Lithium Deposits of Nevada

Brine vs. Clay

2025 Mine Water Management Symposium

Rob Ghiglieri
Administrator

January 27, 2025

Minerals.nv.gov

Photo: Rhyolite Ridge, by Michael Darin

Nevada's Mining

>170 Years of Mining History

Current or Past Production of:

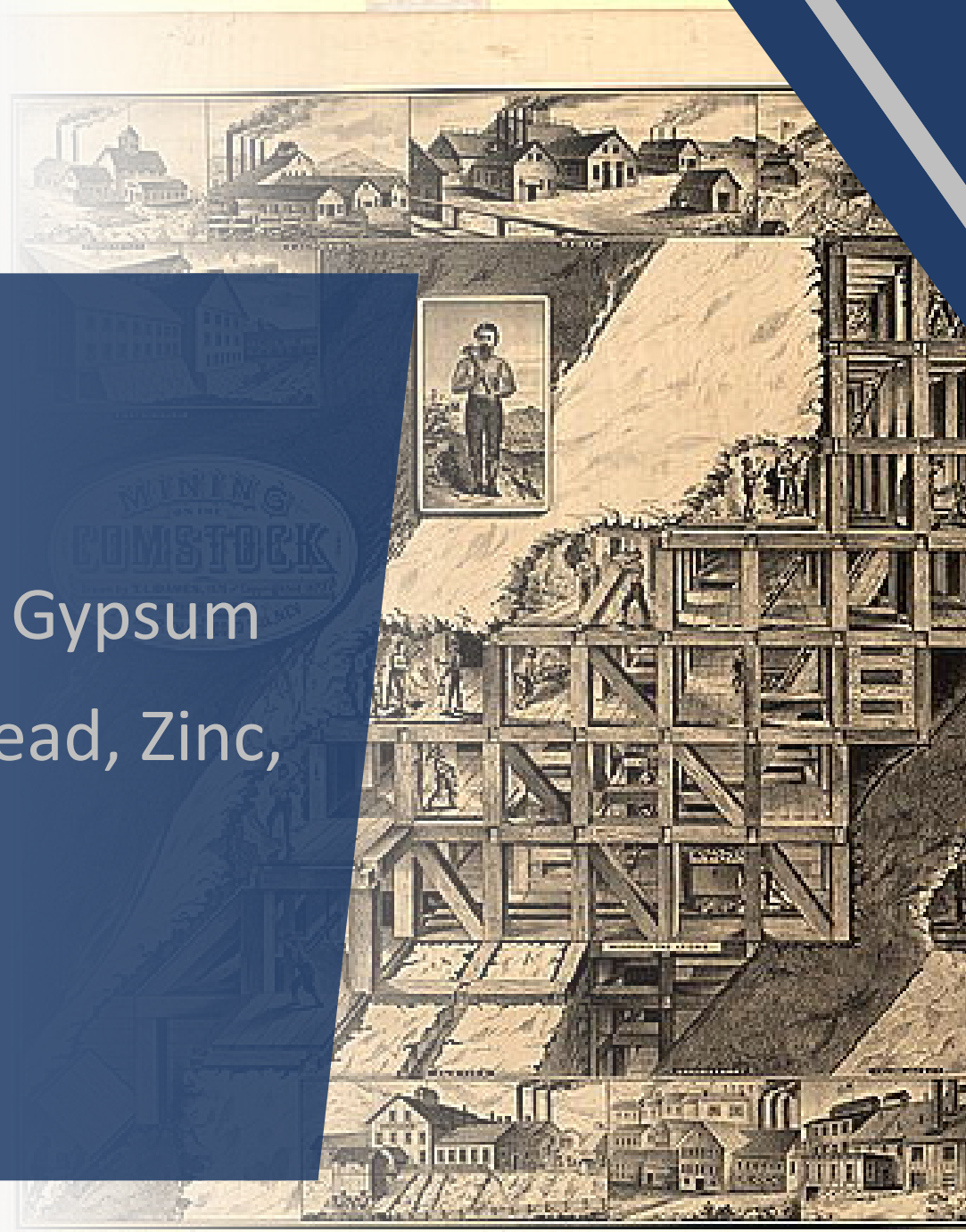
Gold, Silver, Copper, Lithium, Barite, Gypsum

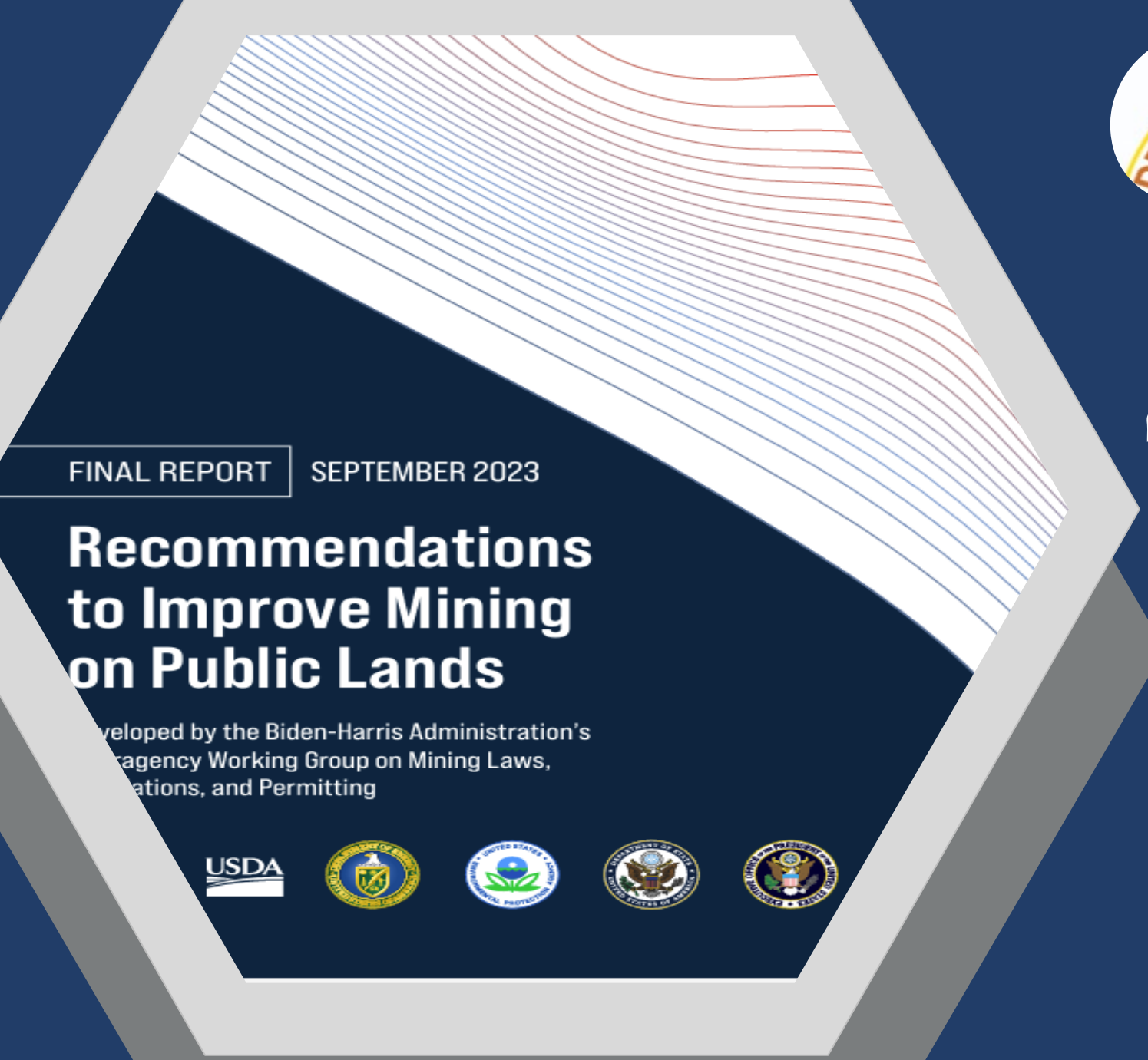
Clays, Limestone, Magnesite, Iron, Lead, Zinc,

and many more

Stable Permitting Environment

World Renown Mineral Endowment





"Update and adopt the BLM-NV permitting process model as standard operating procedure nationwide"

Nevada Commission on Mineral Resources - Division of Minerals

- NRS 513.073 requires the Division to collect and disseminate mineral production and educational materials.
- The Division and Commission are a resource to the Governor and Legislature on mineral related activities
- The Division does not pick or preference any company or project over another, rather only provide publicly available data
- The Division does not give preference or recommend any company over another in this presentation and acknowledges that this presentation has not included all exploration companies in Nevada.

