

Critical Materials: A State Perspective from Nevada

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Presentation for panel discussion on:

***Critical Minerals and Materials: Opportunities, Challenges, and Needs
for U.S. Manufacturing, Economy, and Security***

Committee on Earth Resources

National Academy of Sciences, Engineering and Medicine

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Muntean, National Academy of Sciences
Panel Discussion on Critical Materials,
5/9/2018

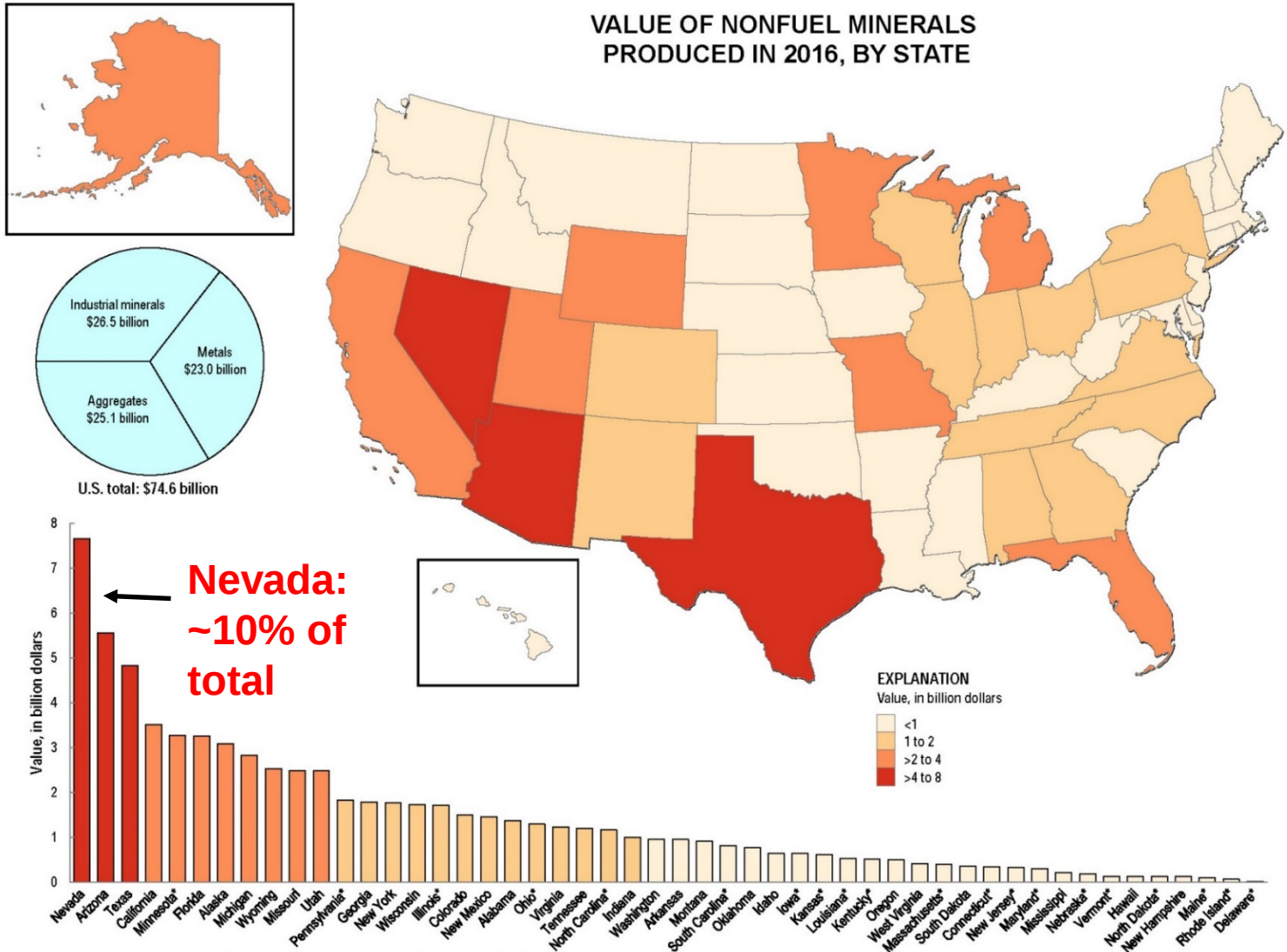


Critical Materials: A State Perspective from Nevada

Outline of Presentation

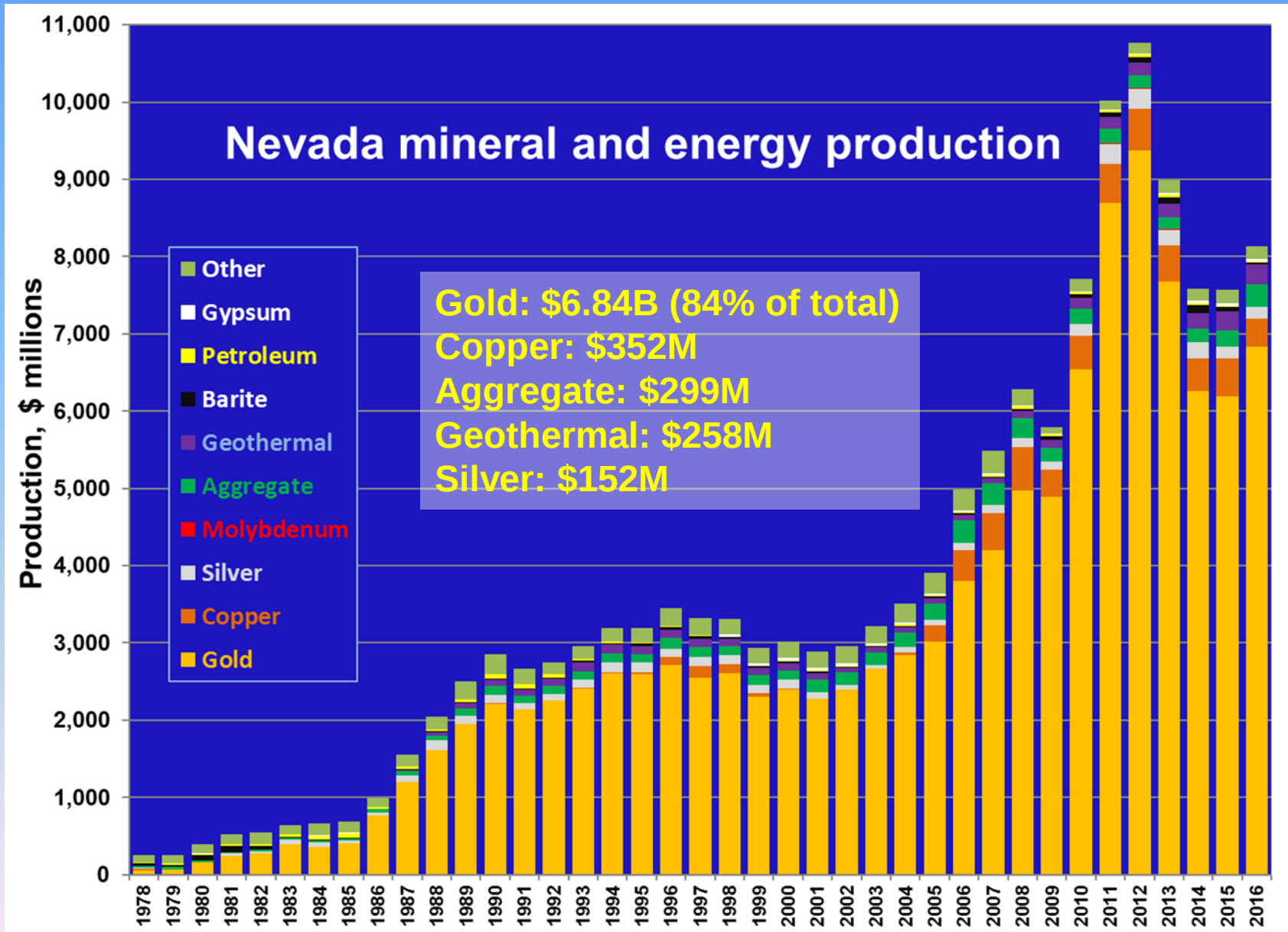
- **Brief Summary of Nevada's Mineral Industry**
- **Opportunities for Critical Materials in Nevada**
- **Challenges facing Nevada and other Western States**

