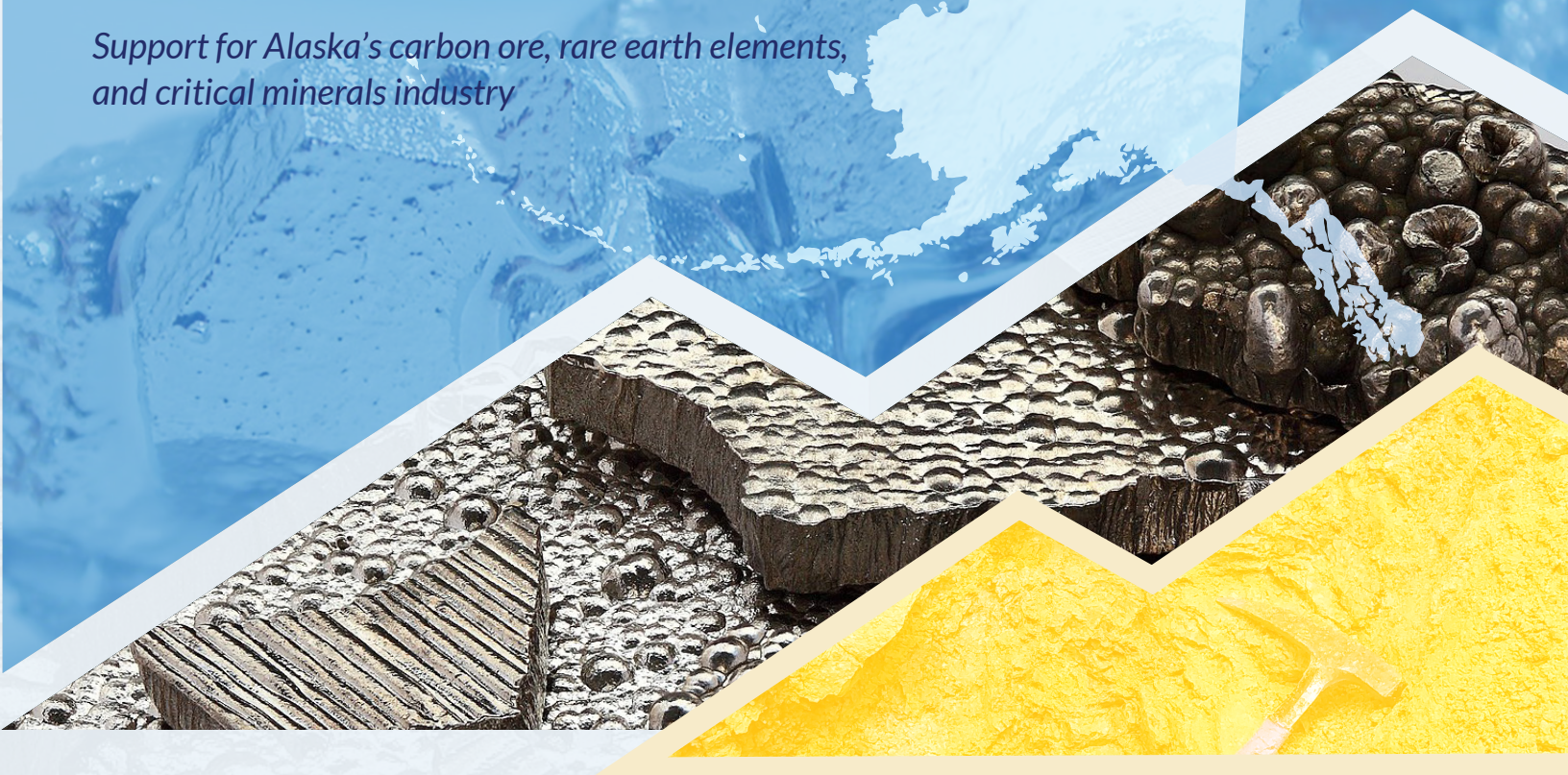


Alaska's Critical Minerals

University Facilities

Support for Alaska's carbon ore, rare earth elements, and critical minerals industry



In phase 1 CORE-CM funding, the U.S. Department of Energy (DOE) is requiring all CORE-CMs to plan for a Technology Innovation Center that will focus on manufacturing value-added, carbon-based products from coal, as well as developing new methods to extract and process rare earth elements and critical minerals. The initial implementation of the TIC occurs in phase 2 of the CORE-CM project.

Separate from the CORE-CM project, the State of Alaska appropriated funds to the University of Alaska for REE/CM Research and Development. UA has built lab and research capacity to further advance the concept and implementation of the TIC.

Technology Innovation Center (TIC)

Alaska's initial Technology Innovation Center plan will discuss how the TIC will support technology development that promotes utilization of Alaska's natural resources while attending to infrastructure, industrial needs, waste stream reuse opportunities, and the environment.

The primary purpose of Alaska TIC will be:

- To accelerate research that will enable commercial deployment of advanced processing and production of REE, CM and high-value, nonfuel, coal products.
- To support engagement of public-private partnerships and Alaska focused industries to advance new and innovative technology development as well as the potential for new product production.
- To advance opportunities for the education and training of the next generation of technicians, skilled workers and STEM professionals.