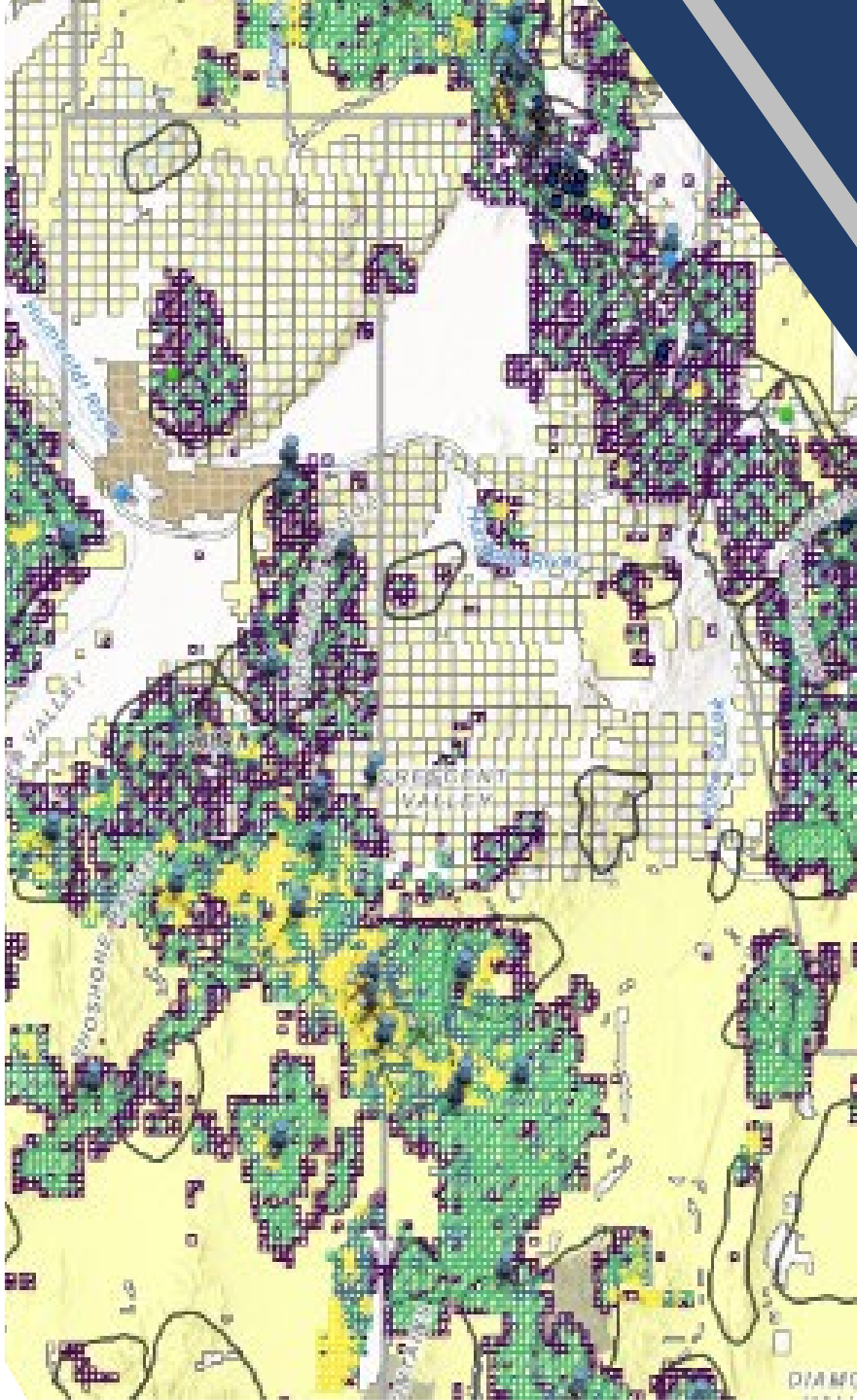
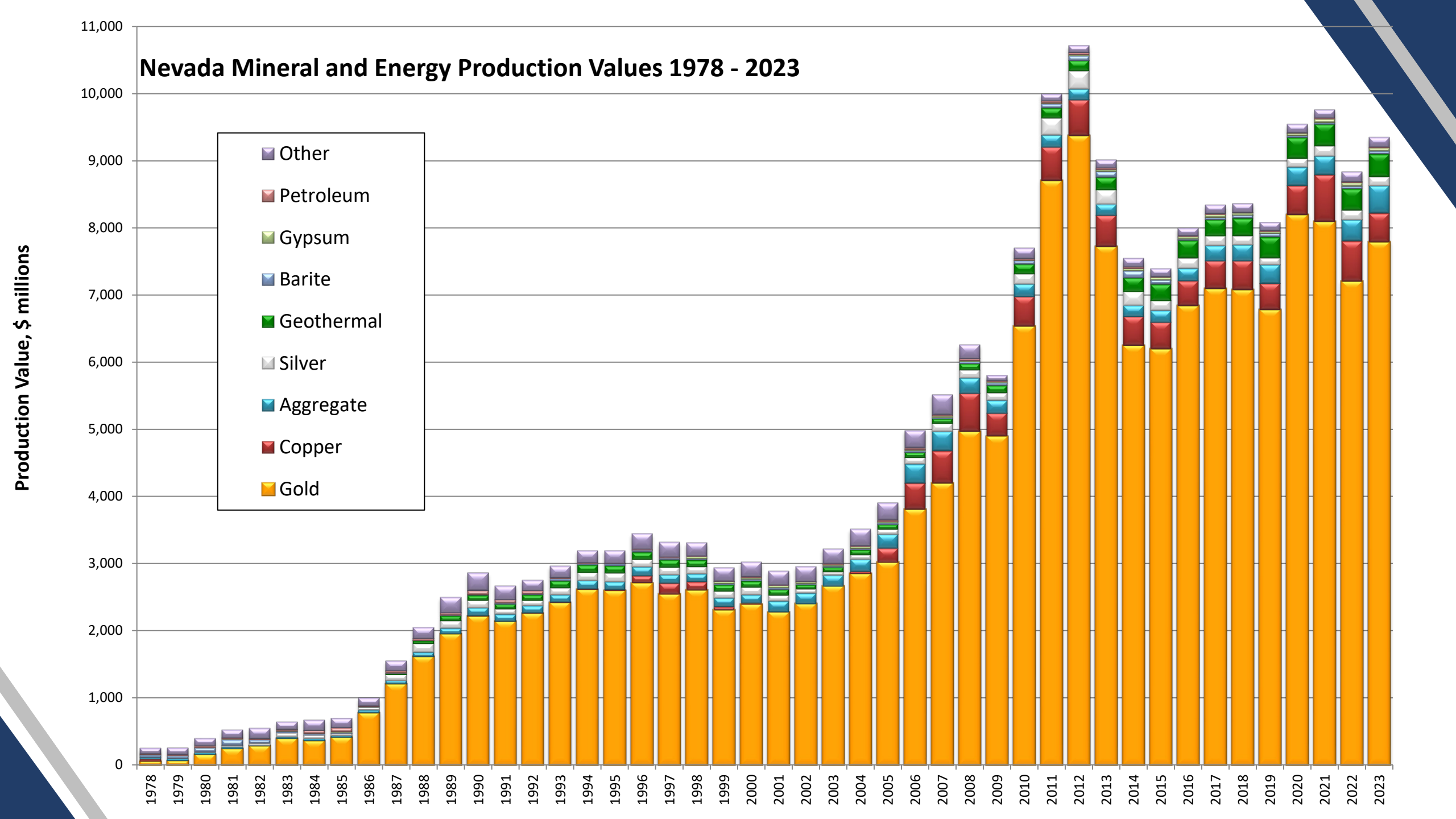


Image of NDOM Open Data Site Claims Map


Nevada Mineral and Energy Production Values 1978 - 2023
Production Value, $ millions
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Other
Petroleum
Gypsum
Barite
Geothermal
Silver
Aggregate
Copper
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2021
2022
2023

NEVADA

Lithium Capital of North America

Nevada Governor's Office of
ECONOMIC DEVELOPMENT
Empowering Success

STAGE 1 — Exploration, Extraction and Processing

COMPANIES
- Albemarle
- American Battery Technology Company
- Century Lithium Corp (Exploration)
- HeliosX/Dajin US Corp.
- Luna Lithium (Exploration)
- Ioneer
- Lilac Solutions/ Western Ceramics Company
- Lithium Americas/ Thacker Pass
- Redwood Materials (Processing)
- Rover Metals
- Schumberger/ NeoLith Energy (SLB)
- Surge Battery Metals (Exploration)
- Tonopah Lithium Corp.

