Critical Minerals & Rare Earth Elements
Part 2 - Earth MRI

www.deq.nc.gov/geological-survey

This is Part 2 of our series spotlighting Critical Minerals (CM) and Rare Earth Elements (REE). Be sure to check out **Part 1 - An Overview**

SUMMARY

CMs and REEs

Minerals, materials, and elements that are essential to the economic and/or national security of the U.S. and the supply chains of which are vulnerable to disruptions. CMs and REEs serve an essential function in many of our manufacturing industries, including energy, technology, healthcare, agriculture, defense, currency, and consumer electronics.

U.S. Energy Act of 2020

Legislation that tasked the U.S. Geological Survey with conducting quantitative resource assessments and evaluating mineral criticality. A Critical Minerals List (CML) should be revised and updated no less than every three years. The draft 2025 CML includes 54 minerals, materials, and elements.

Importance

The United States is 100% net import reliant on 12 of the 50 critical minerals on the 2022 CML and more than 50% net import reliant on an additional 29. The demand for CMs and REEs is expected to increase in the next decade so it's imperative that the U.S. research and assess the supplies of CMs and REEs within our borders.

2021 Infrastructure Investment and Jobs Act

Passage of the Bipartisan Infrastructure Law in 2021 established continued investments into domestic CMs and REEs

Domestic Production and Processing

Funding was provided for projects aimed at extracting critical minerals and materials, pilot projects for processing, and for refining domestic sources of critical minerals and materials.

Research & Development Funding

Directs the Secretary of Energy, along with the Director of the National Science Foundation, to issue grants to support basic research to accelerate innovation to advance critical minerals mining, recycling, and reclamation strategies and technologies to make better use of domestic resources and to reduce the reliance on mineral imports.

Data Preservation

Authorized the National Geological and Geophysical Data Preservation Program to provide for the preservation of samples to track geochemical signatures from critical mineral ore bodies for use in provenance tracking frameworks.

Mine Waste Characterization and Inventory

Funding was provided to sample mine waste tailings and piles to determine the amount of mine waste that exists in the U.S. and to determine if that mine waste contains critical minerals or other valuable geological resources.

Mapping and Assessments

Established the Earth Mapping Resources Initiative (MRI) within the U.S. Geological Survey with the purpose of accelerating efforts to provide integrated topographic, geologic, geochemical, and geophysical mapping.

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EARTH MRI
Earth Mapping Resources Initiative
USGS Mineral Resources Program

To learn more about the Earth MRI project, please visit the U.S. Geological Survey's website

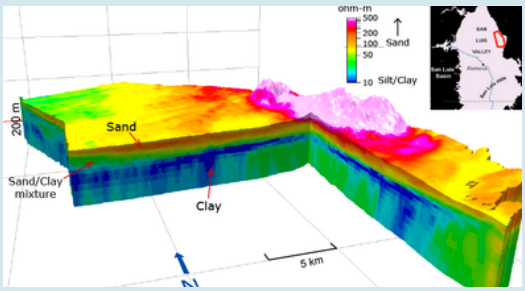
Earth MRI is a partnership effort between the U.S. Geological Survey, State geological surveys, Federal agencies, private industries, Tribes, universities, and others to modernize mapping of the surface and subsurface of the United States. Earth MRI collects multiple types of data (topography, geology, geochemical, geophysical, borehole, and more) to create a broader picture of our country's resources.

Combining all the collected data will transform the 3-dimensional understanding of the geology of the U.S. The data is necessary in order to make important resource and land-use decisions, to support economic development, and to mitigate the effects of natural hazards like earthquakes and landslides.

How is Earth MRI data being collected and used?

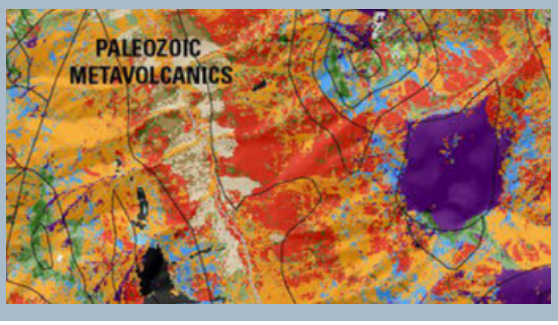
Geophysical Surveys & Mapping

Airborne surveys will be collected in areas that have potential for critical mineral resources. Aeromagnetic surveys are being implemented using helicopter and airplane flyovers in order to conduct magnetic, radiometric, and electromagnetic surveys. These data will be used to identify subsurface rock types and structures associated with mineral deposits. The collected measurements can show different properties of bedrock or soil from ground level down to several kilometers depth.