Major academic units throughout the University of Alaska System are working together in support of developing Alaska's critical minerals and rare earth elements.

University of Alaska Fairbanks

Institute of Northern Engineering (INE)

The **Institute of Northern Engineering** conducts research in all areas of engineering, including civil and environmental, petroleum, mining, geological, electrical, computer, and mechanical. INE is making investments to support economic development of the REE/CM industry in Alaska. For example, INE has recently purchased an Analytik Jena Inductively Coupled Plasma Mass Spectrometer (ICP/MS) and an Applied Spectra Laser Ablation unit.

These two pieces of equipment will allow elemental analysis of both liquid and solid samples and can be used to quantify the elements found within ore samples. Renovations to the lab housing the equipment will be completed by the end of 2023 with commissioning of the instruments shortly thereafter.

INE is located in the UAF Usibelli Engineering Learning and Innovation Building. For more information see <https://ine.uaf.edu>. Billy Connor, INE Acting Director, can be reached at: bgconnor@alaska.edu.

INE houses several research centers. Two are highlighted below.

Mineral Industry Research Laboratory (MIRL)

MIRL specializes in processing strategies for all types of ore, improving recoveries, and fine particulate separation. Additional research areas include issues associated with mining in the arctic in Alaska; mine ventilation design; rock and soil testing for underground structures; reserve estimation; use of computational tools (machine learning) for mine optimization (mine-mill reconciliation); production simulation; hydrometallurgical and electrochemical processes for heap leaching of gold ores in the Arctic and sub-Arctic, and coal characterization and beneficiation.

Dr. Tathagata Ghosh is the MIRL Director and can be reached at: tghosh@alaska.edu. For more information on MIRL see <https://mirl.uaf.edu/>.

Water and Environmental Research Center (WERC)

WERC conducts basic and applied research related to water and environmental resources. Research disciplines at WERC include: environmental, civil, and arctic engineering; environmental science; oceanography; limnology; hydrology; microbiology; geochemistry; and hydraulics. Its research aims to help improve the quality of life for arctic inhabitants while supporting careful and sustainable development of Alaska's bountiful natural resources, protecting fragile ecosystems, and seeking to better understand the role of the arctic and subarctic in the global system.

To support rare earth elements and critical mineral research, WERC has an Agilent 4200 MP-AES that offers atomic emissions analysis for cations, such as Ca, Mg, Na, K, Fe, and Mn. In addition WERC's Analytikjena PlasmaQuant MS Elite 5 is equipped to conduct trace analyses of cations, such as Cd, Cr, As, Se, Pb.

Dr. Nicole Misarti is the WERC Director and can be reached at: nmisarti@alaska.edu. For more information on WERC see <https://ine.uaf.edu/werc>

Geophysical Institute (GI)

Founded in 1948, the **Geophysical Institute** is a world-renowned center for the study of geophysics from the sun to the center of the Earth. The institute focuses on the needs of Alaska, using geophysical data as the basis for decision-making tools. The UAF Geophysical Institute has three laboratories that can assist in development of Alaska's mineral resources:

Advanced Instrumentation Laboratory (AIL)

The UAF **Advanced Instrumentation Laboratory** is a multi-instrument resource specializing in surface and elemental analysis and electron microscopy. One of the instruments is the JEOL JXA-8530F Electron Microprobe, a powerful instrument for critical minerals work and the only one of its kind in Alaska. The microprobe provides an image down to the nanometer scale and can also offer quantitative analysis and mineral mapping. In addition to instrumentation, AIL also houses support sample preparation facilities.

A core instrument in the Advanced Instrumentation Laboratory arsenal of instruments is an X-ray Fluorescence Spectrometer, a tool that is valuable for analyzing mineral deposits and the rocks and soils that hold minerals. It can quantitatively analyze bulk samples of materials.

The X-ray Fluorescence Spectrometer provides analytical services for supporting critical minerals' exploration, mining, and research in support of building Alaska's REE/CM industry. In addition, the AIL has a LeNeo electric fusion instrument, called a Fluxer, that is capable of making glass disks and solutions by fusion. This instrument can be used to make high-quality samples for the X-ray Fluorescence Spectrometer.

Dr. Menghua (Marty) Liu is the AIL Director and can be reached at mliu3@alaska.edu or visit <https://www.uaf.edu/ail/>.

Geochronology Mineral Separation Facility

The **Geochronology Mineral Separation Lab** in the Geophysical Institute at UAF has been completely updated with tools that will allow researchers to perform systematic sample size reduction and separations based on grain size, magnetic properties, and specific gravity as well as check each split for the phases present in real time. The lab has acquired a froth flotation system, a benchtop FTIR for rapid phase identification, a jaw crusher, materials for heavy liquid separation, ultrasonic baths, and other smaller items that will streamline critical minerals research. The lab has also purchased a laser induced breakdown spectrometer system that will provide real-time lithium analysis. The new tools and instruments in the Mineral Separation Lab rely on the same physical processes as the large industrial scale versions.