STAGE 2 — Refined Chemical Manufacturing

COMPANIES
- Albemarle
- American Battery Technology Company
- Ioneer
- Lilac Solutions/ Western Ceramics Company
- Lithium Americas/ Thacker Pass
- Redwood Materials
- Tesla

STAGE 3 — Cell Components

COMPANIES
- Altairnano
- DragonFly Energy
- Entek
- Lithion Battery
- NexTech Batteries
- Redwood Materials
- Tesla
- Ultion Technologies Inc.

STAGE 4 — Battery Cells

COMPANIES
- Altairnano
- DragonFly Energy
- Entek
- K2 Energy Solutions
- Lithion Battery
- NexTech Batteries
- Panasonic
- Quantum Copper
- Tesla
- Ultion Technologies Inc.

STAGE 5 — Battery Packs

COMPANIES
- Altairnano
- DragonFly Energy
- K2 Energy Solutions
- Lithion Battery
- NexTech Batteries
- Quantum Copper
- Rechargeable Power Energy North America
- Tesla
- Ultion Technologies Inc.

STAGE 6 — EV Application

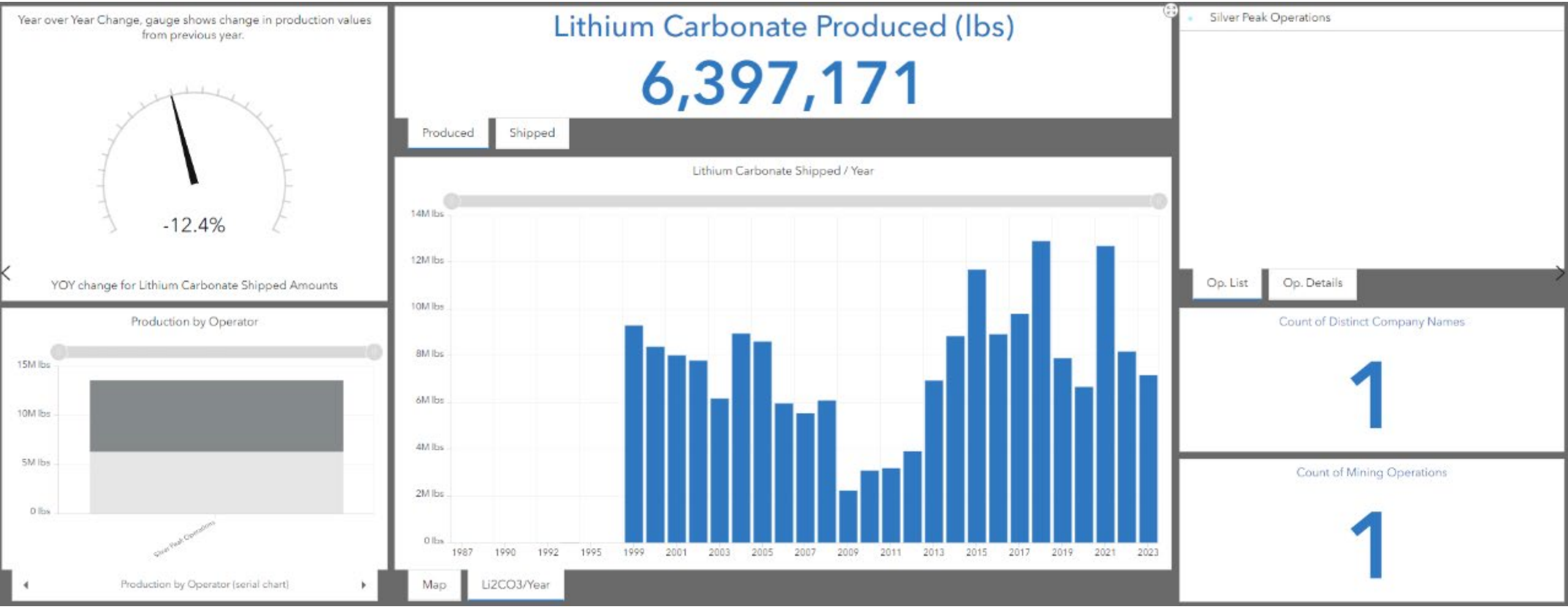
COMPANIES
- Halo
- NexTech Batteries
- Nuro
- Quantum Copper
- Tesla
- Ultion Technologies Inc.

STAGE 7 — Recycling

COMPANIES
- American Battery Technology Company
- Aqua Metals
- LiNiCO Corporation
- Redwood Materials
- Tesla
- Ultion Technologies Inc.

***As of July 2023, the companies listed are to the best of our knowledge.**
To be listed, please contact: Carli Smith: c.smith@goed.nv.gov.

Nevada's Lithium - 2023



Nevada's Lithium

Only Lithium producer in United States

Largest lithium Mine in North America under development

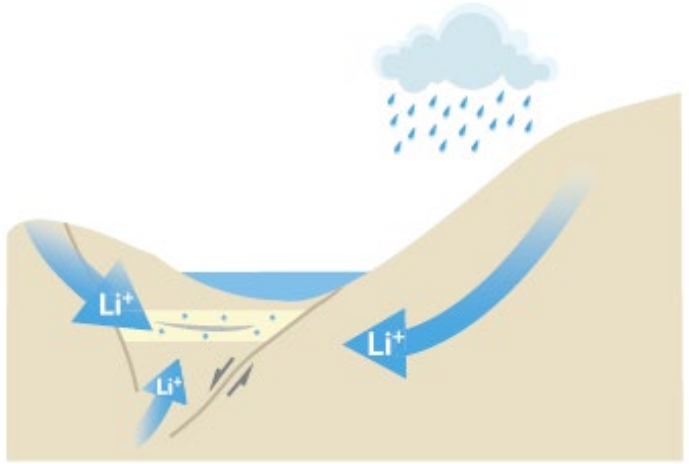
One late-stage exploration project with completed permitting

Estimated >**117 Million** Metric Tons of lithium in resources already discovered

