Alaska's Critical Minerals

Supporting Alaska's decision makers with critical minerals and rare earth elements information

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Critical Minerals, Rare Earth Elements, and Alaska

Alaska has a wealth of critical minerals and rare earth elements. The U.S. Department of Energy (DOE) is strongly supporting efforts to spur regional economic growth and job creation by realizing the full potential value of critical minerals and rare earth elements.

DOE has selected the University of Alaska as one of 13 Carbon Ore, Rare Earth and Critical Minerals (CORE-CM) Centers across the country to conduct research on resource extraction, resource processing, and manufacturing of high-value, nonfuel, carbon-based products. An objective is to accelerate the development of carbon ores and critical minerals. Of the thirteen Centers DOE is funding, Alaska has the only Center that covers all the geologic basins in a state. The other 12 centers are focused on specific, well-developed basins.

Because we Alaskans know that our state's critical minerals and rare earth elements are going to be in high demand and, because we have a window of opportunity to plan, the state wants to ensure we think strategically about what this industry could look like and how it will best benefit Alaskans. The state government has joined with the federal government in providing funding to the University of Alaska, led by University of Alaska Fairbanks, to further the strategic establishment of a CORE-CM industry in Alaska. Participants in Alaska's CORE-CM program have tremendous expertise in engineering, mineralogy, geochemistry, and mining.

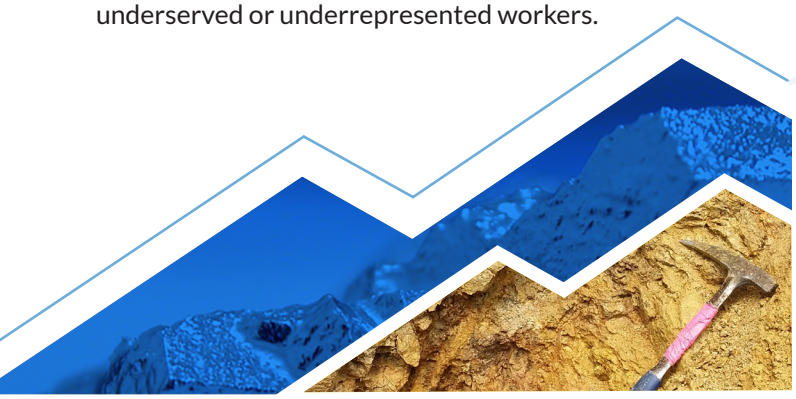
Our CORE-CM team includes the University of Alaska's three universities, state and federal agencies, Alaska mining companies, and other stakeholders. We are using this "window of opportunity" to develop well thought out, workable plans that make sense for Alaska and our unique environment.

Our CORE-CM has 7 tasks

1 Management and Planning

This is primarily an administrative task for coordinating the efforts of our diverse team. This task also provides for cooperating with the other CORE-CM Centers to ensure compliance with the Biden administration's social and environmental justice guidelines.

This task also includes planning for job creation and economic revitalization with particular interest in historically underserved or underrepresented workers.



2 Assess Resources

A component of our CORE-CM program is to begin assembling geologic models for carbon ores associated with potential rare earth elements and critical minerals.

Alaska's CORE-CM resources are spread across a variety of sedimentary basins, ranging from expansive foreland basins (structural basins that develop adjacent and parallel to a mountain belt), to small, extension-controlled basins (basins caused by a depressed block of land between parallel faults). Fully assessing Alaska's entire basin inventory is not feasible; instead, the Alaska Division of Geologic and Geophysical Surveys (DGGS) is thoroughly reviewing the geology of some basins that have key geologic characteristics that are frequently present in Alaska's mineral-rich basins. These basins hold potential for CORE-CM resource development. This preliminary analysis of CORE-CM play types is being drafted for publication by DGGS.

Acronyms and Definitions

AK-TIC
Alaska Technology Innovation Center

Basin
a depression, or dip, in the Earth's surface.