Value of Domestic Production of Nonfuel Minerals in 2016: ~\$74.6B



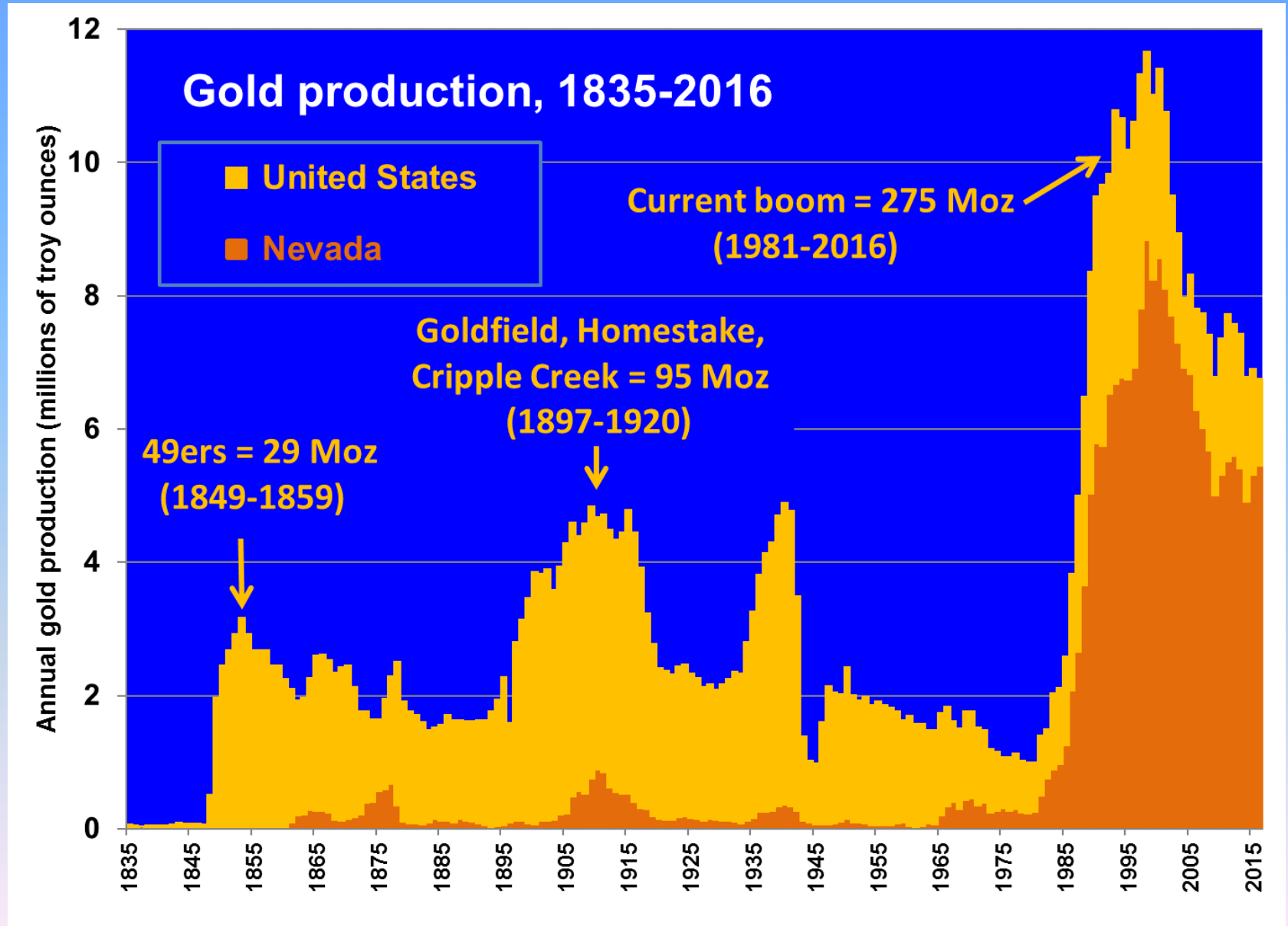
*Partial total, excludes values that must be withheld to avoid disclosing company proprietary data, which are included with "Undistributed" in table 3.