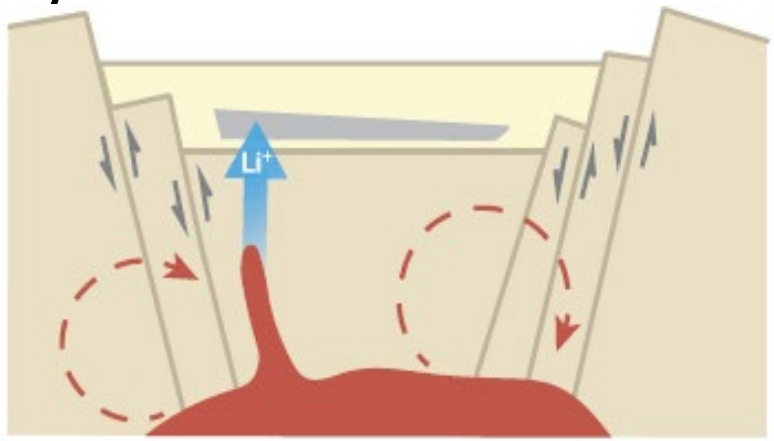
Photo provided by Lithium Americas

Lithium Deposits

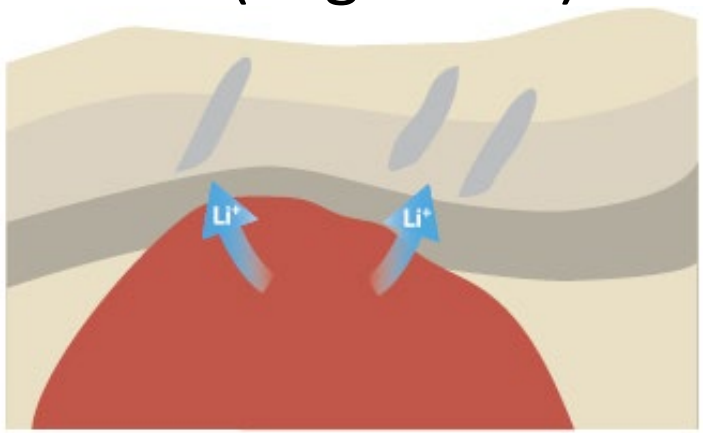
- Salar (Brine)



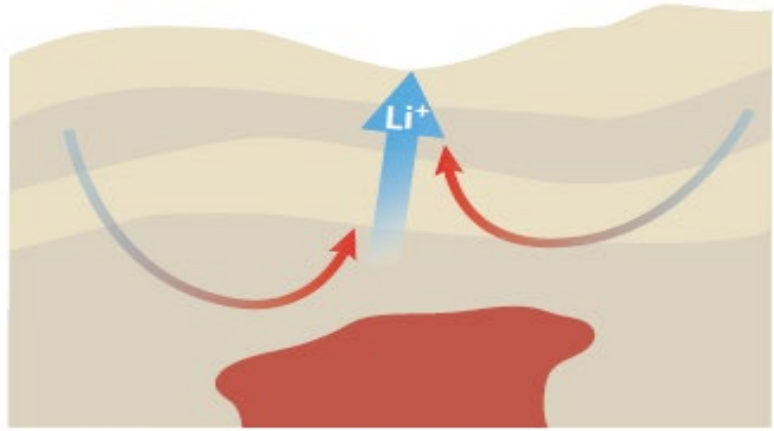
- Clay or Sediment



- Hardrock (Pegmatite)



- Geothermal/Oilfield Brines



Source: Jowitt, S.M., Henry, C.D., Crespo Mena, J., Lindsey, C.R., Darin, M.H., Saftner, D.M., Heintz, K.M., and Hershey, R.L., 2024, Lithium in Nevada—origins, extent, role in the energy transition, and implications for economic development and national security: Nevada Bureau of Mines and Geology Special Publication 40, 48 p

NEVADA DIVISION OF MINERALS

Brine Deposits

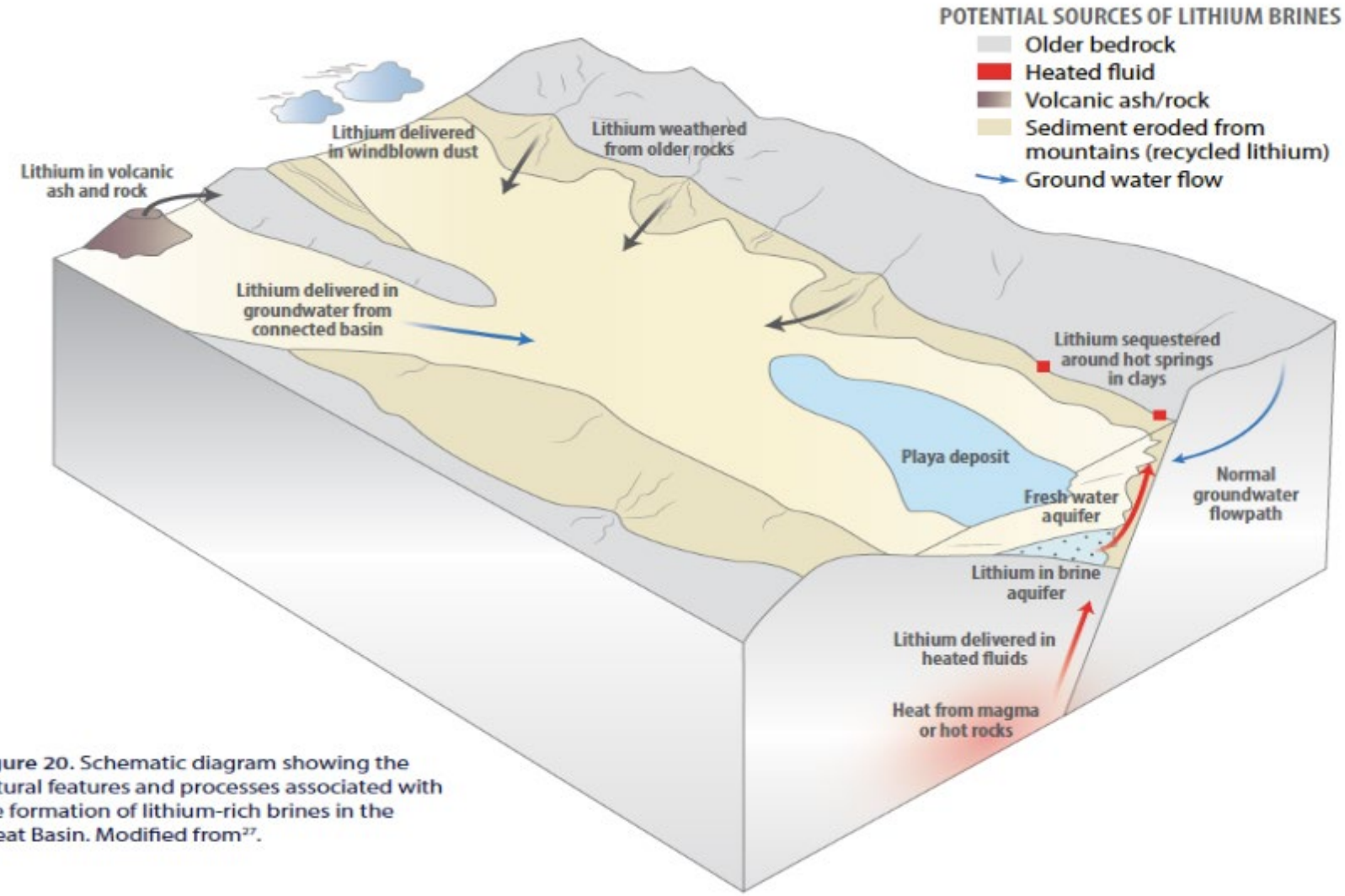


Figure 20. Schematic diagram showing the natural features and processes associated with the formation of lithium-rich brines in the Great Basin. Modified from[27].

Jowitt, S.M., Henry, C.D., Crespo Mena, J., Lindsey, C.R., Darin, M.H., Saftner, D.M., Heintz, K.M., and Hershey, R.L., 2024, Lithium in Nevada—origins, extent, role in the energy transition, and implications for economic development and national security: Nevada Bureau of Mines and Geology Special Publication 40, 48 p

NEVADA DIVISION OF MINERALS

The Challenge to Lithium Brine Exploration in Nevada

- Lithium is locatable mineral under the Mining Law
- Water belongs to the State of Nevada and the State Engineer regulates quantity and beneficial use.
- To pump and test for lithium in brine you need a water right, which is not a quick process and is subject to appeal.
- Some lithium brine projects are located on top of active oil and geothermal leases.
- NRS 534B was passed in 2018 establishing an updated path for safe exploration of lithium brine with limited water.