BEI
Business Enterprise Institute

CAMP
Carbon Advanced Material, Manufacturing and Production

CO2
Carbon Dioxide. In the atmosphere CO2 is a greenhouse gas and when dissolved in water, it causes ocean acidification.

CORE-CM
CORE-CM has two meanings.
1) Carbon Ore, Rare Earth and Critical Minerals; and
2) The 13 groups in the US that were established by the US DOE to address finding and developing plans to acquire critical minerals and rare earth elements. In our communications, CORE-CM is most often used to refer to the Alaska initiative.

CM — Critical Mineral
a non-fuel mineral essential to the economic and national security of the United States, the supply of which is vulnerable to disruption. It serves an essential function in the manufacturing of products and its absence would have significant consequences for our economy or national security.

DGGS
Division of Geological and Geophysical Surveys

DOE
US Department of Energy

EDX
Energy Data Exchange

ICE
Center for Innovation Commercialization, and Entrepreneurship

LCA
Life cycle assessment. The systematic analysis of the potential environmental impacts of products or services during their entire life cycle.

MEP
Manufacturing Extension Partnership

NCC
National Coal Council

NEPA
National Environmental Policy Act

NETL
National Energy Technology Laboratory, a U.S. national laboratory located in Morgantown, West Virginia and under the Department of Energy Office of Fossil Energy and Carbon Management.

Priority Matrix
a means of ranking the basins and resources that the team will focus on improving/refining throughout the CORE-CM period of performance. The priority matrix will consider geological, technical, and financial factors that impact the potential for the economic production of REE-CM's from Alaska carbon ores.

REE
Rare Earth Elements

REE/CM
Rare Earth Elements and Critical Minerals

TIC
Technology Innovation Center

UA
University of Alaska System Office and the three universities of UAF, UAA and UAS

UAF
University of Alaska Fairbanks

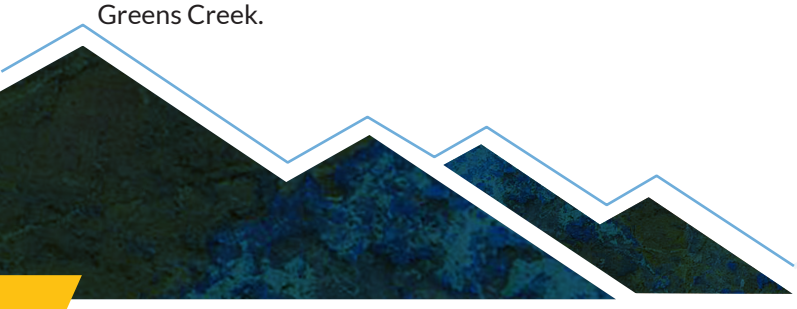
UAA
University of Alaska Anchorage

UAS
University of Alaska Southeast

3 Strategies to Reuse Waste Streams

The initial focus in this task will be to evaluate existing mining waste streams to determine what minerals and elements are in the waste streams and determine if the amounts are enough to make the waste streams a viable resource for rare earth and critical mineral production.

The initial waste streams to be assessed will come from Usibelli coal production. We will be assessing bottom and fly ash from the power plants the coal mine supplies.
We will also be assessing waste streams from Red Dog and Greens Creek.



Mining in Alaska

When it comes to developing a new CORE-CM mine in Alaska, we will face challenges such as limited access to existing roads and limited access to electricity. As a result, when we consider the potential value of the mineral content in different basins, we will also consider how we could acquire the minerals and identify innovative approaches we could use to overcome obstacles. It is unlikely new mines for producing REE/CM will be economical.

Our CORE-CM will be working with existing Alaska mines to determine whether rare earth elements and critical minerals are found in existing mining waste streams. These mines have already borne the expense of installing infrastructure, so the incremental cost associated with producing REE/CM will be much lower.

Whether it is in the lower 48 or in Alaska, whether an existing mine or a mine waiting to be developed, each requires a unique approach to the mining and for the processing.

