Titanium Tungsten*
Cesium Chromium Cobalt	Manganese* Niobium PGM	Titanium Tungsten* Uranium*
Cesium Chromium Cobalt Fluorspar*	Manganese* Niobium PGM Potash	Titanium Tungsten* Uranium* Vanadium
Cesium Chromium Cobalt Fluorspar* Gallium	Manganese* Niobium PGM Potash REE	Titanium Tungsten* Uranium* Vanadium Zirconium

Bold indicates known occurrences

* indicates past or present production in Nevada

Energy Materials - Projected Market Growth



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.

MINERALS ESSENTIAL TO ADVANCED ENERGY TECHNOLOGY





INFRASTRUCTURE Copper, Iron Ore, Molybdenum

PUBLIC TRANSIT Aluminum, Titanium, Magnesium





RENEWABLE ENERGY Gold, Silver, Zinc

Renewed exploration in NV for cobalt, copper, graphite, lithium, REE, tungsten, vanadium, and zinc while conservation efforts continue to remove land from development.







- 5 Critical Mineral Occurence(s)/Deposit(s)
- 6 Critical Mineral Occurence(s)/Deposit(s)
- 7 Critical Mineral Occurence(s)/Deposit(s)



Antimony

Oxide, sulfide, metal

Domestic Mining (2018-2019):

None.

Secondary Production (2018-2019):

One metal producer (feedstock from imports), antimonial lead from smelters. 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.

Import Sources (2016-2019): China, Italy, India, Mexico, Belgium, Bolivia, Thailand, Vietnam, and the United Kingdom. Supply Options: Domestic recycling of scrap and further research on deposit models to assist in exploration.

Investment Attractiveness Ranking 2020

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

US Supply Source

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

Barite

Mineral, powders

Domestic Mining (2018-2019): Some US production, which only meets a small fraction of total demand.

Secondary Production (2018-2019): None.

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

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

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

Investment Attractiveness Ranking 2020



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 <u>single</u> mining company. That company processes domestic and foreign ores. <u>Secondary Production (2018-2019):</u> 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.

<u>Supply Options:</u> Developing assessment models for new deposits, and more efficient extraction methodologies.

Investment Attractiveness Ranking 2020

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

US Supply Source

Uses: <u>Crucial</u> 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.

Cobalt

Chlorides, carbonates, oxides, metal

Domestic Mining (2018-2019): Concentrates exported for processing.

Secondary Production (2018-2019): Recycling of scrap contributes significantly to US demand.

Global Production (Last 10-15 yrs):

D.R. Congo is largest global source where China dominates refinery production.

Import Sources (2016-2019): Norway,

Canada, Japan, D.R. Congo, China, and <u>Supply Options:</u> Recycling, better geologic models to aid in exploration, new methods for increased recovery and processing.

Investment Attractiveness Ranking 2020



US Supply Source

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

Fluorspar

Metallurgical grade, acid-grade mineral

Domestic Mining (2018-2019):

Very Limited quantities for metallurgical-grade, none for acid-grade.

Secondary Production (2018-2019): None.

Global Production (Last 10-15 yrs):

More than 50% of global fluorspar production comes from China. In general, global production is stable.

Import Sources (2016-2019): Mexico, Vietnam, China, and South Africa.

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

Investment Attractiveness Ranking 2020

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

US Supply Source

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

Gallium

Metal, gallium arsenide wafers

Domestic Mining (2018-2019): None.

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

<u>Global Production (Last 10-15 yrs):</u> Refining concentrated in China.

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

<u>Supply Options:</u> 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.



US Supply Source

Uses: Crucial to the functionality of many electronic applications.

Graphite

Natural, synthetic, amorphous, flake, lump

Domestic Mining (2018-2019): None (some resources in development). Secondary Production (2018-2019):

Recycling refractory graphite and reprocessing of new scrap from gallium² arsenic based devices.

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

Investment Attractiveness Ranking 2020

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

US Supply Source

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

Lithium

Oxides, carbonates, Li-Co-dioxide, metal

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

<u>Secondary Production (2018-2019):</u> 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.

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

Investment Attractiveness Ranking 2020

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

US Supply Source

Uses: Batteries, ceramics, glass, and lubricating greases.