NEVADA DIVISION OF MINERALS

NRS 534B Dissolved Mineral Resources Exploration

- Defines a dissolve mineral exploration borehole, well, and project
- Allows for sampling of water in exploration boreholes
- DMRE approved well permits expire after 2 years, can be extended for 2 more years
- Requires a Nevada licensed water well driller to drill DMRE boreholes and wells
- Well design approval required: casing, seals, etc.
  - Very similar to those for NDWR
- Well permits not retroactive to existing MM waivers or existing permitted rights issued by NDWR
- Plugging logs signed by licensed water well driller to be submitted for all boreholes and wells

NEVADA DIVISION OF MINERALS

NRS 534B

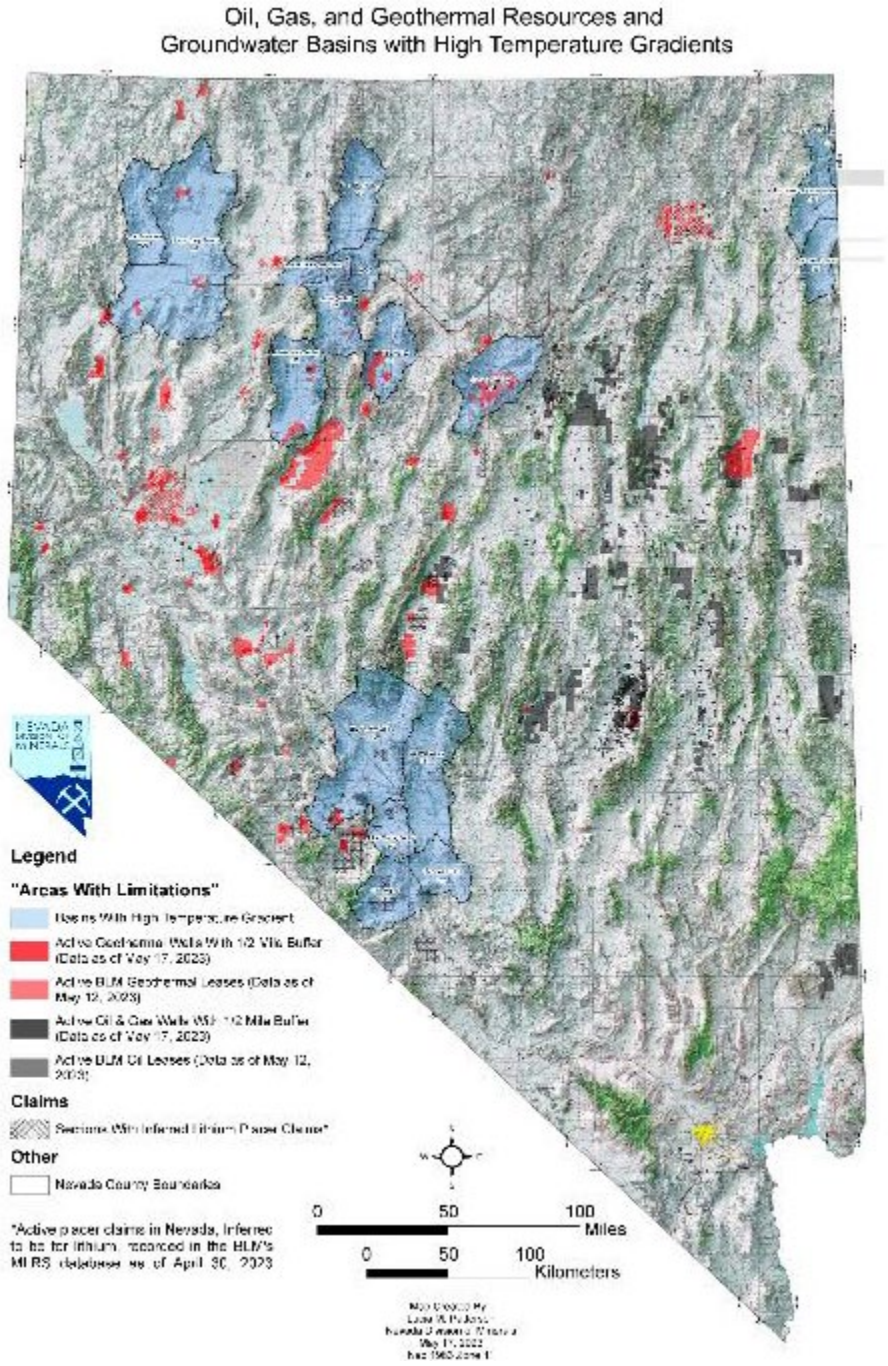
- Allows for up to 5 acre-feet of water to be pumped for testing per project (not annually)
- All permits are provided to NDWR for input before approval
- > 5 acre-feet requires a water right from NDWR
- Must comply with NRS 445A for discharges during pump tests
- Does not change the appropriation procedures in NRS/NAC 533, 534
- Reclamation bonding required
- A penalty can be assessed for a violation and for each day violation continues

NEVADA DIVISION OF MINERALS

NRS 534B

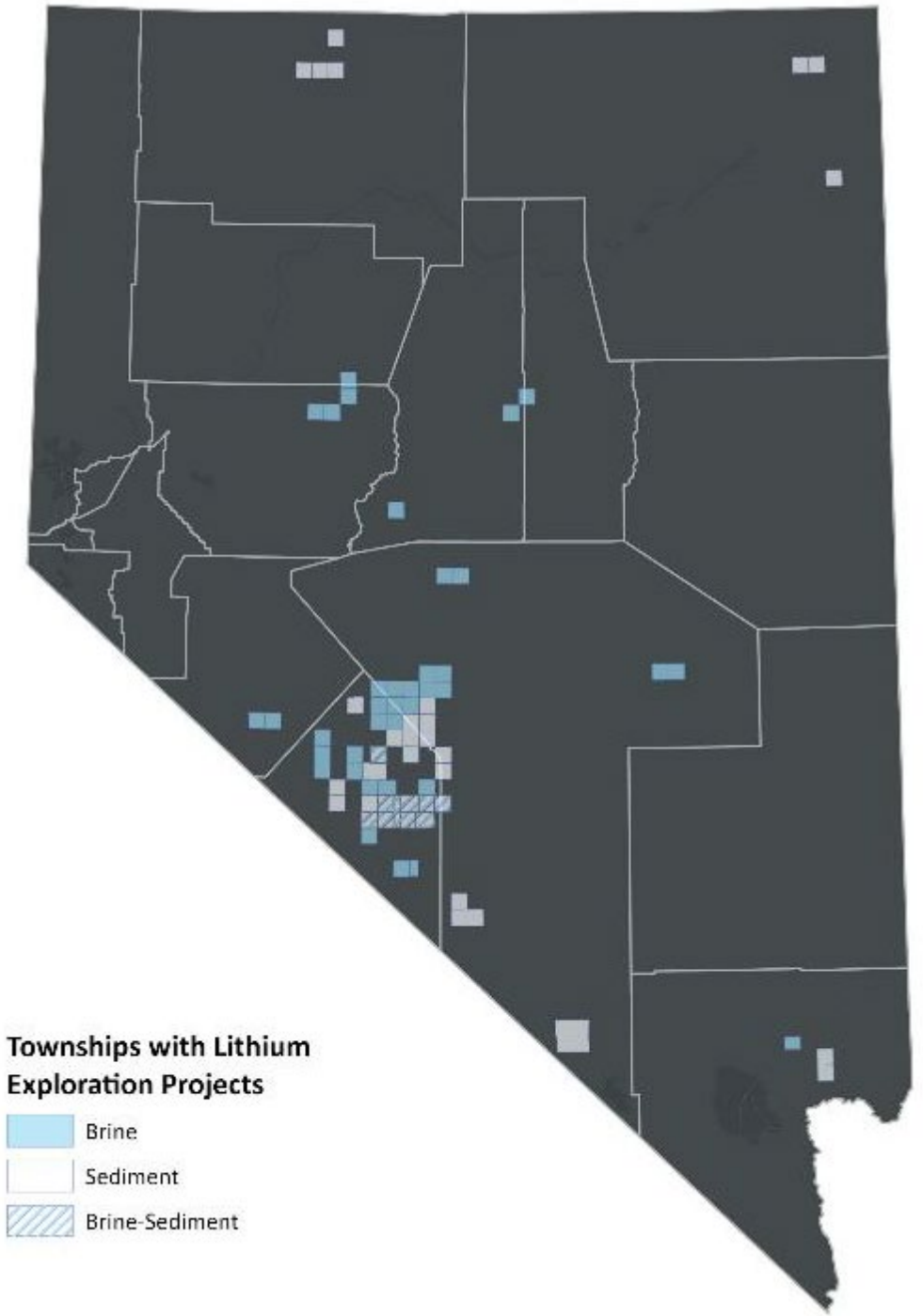
Areas of Limitations

- Regulatory mechanism for additional review to ensure proposed DMRE activity is safe and doesn't impact permitted oil, gas, and geothermal (OGG) wells and resources
- Uses map published on NDOM website depicting:
  - NDOM-permitted OGG wells
  - Federally-authorized oil, gas, and geothermal leases
  - Groundwater basins having increased thermal gradient
- Depth limitations and BOP requirements
- Monitoring of drilling mud temperatures