Value of Nevada's Mineral and Energy Production



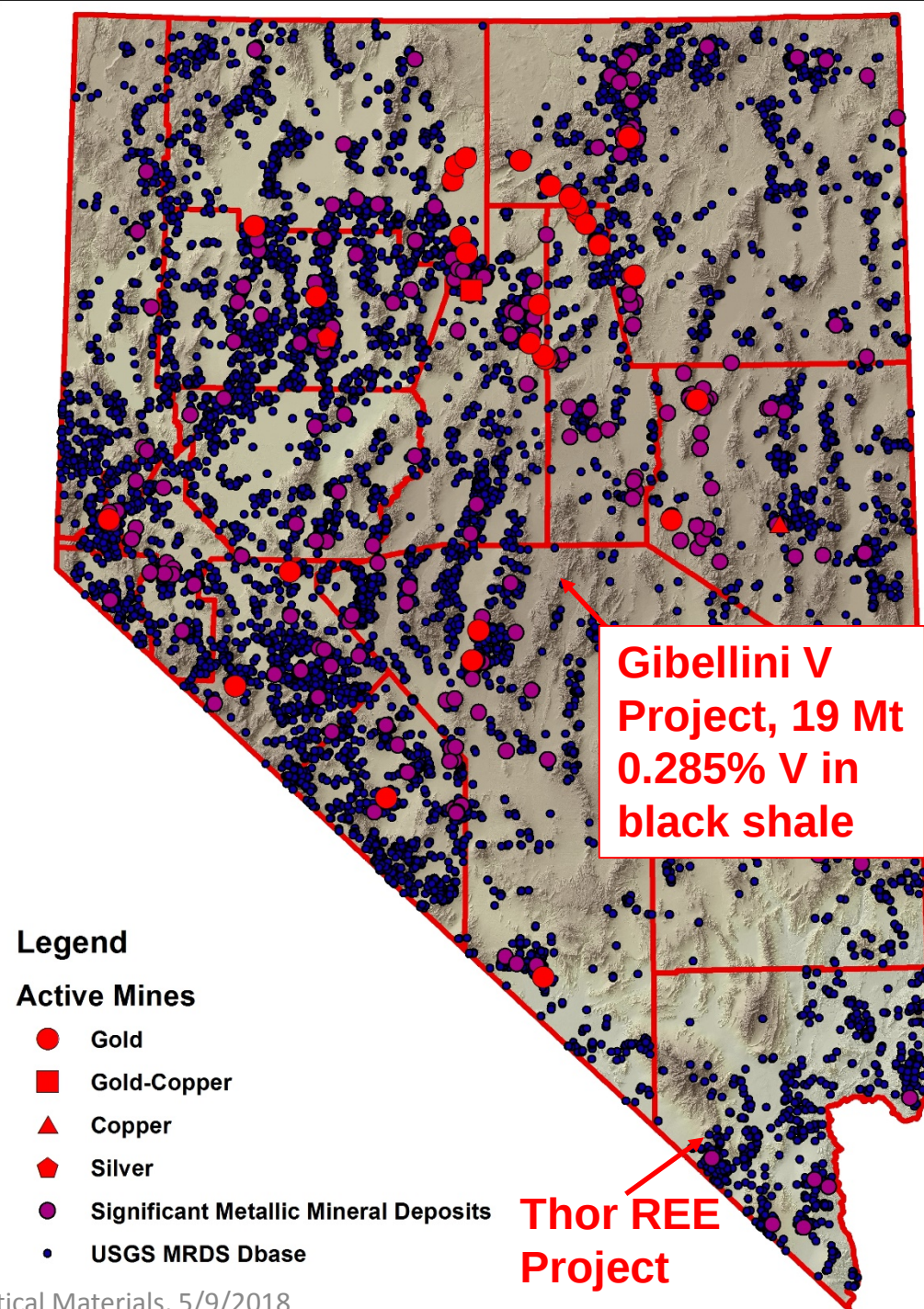
Nevada Gold Production

1998 Peak: 8.87 Moz