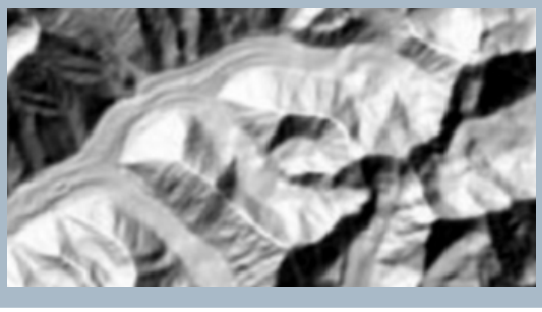
Hyperspectral Mapping

Airplanes and drone surveys capture light that is reflected off Earth's surface across a wide spectrum of wavelengths (including infrared to ultraviolet) to identify minerals and materials based on their unique spectral properties. Each specific mineral has a unique combination of absorption and reflection of light at different wavelengths, creating a unique "spectral fingerprint".



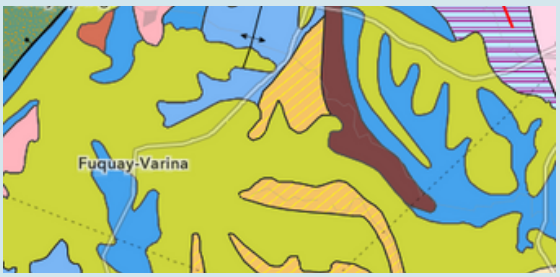
LiDAR

LiDAR (light detection and ranging) technologies attached to drones or airplanes can detect small changes in the elevation of the landscape, even beneath dense vegetation. The elevation data collected produces high-quality topographic data that can reveal landforms, indicate changes in rock type, and/or evolving geologic processes such as landslides, erosion, or river/stream changes.



Geologic Framework Mapping

Geologic maps are necessary for identifying potential resources and hazards as well as for land-use planning and agriculture. The USGS, in partnerships with State geological surveys (such as the NC Geological Survey) creates geologic maps by identifying and measuring rocks and minerals and by using geochemical and geophysical data. Geologic maps are used to predict where mineral and energy sources might exist and where natural hazards might occur.



How is Earth MRI data being collected and used?

Mine Waste

Mine waste, such as tailings, have the potential to contain valuable minerals. Since the waste is already above ground, recovering valuable minerals could create a much smaller environmental footprint than producing minerals through traditional mining. The USGS, in partnerships with State geological surveys (such as the NC Geological Survey), is developing a National Inventory of Legacy Mine Sites that will help geologists begin to understand the resource potential of U.S mine waste.

Geochemical Analysis

Geochemical data helps geologists understand the composition of rocks - the minerals that make up the structure of a rock or group of rocks. These data help geologists to assess the mineral and/or resource potential of a rock or group of rocks. Rocks and/or soil samples are collected and then analyzed in a laboratory or with field equipment to identify the minerals or elements that are present.

Data Preservation and Dissemination

The geologic data being collected through Earth MRI must be usable, preserved, and disseminated. Through partnership with the National Geological and Geophysical Data Preservation Program (NGGDPP), the USGS will work with State geological surveys to preserve and disseminate historical records and geological samples. These records and samples could provide useful information about critical minerals and materials as well as data collection locations and cores collected through drilling.

Would You Like More Earth MRI Information?

1. The U.S. Geological Survey has an interactive web-based map tool called the Earth MRI Acquisitions Viewer where you can view the active and completed Earth MRI projects across the U.S., including in North Carolina.

2. Interested in geologic maps? Check out The National Geologic Map Database where you can access geologic maps, geologic stratigraphy information, GeMS (Geologic Map Schema) digital maps, and more.

Earth MRI is modernizing the way Earth's surface and subsurface are mapped. The new critical minerals, elements, and materials data will enhance our understanding of our nation's geology, resources, and energy sources and will help to inform decisions as our technology-based society continues to evolve.

Part 3 of our series will dive into the Earth MRI work that the North Carolina Geological Survey is conducting and the critical minerals and rare earth elements in our State.