Dr. Sean Regan may be reached at sregan5@alaska.edu or by visiting <https://www.uaf.edu/geosciences/facilities/geochronology-lab/>.

Hyperspectral Imaging Laboratory (HyLab)

Hyperspectral imaging is an advanced remote sensing technology that uses sophisticated sensors that can scan and generate hundreds of images of any target material. The technology helps researchers to measure rather than simply observe.

HyLab airborne data acquisition flights are scheduled until September and staff are working to acquire permission from landowners to acquire additional data. To interpret the data, the HyLab is adding a new faculty member with expertise in processing hyperspectral data for analysis and data interpretation.

For more information on the Hyperspectral Imaging Laboratory see <http://hyperspectral.alaska.edu/background.html>. Dr. Martin Stuefer is the director and can be reached at mstuefer@alaska.edu.

University of Alaska Anchorage

Advanced Instrumentation for Microbiome Studies (AIMS) Core Facility

The **AIMS** core was established and currently maintained through support from NIH-COBRE and the Department of Biological Sciences at UAA. Microbes provide a wealth of untapped processes that can be used for biotechnological applications. This core provides advanced instrumentation and expertise to characterize microbes and their potential to help humankind. For example, some microbes have the ability to break apart minerals and bind onto critical minerals. AIMS provides key equipment for bench-scale critical mineral processing (incubators, Eppendorf Das-box bioreactor-8), and genomic sequencing (Oxford NanoPore, Illumina MiSeq).

For more information contact Dr. Brandon Briggs, lab director, at bbriggs6@alaska.edu or visit <https://www.uaa.alaska.edu/academics/college-of-arts-and-sciences/departments/biological-sciences/aims-lab/index.cshml>.

Applied Science Engineering and Technology (ASET) Lab

The **ASET lab** is an established recharge and training center specializing in chemical analysis of organic and inorganic compounds in environmental samples. The lab houses a wide range of advanced, modern instrumentation, including ICP-MS with laser ablation, LC/MS, high resolution mass spectrometry, NMR, ion chromatography, GC/MS, Total Carbon / Total Nitrogen, among others. Recent acquisitions of this instrumentation have been made possible by recent grants through the National Science Foundation Major Research Instrumentation and NIH INBRE programs.

The team is led by Director Dr. Patrick Tomco (pltomco@alaska.edu) and supports one full-time research professional staff member to assist with sample preparation and processing. Subsidized rates are available for student involvement, please contact the laboratory director for more information on available analyses.

Alaska Critical Minerals Hydrogeochemistry Lab

The **Alaska Critical Minerals Hydrogeochemistry Lab** is an integrated research group that draws upon the disciplines of geology, hydrology, geochemistry and advanced analytical chemistry for cutting edge research on the exploration, discovery and environmental issues associated with critical minerals (CM). The team is highly skilled in field and laboratory-based investigations of CM deposits and environments in Alaska, other parts of North America and in South America. In these high latitude and altitude environments they advance the science around 1) sources, transport and accumulation of lithium and other CM for the energy transition, 2) environmental geochemistry of CM in mined and unmined watersheds, and 3) physical and chemical mechanisms that release CM to the environment.

The team has an extensive publication record incorporating the interdisciplinary tools of remote sensing, isotope and trace element geochemistry, environmental tracers, surface and groundwater dynamics and data science to solve critical issues around resource definition and extraction. The lab collaborates with other academic institutions including the University of Alaska Fairbanks, as well as state, federal, and international partners, and Alaska Native corporations. The lab is supported by the National Science Foundation and private entities including the mining, auto and chemical industries.

Dr. Lee Ann Munk, director, can be reached at lamunk@alaska.edu. For more information see hygeolab.org.

Geomicrobiology Lab

The **Geomicrobiology Lab** crosses the lines between geology and microbiology to understand how microbes interact and process minerals. The research in critical minerals uses novel Alaskan microbes to extract, recover, and concentrate REEs. These microbes are very efficient at pulling the REEs away from the minerals and they do it without producing hazardous chemicals. The process is sustainable and environmentally friendly. The current research focuses on 1) adapting the process to different types of minerals, 2) increasing the speed at which REEs are recovered, 3) separating individual REEs for high purity, and 4) proving the process will work at a pilot scale.


For more information contact Dr. Brandon Briggs, lab director, at bbriggs6@alaska.edu.

Institute of Social and Economic Research (ISER)

ISER has been at the forefront of public policy research in Alaska for 60 years. ISER's multidisciplinary staff uses a non-partisan approach to study Alaska's major public policy issues. Bob Loeffler and Brett Watson have published a number of studies examining the mining industry in Alaska, including a review of the potential for REE/CM development. They are beginning a study that compares Alaska's environmental standards for oil, gas, and mineral development with those of other leading national and international jurisdictions. The results can be used by policy makers to ensure Alaska remains an attractive destination for investors interested in developing Alaska's natural resources. ISER's research is available to the public. Dr. Diane Hirshberg is the ISER Director.

For more information see <https://iseralaska.org/>.

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