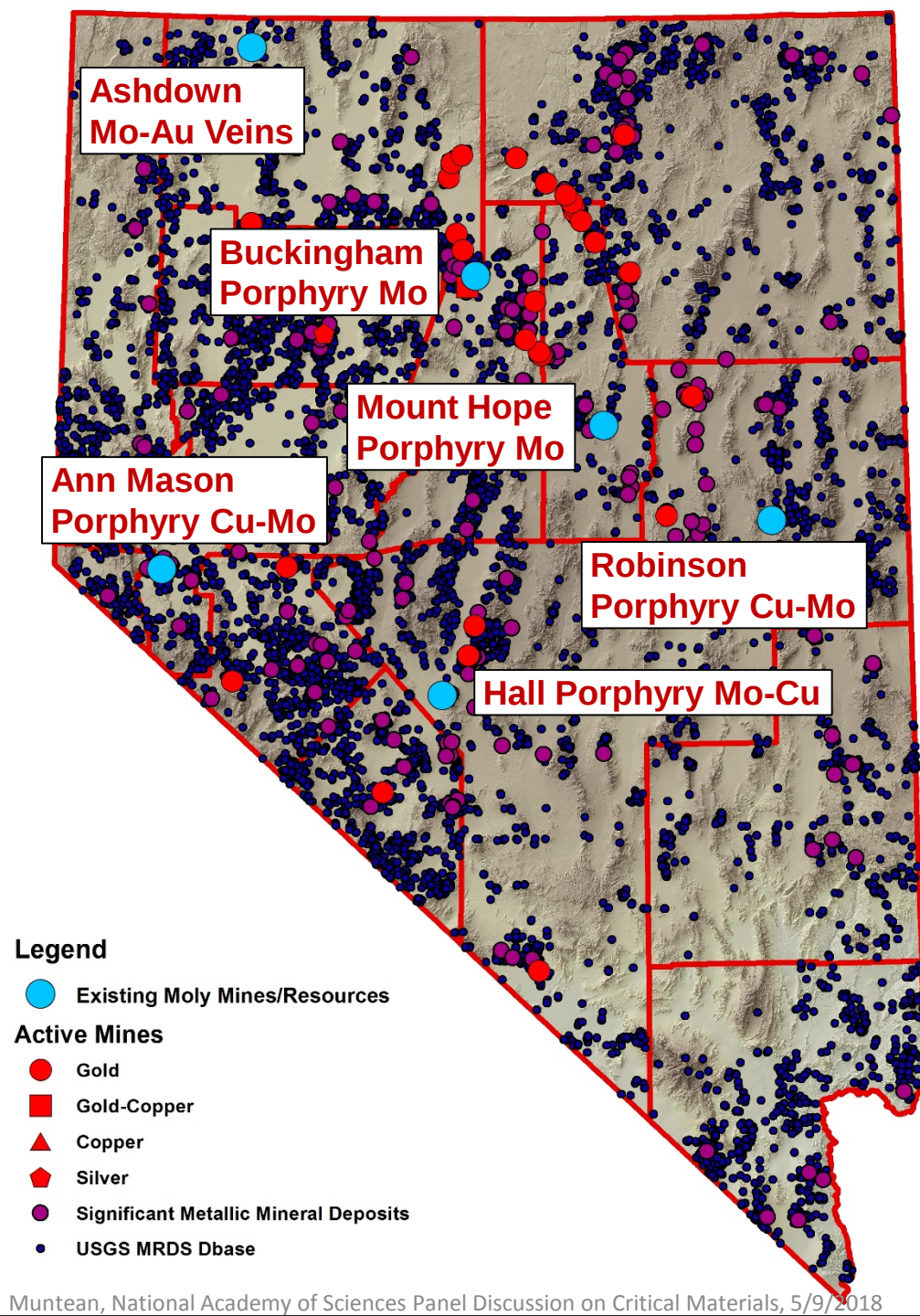
Nevada contains abundant mineral deposits and occurrences of various types