Nevada Exploration

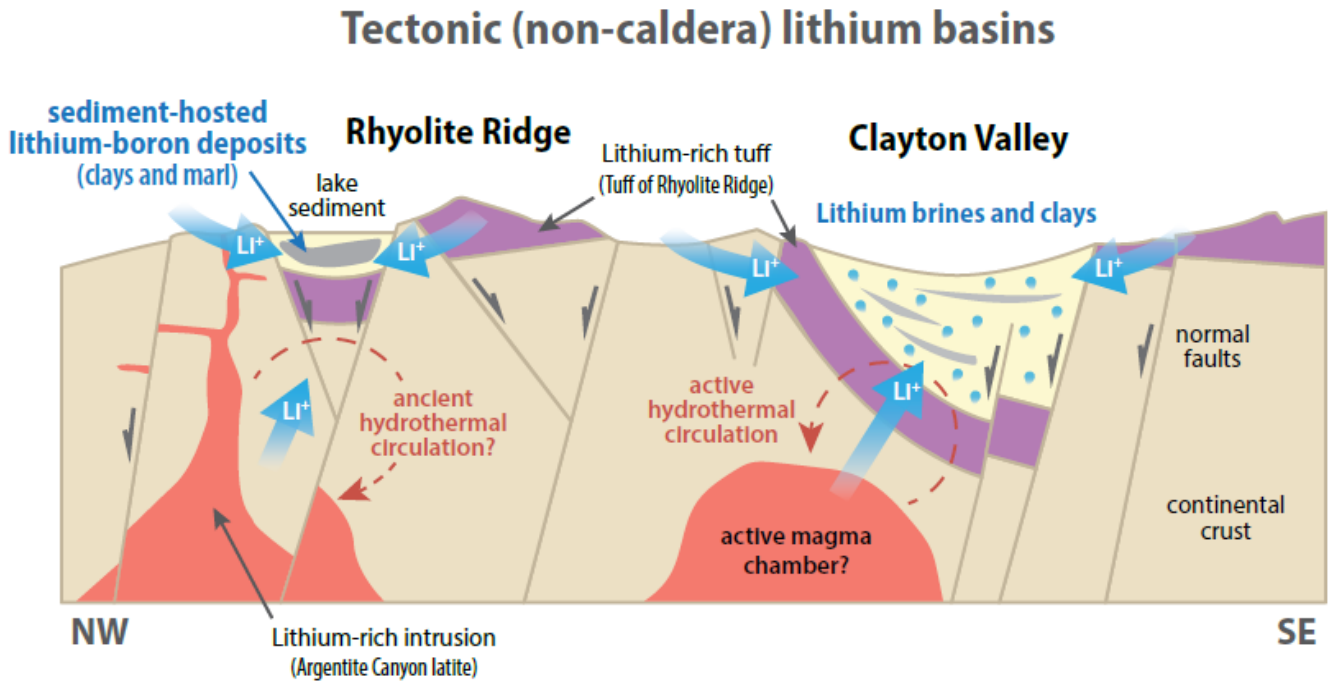
1074654 Nevada Corp
3 Pl Operating Inc
Albemarle Us Inc
Altitude Lithium Usa Corp
American Battery Technology Company
American Lithium Corp
Authium LLC
Battery Mineral Resources Nevada Inc
Belmont Nevada Inc
Bonaventure Nevada Inc
Bronco Creek Exploration Inc
Centerstone Resources LLC
Cosmo E&P Usa Inc.
Cruz Battery Metals
Cypress Holdings (Nevada) Ltd
Dome Rock Resources, LLC
Fort Cady California Corp
Geoxplor Corp.
Great Basin Resources Inc
Green Energy Resources Inc
Grid Battery Metals Usa Inc
Halo Lithium LLC
Intor Resources Corporation
Ioneer Usa Corporation
Ionic Minerals (Bonaventure
Last Basin LLC
Lithic Lithium LLC
Lithium Holdings Nevada LLC
Lithium Nevada Corp
Lithiumore Corp
Logan Resources Usa Inc
Lone Mountain Resources, LLC
Mathers Lithium Corp
Ml Nevada Corp
Morella Minerals Corporation
Needles Holdings Inc
Neolith Energy
Nevada Lithium Exploration Inc
Nevada Alaska Mining
Nevada Li Corp
Nevlith LLC
Origin Minerals Exploration, LLC
Ormat Mineral LLC
Paradigm Minerals Usa Corp
Pilot Peak, LLC (Ppl)
Playa Minerals Co
Powr Lithium Corp.
Pure Energy Minerals Ltd
Rangefront Consulting LLC
Rangefront Mining Services
Red Mountain Mining Company
Rover Metals (Usa) Inc
Rubicon Explorer Corporation
Schlumberger Technology Corporation
Scotch Creek Ventures Nevada, Inc
Sienna Resources (Us) Corp
Sierra Lithium LLC
Stone Brothers Inc.
Surge Battery Metals Usa Inc
Ultra Lithium Usa Inc
Us Energy Metals Corp
Usha Resources Ltd.
Waterleaf Minerals, LLC (WML)
WC1 Nevada Lithium
Zanskar Geothermal & Minerals, Inc

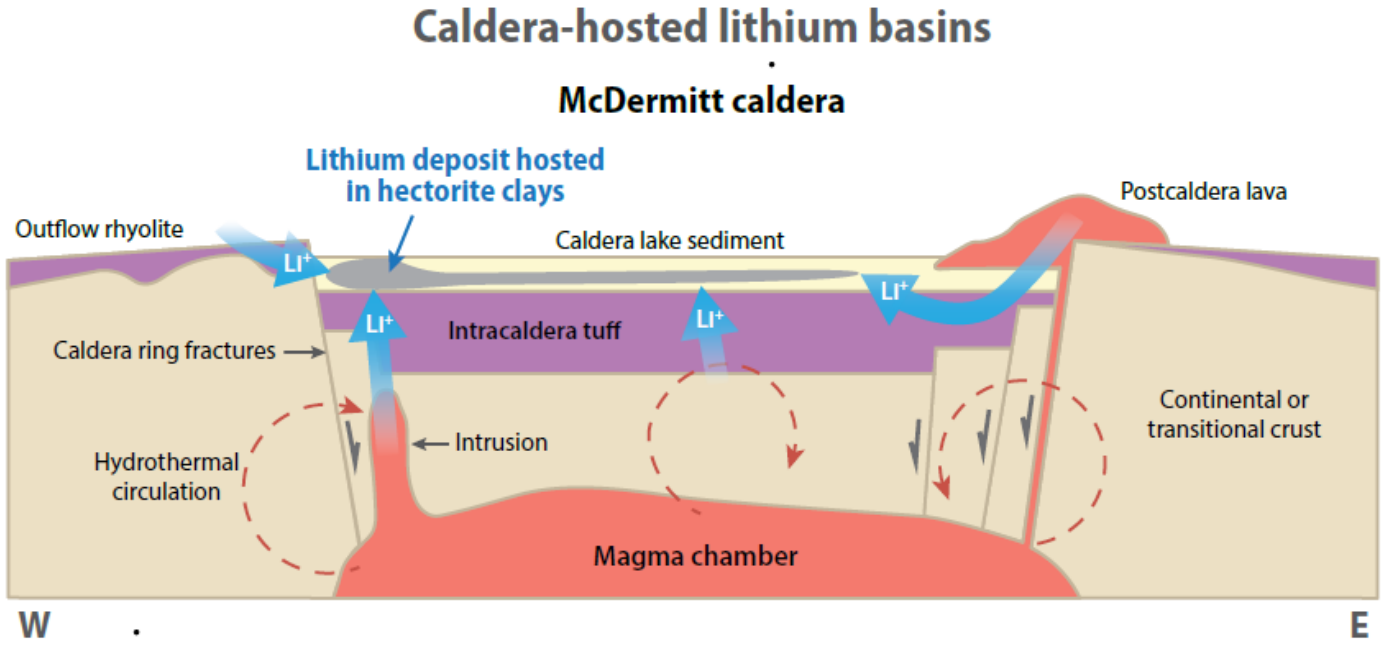


NEVADA DIVISION OF MINERALS

Source: List of companies and map locations were derived by use of the BLM's MLRS database. The Division of Mineral locations or if all companies looking for lithium were captured or if all companies listed are currently active