4 Strategies for Infrastructure

In this task, the team will build development scenarios (plans for how specific sites could be developed) for one or more basins of interest. The team will identify challenges associated with developing the minerals and elements and work toward developing solutions. Topics may include considering how relatively-self-sufficient mining and refining operations could be established where there is no existing infrastructure or where it is not likely the infrastructure will be extended. The CORE-CM team will consider the infrastructure needs of active and planned Alaskan mining operations. The plans that come out of this task will be used as planning documents for implementing an Alaska Focused Technology Innovation Center (AK-TIC) (see Task 6).

5 Technology Assessment, Development and Field Testing

In this task, the team will generate information about technologies that are appropriate for use in different locations so that businesses and industry can make well- informed decisions with respect to environmentally sensitive development.

Technologies to be considered may include:

- *Selective mining* — evaluating how we can reduce the amount of material from which REE-CM must be separated. This is extremely important because Alaskan mines and potential Alaskan mines are often in remote locations and transportation is costly.
- *Investigating processes to separate and purify REE and CM* — minerals and elements are attached to rocks, coal, and other materials from which they must be separated before they can be used. Perhaps equally important is that the minerals and elements must be roughly separated before they are transported. Alaska's frequently remote locations can significantly add to the cost of transportation and it is important to transport high-value loads. Some of these highly-technical separations processes can result in as much as 20 times the concentration of rare earth elements.
- *Exploring the viability of creating products from carbon ore* – This subtask deals with manufacturing high-value, non-fuel, uses of coal. Composite materials, asphalt binders, and soil amendments are examples of non-fuel uses for coal.

6 AK Focused Technology Innovation Center (AK-TIC)

DOE requires each of the 13 CORE-CM centers to make plans for a regional Technology Innovation Center (TIC). From those plans, DOE has announced it plans to provide funding to eight TICs to implement their plans. If funded, the mission of the Alaska TIC will be to perform research and development that will result in commercial processing technologies and production of Rare Earth Elements and Critical Minerals, and the production of high-value, nonfuel, coal products. The AK-TIC will develop public-private partnerships and educate the next generation workforce.

Specifically, the Alaska Technology Innovation Center will:

- Accelerate research to enable commercial deployment of advanced processing and production of REE, CM and high-value, nonfuel, carbon/coal products in an environmentally acceptable manner.
- Pursue public-private partnerships to develop and deploy innovative technologies that lead to a complete Alaska-based supply chain.
- Advance opportunities for the education and training of the next generation of technicians, skilled workers and STEM professionals. The University of Alaska is already investing in the Alaska Technology Innovation Center (AK-TIC) by remodeling laboratory space, purchasing new equipment to bring new capabilities to the State, and partnering with other universities, national laboratories, industry partners, and government agencies to focus on meeting Alaska's technology needs.

7 Stakeholder Outreach and Education

In this task, our CORE-CM will focus on communications and gaps in technologies and infrastructure. The project team will reach out to stakeholders from industry, government, Alaska Native Corporations, and Non-Governmental Organizations. We will be posting our work products and updates to the CORE-CM website and publicizing its content so interested parties can easily find information about our plans, review our work products, and provide feedback to the CORE-CM team. In addition, this is the first in a series of informational newsletters that will help to inform the public about CORE-CM actions.

What are critical minerals?

Critical minerals are non-fuel minerals essential to the economic and national security of the United States, the supply of which is vulnerable to disruption.

Critical minerals serve an essential function in the manufacturing of many products and the absence of these critical minerals would have significant consequences for our economy and national security. They are also critically important to our nation's clean energy goals.

Critical minerals are necessary for high-tech devices, national defense, and green technologies. They are minerals that have important uses and no known substitutes and, as a result, a disruption in the supply of a critical mineral would have a negative effect on the nation's economic and national security.

We will provide more information on critical minerals in future issues.

akminerals@alaska.edu

akminerals.alaska.edu

STATE OF ALASKA
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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UNIVERSITY OF ALASKA FAIRBANKS

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