- Mainly Metals: Au, Ag, Cu, Mo, Pb, Zn, W
- “Critical” Materials: Lithium, REE project (now inactive), V project
- Are there any critical elements as possible by-products in ore currently being mined, in unmined resources, or old tails?



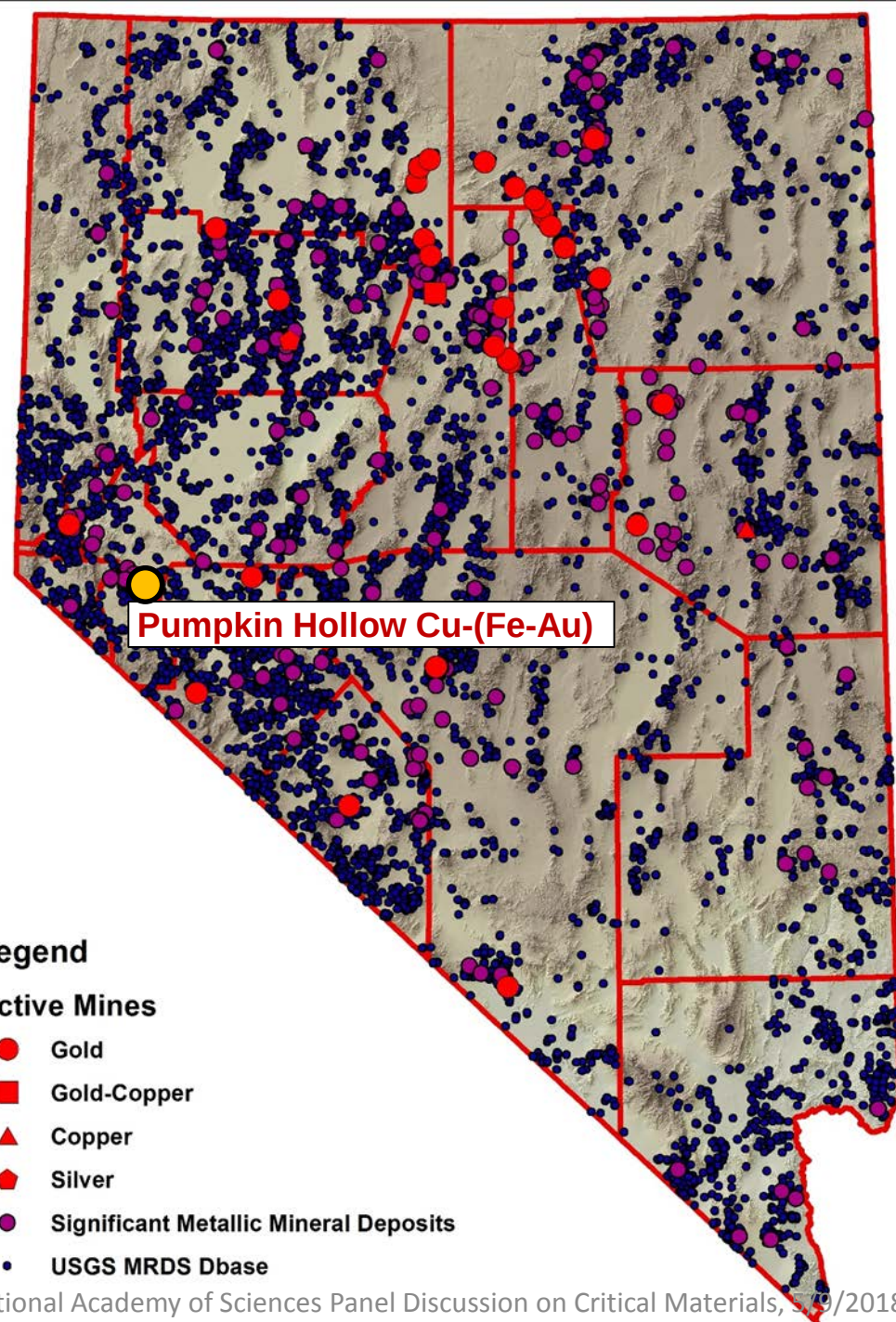
Example: Rhenium

- Almost all of the rhenium mined is from processing of molybdenite-bearing ore (porphyry and sediment-hosted Cu deposits)
- Molybdenite in porphyry Cu-Mo deposits has higher Re concentrations than molybdenite in porphyry Mo deposits
- Nevada has 5 significant Mo mines/resources (Blue Dots)
- Elevated Rhenium reported for Robinson but not recovered, not measured in the other deposits
- Mount Hope is a >billion ton resource (is there Re in the moly?)



Pumpkin Hollow

- Hybrid IOCG-Porphyry Cu deposit
- Nevada Copper continues to make rapid progress of construction of its 5,000 tons/day underground mine production planned for 2019
- Chalcopyrite is the main ore mineral; large amount of magnetite
- Used as a case history for UNR MS thesis (Yano, 2012) to look at concentrations of critical element in sulfides and magnetite



Pumpkin Hollow

Case Study of Concentrations of Co, Te, In, Se, and Ga in Sulfides and Magnetite

- Co – occurs in pyrite (up to 7800 ppm), pyrrhotite (~400-800 ppm), and magnetite (~3-10 ppm)
- Te – occurs in chalcopyrite (~7-23 ppm), pyrite (up to 18 ppm), and pyrrhotite (~10-16 ppm)
- In – occurs in chalcopyrite (~3-33 ppm), pyrite (up to 18 ppm), pyrrhotite (up to 10 ppm), and magnetite (up to 3 ppm).
- Se – occurs in pyrrhotite (~65-430 ppm), chalcopyrite (~40-300 ppm), and pyrite (~40-200 ppm)
- Ga – occurs in magnetite (~10-45 ppm) and pyrrhotite (~2-4 ppm)