Manganese

Metal, aloy, ferromanganese, silcomanganese, addes, manganates and other compounds <u>Domestic Mining (2018-2019):</u> None <u>Secondary Production (2018-2019):</u>

Processing imported manganese ore mostly for steel production and minor recycling.

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

<u>Supply Options:</u> Increasing efficiency of mining and processing, discovery of highergrade deposits in the US.

Investment Attractiveness Ranking 2020

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

US Supply Source

Uses: Steel production, rechargeable lithiumion batteries, alkaline batteries and Li- $Mn-O_2$ batteries, aerospace and other transportation applications.

REE

SEG+, heavy REE mbx, axide metal

Domestic Mining (2018-2019):

The Mountain Pass Mine is an active producer and other projects are in development. All ore is exported for processing.

Secondary Production (2018-2019): Limited quantities recycled.

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

Import Sources (2016-2019): China, Estonia, Japan, and Malaysia.

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

Investment Attractiveness Ranking 2020



US Supply Source

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

<u>vrs):</u> China leads global production, but US imports most tellurium from Canada.

Import Sources (2016-2019):

Canada, China, Germany, and the Philippines.

<u>Supply Options:</u> Recovery from new sources.

Investment Attractiveness Ranking 2020

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

US Supply Source

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

Tungsten

Ammonium paratungstate, oxides, chiorides, fungstates, tungsten carbide, metal, ferrotungsten

Domestic Mining (2018-2019): None.

<u>Secondary Production (2018-</u> <u>2019):</u> Recycling, processing of imported concentrates and ore.

Global Production (Last 10-15

vrs): Has long been a crucial mineral. China leads global production.

Import Sources (2016-2019):

China, European Union countries, Bolivia, Germany, Austria, Canada, and Vietnam.

<u>Supply Options:</u> Increased domestic recycling.

Investment Attractiveness Ranking 2020

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

US Supply Source

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

Vanadium

Vanadium pentoxide, other compounds, metal, ferrovanadium, special alloys

Domestic Mining (2018-2019): Sporadic domestic production.

Secondary Production (2018-2019): Recycling.

<u>Global Production (Last 10-15</u> <u>yrs):</u> 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.

Investment Attractiveness _____Ranking 2020

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

US Supply Source

Uses: Alloying element (turbine blades for jet engines and power generating turbines), batteries, catalyst to produce chemicals.



- 9 Alaska
 8 South Australia
 7 Quebec
 6 Saskatchewan
 5 Newfounland
 4 Finland
 3 Arizona
- 2 Idaho
- 1 Nevada



EXPLORATION FOR CRITICAL MINERALS

As of September 27, 2021, there have been no fewer than: 323 BLM Notices for Critical Minerals in NV since 1981with 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.
ROWNSTONE 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
HALLIBURTON ENERGY SERVICES
HERRON DAVID
ITOR RESOURCES CORPORATION
IONEER USA CORPORATION
LITHIUM ORE CORP
ITHIUM NEVADA CORPORATION
M-I LLC
NATIONAL OILWELL VARCO
NUTRITIONAL ADDITIVES CORP
101
PURE ENERGY MINERALS LTD
BICON EXPLORER CORPORATION
STINA RESOURCES LTD
WOODS BRUCE
zenolith USA, LLC

CLAIMS IN MINING DISTRICTS WITH CRITICAL MINERALS

For what it's worth:

23,377 mining claims have been staked in mining districts with critical mineral occurrences/deposits since December of 2017.



Geothermal... Why Nevada?



- 2nd Largest Geothermal Producer in US
- Largest Area of Geothermal Potential in US
- Largest number of hot springs in the US
- 26 electrical plants, 3 utility districts, and 1 casino heating operation
- Demand largely influenced by Renewable Portfolio Standard requirements in Nevada and California



*Authorized leases are plotted by section and do not necessarily depict actual lease boundaries. Lease data as of January 20, 2022





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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.
- Increasing geothermal energy production
- Escalation in investor interest on the value of environmental, social and corporate governance (ESG)

For More Info:

- Agency Homepage: <u>minerals.nv.gov</u>
- "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

