Tracing Critical Minerals Genealogies through Arizona's Emerging Helium Boom

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Introduction

In 2018 the U.S. Department of Interior, for the first time, published an official list of minerals deemed "critical" to national security and economic development. Alongside cobalt, uranium, and lithium, helium earned a place as the only gas included on this list. Helium is the second most abundant element in the universe, but one of the rarest on Earth. Yet, helium is an essential resource for a range of future-facing industries, including clean energy, space exploration, and superconducting. Aside from commercial uses, more than 400 research centers in the U.S. depend on helium to run various experiments, and thousands of labs use instruments such as spectrometers, superconductors, and quantum computing equipment, that run on helium. Global helium shortages in 2011-2014 and, most recently in 2018, have brought increasing urgency to expand helium sources in the U.S. Gas extraction companies are responding to this call by prospecting for new helium reserves, with an intense focus on Northeast Arizona's Holbrook Basin. Residents of the Holbrook Basin are now coming to terms with what a nascent helium boom may bring to the region.

In our presentation today, we argue that Arizona's emerging relationship with helium extraction must be considered within a much longer pattern of what Traci Voyles (2015) refers to as "wastelanding" in the American West. Uranium mining in Northeast Arizona in the 1950s was similarly rationalized by a drive for nuclear weapons and energy development in the atomic age. Helium is also socio-politically bound to the explosive growth, and equally sudden decline, of coal mining in Northeast Arizona. In our work, we have theorized these legacies and their shared

imperatives through a conceptual lens of "critical mineral genealogies" in order to explore and clarify new temporal relationships in the study of critical minerals. We illustrate the usefulness of this concept in the remainder of our presentation today.

Arizona's Helium Boom

The federal government has maintained near complete control over the U.S. helium market for nearly a century due to its strategic economic and military importance, couched as "national security"—from keeping afloat a fleet of WWI airships to launching the cold-war space race. The Mineral Leasing Act of 1920 excluded private industry from extracting helium from federal lands. The Helium Act of 1925 then tasked the Bureau of Mines—later called the Bureau of Land Management—with securing helium-rich gas fields. The Helium Act also led to the establishment of the Federal Helium Reserve in 1929. Growing commercial demand in the 1970s and 1980s again shifted the helium regulatory landscape. To promote a private helium extraction industry, Congress passed the Helium Privatization Act in 1996, and the Helium Stewardship Act in 2013, which allowed government agencies to purchase helium from nongovernmental producers. These acts also set in motion plans to close the Federal Helium Reserve to all but federal clients by the end of this year. In addition to global market disruptions, traditional U.S. helium sources are in a state of steady decline.

Helium is historically recovered as a byproduct of conventional natural gas extraction. Shale gas, which now accounts for nearly 70% of total U.S. natural gas production, contains no helium, as its molecules are small enough to escape from shale rock formation. The shift from conventional drilling to shale gas extraction has contributed to a precipitous drop in helium recovered from natural gas. The profound consequences of long-term helium shortages ultimately resulted in helium being listed as a critical mineral in 2018, which set the stage for aggressive privatization measures. The 2019 Conservation, Management, and Recreation Act, as well as recent changes to expedite the Bureau of Land Management's environmental impact assessment process, loosened federal gas leasing terms to encourage helium extraction, particularly in Western states along Colorado Plateau.

Compared to its neighboring states of New Mexico, Colorado, and Utah—all of which claim significant hydrocarbon reserves—Arizona is not generally known for its oil and natural gas industry. Of more than 1,200 wells drilled in Arizona over the decades, 90% have resulted in

dry holes. However, Northeast Arizona's Holbrook Basin, a low-lying stretch of plains located along the southern border of the Native American Navajo Nation, is rich in non-hydrocarbon gas deposits. Helium was first discovered in the Holbrook Basin in 1950 while prospecting for oil near what is today Petrified Forest National Park. While declining production later closed these fields, the more than 700 million cubic feet of grade-A helium produced in those years have captured the helium industry's imagination, as well as state interests, ever since. Beginning in 2014, several gas extraction operators seeking to capitalize on federal privatization plans returned to the Holbrook Basin in search of commercial helium sources. These operators—largely small entities spun off by drillers in the stalling shale gas industry—rapidly acquired hundreds of thousands of acres of mineral rights on state, federal, private, and tribal lands. The Arizona Oil and Gas Conservation Commission began issuing permits for exploratory wells in 2016, and the new helium boom was born. As one industry representative told us, "We literally wrote our first royalty check for helium in Arizona in 40 years."

The helium boom has unleashed significant unease among residents in the Holbrook Basin. Permits suggest helium will be extracted at depths proximal to the Coconino aquifer, an important source for drinking water and agriculture in one of the most arid geographies of the U.S. These uncertainties are amplified by lack of clarity on acid-stimulation drilling techniques employed by the helium industry, leading some to believe that hydraulic fracturing will come to Arizona. Anxieties additionally focus on the state's capacity to manage a helium boom. Regulatory agencies have incentivized operators through rapidly approved aquifer protection permits, well-spacing exemptions, and by allowing companies to redact drilling data from public records. Furthermore, the Arizona Oil and Gas Conservation Commission consists of only five volunteer commissioners and a single staff person tasked with reviewing and enforcing oil and gas permits. The Arizona Geological Survey, historically a resource for mining-related expertise across these agencies, was largely defunded in 2016, leaving industry as the primary generator of new scientific information driving permit approvals and new oversight policies.