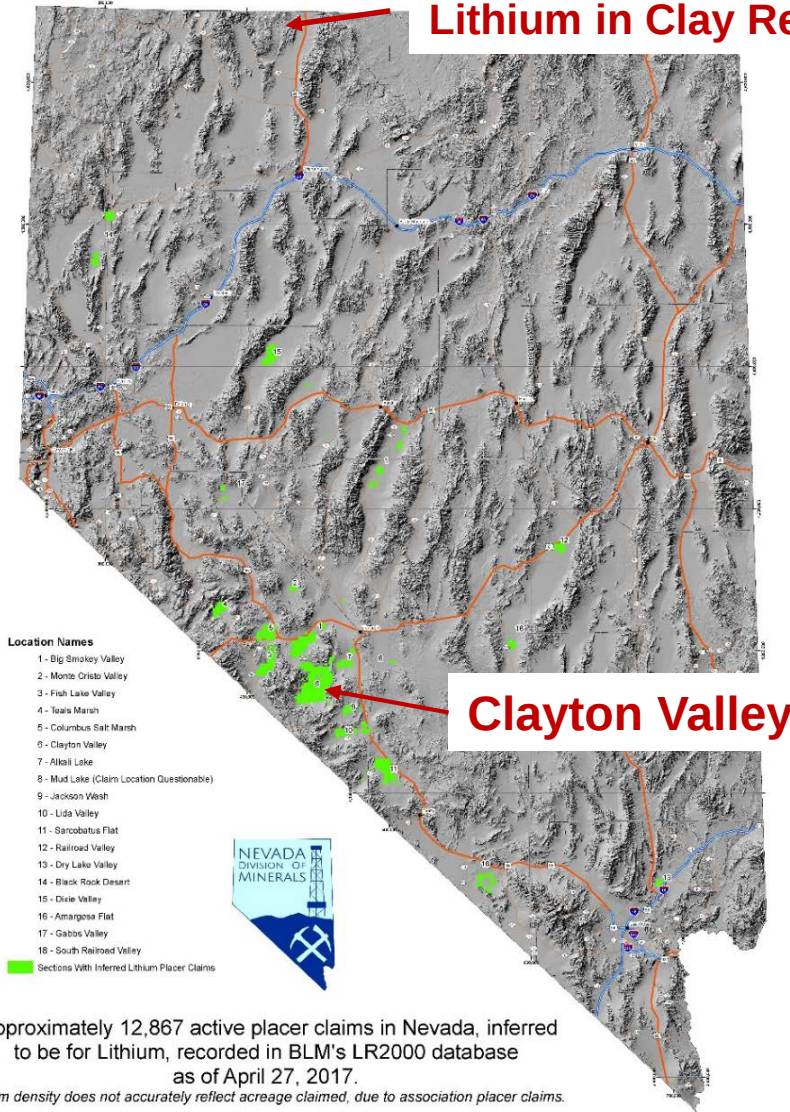
Yano, 2012 UNR MS thesis, Analyses were done using LA-ICPMS at USGS Labs in Lakewood, CO

Not Just Gold: Lithium Exploration Boom

Just over half of the 19,040 new claims staked in 2016 were for Lithium

Inferred Active Lithium Placer Claims in Nevada

Map Produced by: Lucia M. Patterson



Lithium in Clay Resource in Moat Sediments of McDermitt Caldera



Albemarle Corp.'s Lithium Brine Operation in Clayton Valley, Nevada

Challenges: Withdrawal of Lands to Mineral Entry

Lithium in Clay Resource in Moat Sediments of McDermitt Caldera

Current and Proposed Withdrawals as of 2016

Legend



70% is Military, Wilderness, and Wilderness Study Areas

Challenges: Withdrawal of Lands to Mineral Entry

Land Area Totals (through 2016; Inclusive of proposed withdrawals (including SFAs – Pending EIS)

As a percentage of the entire state:

Year	Acres	Percent of Nevada	
1930	132,247	0.19%	
1940	5,460,598	7.77%	
1950	5,861,114	8.34%	
1960	5,951,860	8.47%	
1970	6,672,218	9.50%	←FLPMA
1980	11,767,565	16.75%	←Wilderness
1990	12,701,336	18.08%	
2000	14,299,822	20.35%	
2010	14,848,842	21.13%	
2016	15,610,982	22.22%	←SFAs
2018	19,729,022	28.08%	

Some Topics for Further Discussion

- 1. Is there a need to catalog critical materials on Federal lands, not just primary ores of critical materials but whether critical materials can be by-products of ores of non-critical materials?**
- 2. Metallurgical studies are needed to better understand whether trace elements can be economically extracted from primary ore minerals. For example, can cobalt realistically ever be economically extracted from pyrite or chalcopyrite, and if so what types of concentrations are necessary?**
- 3. What is critical now, may not have been in the past or may not be in the future. Thus, mineral assessments of federal lands considered for closure to mineral entry are only snapshots and should not be considered the final word.**