Nevada Clay Deposits





Source: Jowitt, S.M., Henry, C.D., Crespo Mena, J., Lindsey, C.R., Darin, M.H., Saftner, D.M., Heintz, K.M., and Hershey, R.L., 2024, Lithium in Nevada—origins, extent, role in the energy transition, and implications for economic development and national security: Nevada Bureau of Mines and Geology Special Publication 40, 48 p

NEVADA DIVISION OF MINERALS

Clay Processing Technology

Photo from Lithium Americas Website

Lithium Americas
- Sulfuric acid plant with thinking, filtration, and centrifuge to crystallization
- Onsite energy production
- Battery Grade Lithium Carbonate

Ioneer
- Sulfuric acid plant with vat leaching process then evaporation and crystallization phased process and filtering
- Onsite energy production – no grid connection

ABTC
- Selective leach extraction (SLE) and novel purification technologies

Nevada Lithium
- Borehole mining at depth

Source: https://www.ioneer.com/rhyolite-ridge-project/about-rhyolite-ridge/processing-facilities/ https://americanbatterytechnology.com/projects/tonopah-flats/ https://lithiumamericas.com/thacker-pass/mining-and-processing/default.aspx https://nevadalithium.com/

SLB's Direct Lithium Extraction (DLE)

September 10, 2024, SLB Press Release:

- Produced lithium from DLE at scale
- "The proprietary integrated solution…. …produces lithium 500 times faster than conventional methods while using only 10 percent of the land. Operating at approximately one tenth the size of a commercial-scale facility, the plant reached a verified recovery rate[1] of 96% lithium from brine."
- "The entire SLB solution, from extracting lithium from brine to converting it to lithium carbonate, takes just hours. Traditional evaporation methods can take up to 18 months and have a much lower recovery rate of 50 percent or less."
- Uses resin that selectively absorbs lithium ions while rejecting most undesired ions
- Uses less water and returns the spent brine, or the brine with a reduced lithium concentration, back to its source after the lithium is processed and separated.

Photo from SLB Press Release: https://investorcenter.slb.com/news-releases/news-release-details/slb-achieves-breakthrough-results-sustainable-lithium-production

Source: https://investorcenter.slb.com/news-releases/news-release-details/slb-achieves-breakthrough-results-sustainable-lithium-production

World's 2023 Lithium Mining

2023 Worldwide Production 180,000 Metric Tons

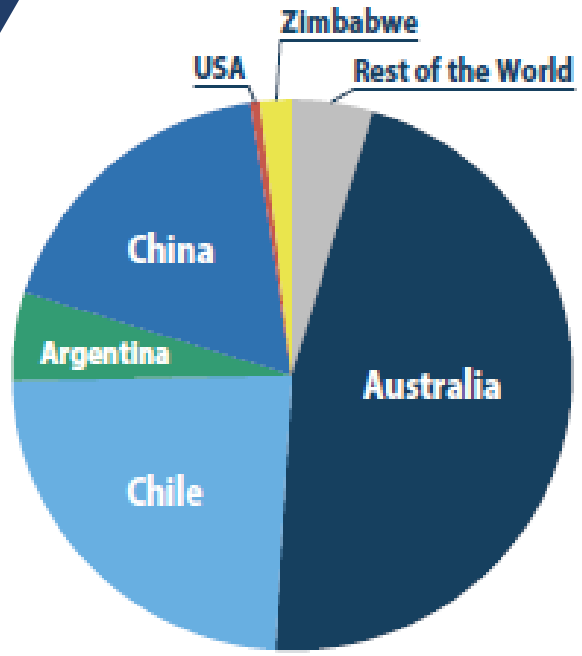
7 Australia – 86,000 metric tons - Hardrock

2 Chile – 44,000 metric tons - Brine

9 China – 33,000 metric tons – 5 Hardrock 4 Brine

2 Argentina – 9,600 metric tons - Brine

1 Nevada – 2,900 metric tons - Brine



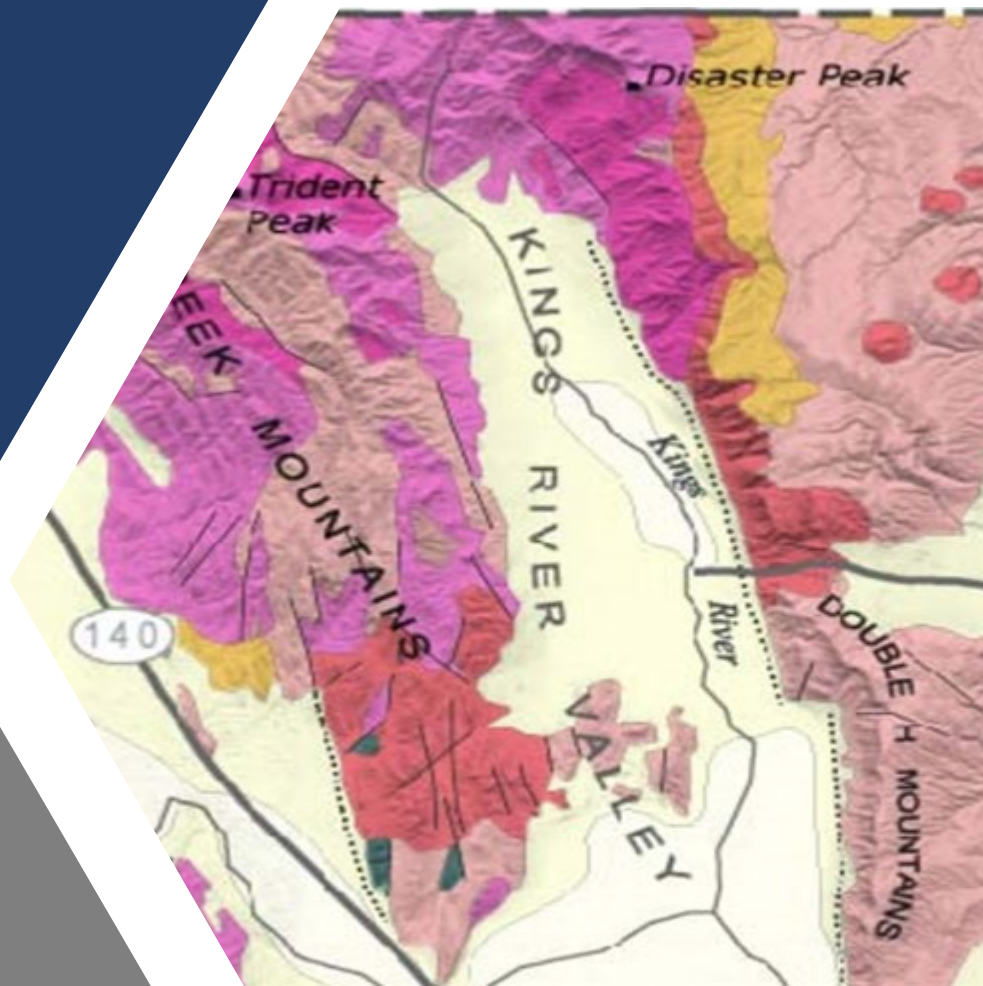
Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2024, Division of Minerals: NDOMdata.com