Critical Mineral Genealogies in the Holbrook Basin

The rise and fall of uranium and coal mining in Arizona underscores the political, economic, and environmental perils of another under-regulated resource boom in Northeast Arizona. Under the aegis of the Atomic Energy Commission, to spur weapons development and

the nuclear energy industry, “Yellowcake towns” for processing uranium sprang up across Northeast Arizona in the 1950s and the Navajo Nation accounted for a majority of uranium mines. However, due to the prioritization of uranium as critical to national security concerns, uranium mining companies faced very little oversight in immediate or long-term planning for waste management and environmental contamination. Culturally, the Navajo understood uranium as a dangerous mineral best left in the ground, but were persuaded by promises of economic development, especially the lure of well-paying jobs that allowed Navajo workers to remain closer to their families. Uranium mining was also viewed as a patriotic duty; one that would gain the Navajo and other uranium communities respect and recognition from the federal government. These nationalist imperatives undermined local public health officials, who were pressured to suppress their research on the deleterious effects of inhaled radon particles. Because the Navajo had few mechanisms to engage with political power dynamics rooted in structural racism and systemic land dispossession, Navajo miners and their families suffered from unprecedented levels of cancer and other illnesses; tragedies that were compounded by loss of trust in their local environment as radiation seeped into local waterways and soils, creating a legacy of environmental health issues that have yet to be systematically addressed. Over 500 uranium mines remain unaddressed across the Navajo Nation to this day.

The nascent helium boom also has under-examined parallels with coal mining in Northeast Arizona. Coal reserves, discovered on Black Mesa in the 1960s, were promoted as critical to economic development in the sunbelt cities, such as Phoenix and Las Vegas. The Navajo government entered into agreements with energy companies to explore, strip mine, and export coal. This new industry provided revenue for the Navajo, allowing them to expand tribal agencies and services for its members while enmeshing them deeper into capital markets. However, the effects of coal mining and coal-fired power plants have left a similar environmental and political legacy to that of uranium in Northeast Arizona. Lack of local legal expertise and political power resulted in unfavorable leases and massive aquifer withdrawals. With the sudden collapse of the coal industry and closure of Navajo Generating Station in Page, as well as the Kayenta Coal Mine in 2019, Northeast Arizona faces the prospects of widespread unemployment. Energy companies have faced criticism for making decisions solely from an economic view, with little recognition of their local economic or environmental obligation to

coal communities, leading to "epistemic erasure" of the political claims of the Navajo. Equally troubling, some 40% of Navajo still lack access to electricity in their homes.

As these histories of uranium and coal mining demonstrate, Arizona's existence is largely premised on making the American West economically productive and supporting national security imperatives. However, in the spaces in which these imperatives play out, communities have limited capacity to fight for representation and restitution. In our research, we have observed that lessons from past waves of extraction are largely unaccounted for in Arizona's emerging helium boom. Besides the obvious culprits of resource capitalism, we suggest that this is due to several factors. There are strong disconnects in the scales of governance between uranium and coal, which are primarily managed at, and therefore viewed as, federal and tribal levels, compared to the helium industry's management by state and local governments. There is little communication between the two systems of governance, and no recognition by local regulators of any overlapping concerns. Within the state, compartmentalization in gas versus minerals industry oversight have also created barriers to sharing knowledge that could otherwise build cross-awareness of uranium and coal mining legacies. Arizona's helium boom is also defined by low public literacy of what is involved in gas extraction, despite its long relationship with other forms of mining. Finally, residents in the Holbrook Basin lack capacity to engage with the complexities of helium extraction due to rurality and poverty, resulting in a lack of political power. And, while the Basin is home to significant Indigenous populations, most sites of helium extraction are centered in regions occupied by Anglo ranchers, small Mormon communities, and residents fleeing urban centers for off-grid living. These cultural, demographic, and geographic differences manifest a disconnect in realizing the gravity of historical extraction-related tragedies experienced on tribal lands.

Conclusion

Increasingly, globalized economies rely on new technologies that in turn are reliant on critical minerals located in hard-to-reach geological locations, require extreme forms of extraction, or are recovered as the byproduct of other resources. Political economies and globalization also shaped resource flows and created precarious supply-chains. As these patterns reveal in helium extraction, and its predecessors of coal and uranium in Arizona, critical minerals are thus co-produced by their natural and social scarcity. Echoing economist Charles Akong

(2019), the "material-discursive practices" of minerals shape their development outcomes across "extractive spaces and time."

These ideas are frequently the terrain of sociotechnical imaginaries work in STS and beyond. However, in foregrounding both the sociotechnical contexts in which minerals become "critical" to nations' articulations of security and development, and the sociocultural understandings that emerge around processes of mineral extraction, a theory of critical mineral genealogies has added value in locating minerals not only as geological and social constructs, but as entities produced by otherwise illegible regionally-dependent histories. We suggest that a concept of critical mineral genealogies also foregrounds how discourses around national security and economic necessity frame and excise considerations of justice and equity in environmental systems. In our empirical study of the helium boom, this entails a revealing of the dependence of modern social democracies on "cheap" natural resources and unregulated land use, as well as an acknowledgement of the continuing damages of settler colonialism and the exploitation of poor communities across the U.S. Finally, we hope that attending to genealogies makes these sources of conflict legible and the prospect of mitigating their repetitive harms possible and preventable.

References

Akong, C. 2019. Reframing matter: Towards a material-discursive framework for Africa's minerals. *Extractive Industries and Society* 7(2):461–469.

Voyles, T. B. 2015. *Wastelanding: Legacies of Uranium Mining in Navajo Country*. University of Minnesota Press, Minneapolis, MN.