World Lithium Reserves

- Bolivia, 23 million tons – Primarily Brine
- Argentina, 22 million tons – Primarily Brine
- United States, 14 million tons – Various*
- Chile, 11 million tons – Primarily Brine
- Australia, 8.7 million tons – Primarily Hardrock
- China, 6.8 million tons - Various
- Germany, 3.8 million tons - Primarily Hardrock
- Canada, 3 million tons - Primarily Hardrock

*United States Estimates from continental brines, claystone, geothermal brines, hectorite, oilfield brines, and pegmatites

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2024
Map: NBMG Generalized Nevada Geologic Map



Nevada Lithium Reserves

NBMG Lithium Report, September 2024 - Table 1

- 17 individual projects
  - 14 clay/sediment
  - 3 brine
- Total Reserves
  - Clay 4.28 million tons
  - Brine 0.36 million tons
- Total Resources
  - Clay 117 million tons
  - Brine 1.52 million tons

Thacker Pass – December 2024

- 14.3 million ton reserve
  - Up to 160,000 tons a year

Rhyolite Ridge – April 2023

- 3.4 million tons
  - 22,000 tons a year

Clayton Valley (Century Lithium) – April 2024

- 1.76 million tons

Silver Peak – December 2023

- 0.36 million tons

Lithium Price was ~$10,250 per ton at the end of 2024

Sources: https://lithiumamericas.com/thacker-pass/overview/default.aspx https://rhyolite-ridge.ioneer.com/new-ioneer-mineral-resource-update/#:~:text=The%20updated%20report%2C%20conducted%20by,tonnes%20of%20boric%20acid%20 equivalent. Century Lithium - NI 43-101 TECHNICAL REPORT ON THE FEASIBILITY STUDY OF THE CLAYTON VALLEY LITHIUM PROJECT Esmeralda County, Nevada, USA https://s201.q4cdn.com/960975307/files/doc_financials/2023/q4/9aefa2f5-78dc-4015-bf20-b71aba0bb593.pdf Jowitt, S.M., Henry, C.D., Crespo Mena, J., Lindsey, C.R., Darin, M.H., Saftner, D.M., Heintz, K.M., and Hershey, R.L., 2024, Lithium in Nevada—origins, extent, role in the energy transition, and implications for economic development and national security: Nevada Bureau of Mines and Geology Special Publication 40, 48 p.

NEVADA DIVISION OF MINERALS

Nevada Companies Federal Funding and Offtake Agreements

Lithium Americas

- Offtake agreement with General Motors for 100% of production volumes from Phase 1 for 20 years, plus 38% of Phase 2 production volumes for 20 years, and a right of first offer on the remaining Phase 2 production volumes
- DOE Loan, $2.26 Billion

Ioneer

- Offtake agreements with Ford, Prime Planet Energy & Solutions (a joint venture battery company between Toyota Motor Corporation and Panasonic Corporation), and EcoPro Innovation
- DOE Loan $996 Million

ABTC

- $144 million DOE Grant for Recycling Facility

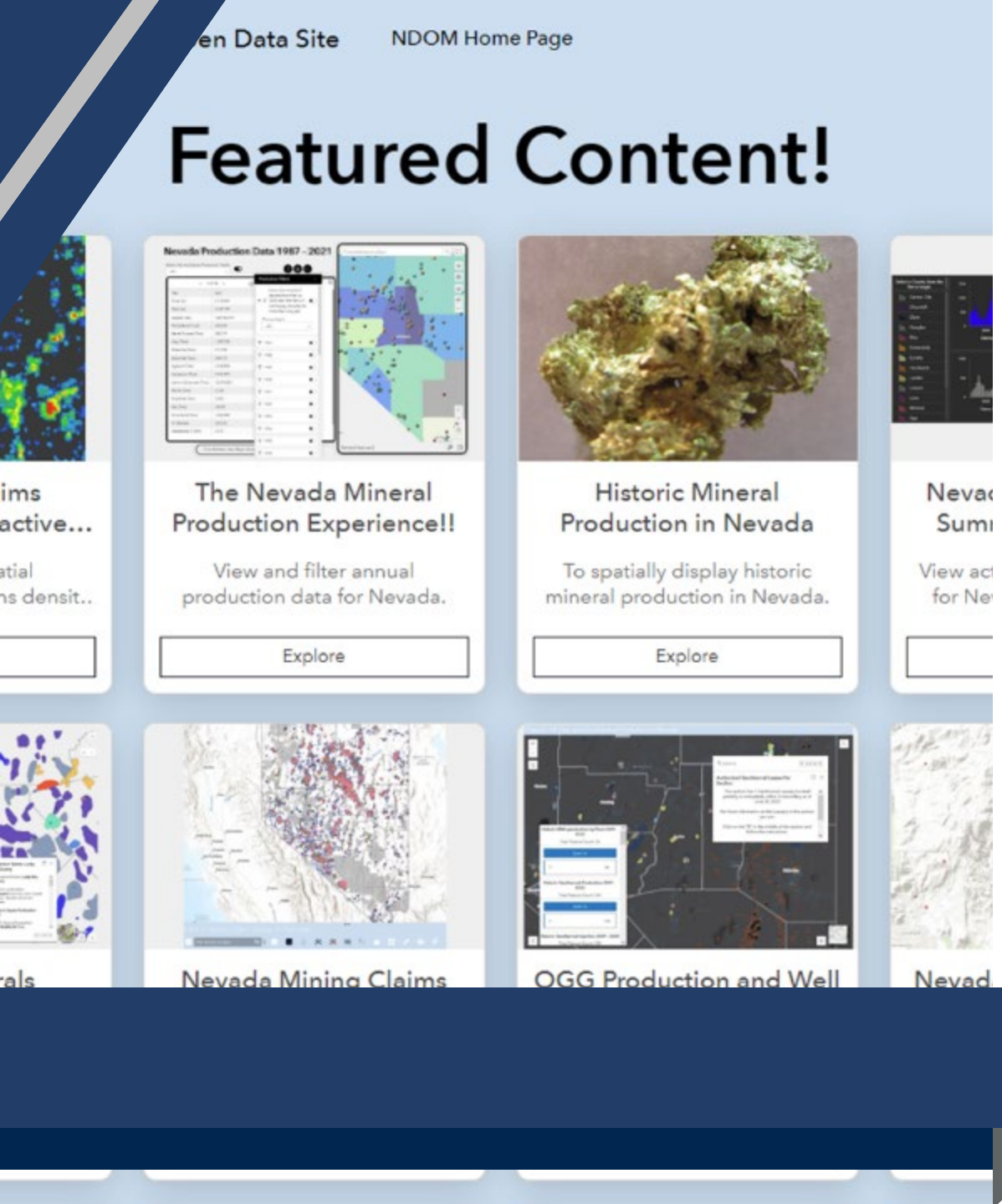
Sources: https://lithiumamericas.com/thacker-pass/overview/default.aspx https://www.reuters.com/markets/commodities/us-energy-dept-finalizes-226-billion-loan-lithium-americas-nevada-mine-2024-10-28/ https://www.energy.gov/lpo/articles/doe-announces-996-million-loan-guarantee-ioneer-rhyolite-ridge-advance-domestic

NEVADA DIVISION OF MINERALS

Brine vs. Clay

Depends on locality

- In NV, Clay has taken a significant lead
- South America, Brine looks to dominate
- Technology advances can play a big role
  - DLE for traditional brine and spent oil and gas
    - Needed for low Li concertation, ~100ppm
    - Water availability
- Co-location with Geothermal
  - Possible, but would need to be able to handle the flow of water geothermal deals with
  - Need's DLE technology



Nevada's Open Data Site

All Publicly Available Data in ONE Location

ndomdata.com

- Claims
- Notices
- Plans
- Production
- Critical Minerals
- Oil & Gas
- Geothermal
- Historic Data
- Public Land Issues
- Education and Outreach
- Links to other important sites
- FREE DOWNLOADABLE DATA

Questions

MINERALS.NV.GOV

NDOMDATA.COM