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Science & Technology

Mar 24, 2023

New Mining Technology Uses CO2 as Tool to Access Critical Minerals

Critical minerals like lithium, nickel and cobalt are vital for the energy transition.

AUSTIN, Texas — A mining technology pioneered by researchers at The University of Texas at Austin could reduce the amount of energy needed to access critical minerals vital for modern energy technologies and capture greenhouse gases along the way.

Esti Ukar

Transitioning the world's energy to technologies and sources with low-carbon emissions will take, in part, tremendous amounts of lithium, nickel, cobalt and other critical minerals that exist in low concentrations in the Earth's crust. Mining those elements takes much energy and produces waste, which can negatively affect the environment and create significant amounts of greenhouse gas emissions such as carbon dioxide (CO_2).

This research could turn these emissions into a tool by using CO_2 to weaken the rock containing critical minerals, reducing the amount of energy needed for mining. The ultimate goal is to significantly reduce the emissions produced during mining by storing them safely in the rocks, and potentially even make mining carbon negative – storing *more* carbon than is produced – by piping in and storing CO_2 emissions from other industrial operations.

This CO_2 storage is possible because of the way ultramafic rocks, which typically contain critical minerals, react with carbon. The CO_2 chemically reacts with the rock to mechanically break its structure, making the minerals easier and less energy intensive to mine. This reaction also partially turns the rock into a limestone, incorporating the carbon dioxide into the mineral structure and storing it permanently.

"Mining processes create a lot of CO_2 as a byproduct," said Estibalitz Ukar, a research scientist at the Bureau of Economic Geology at the UT Jackson School of Geosciences. "If you can capture what is produced at the mine, then you can come up with a low-emission operation, which is good, but we want to use the CO_2-reducing properties of ultramafic rocks to help eliminate even more CO_2."

Ukar is leading a team of scientists that is working to perfect the mining technology, which is supported by a $5 million grant from the U.S. Department of Energy Advanced Research Projects Agency-Energy. The three-year project will work to refine the mining method in the lab for two years before trying a full-scale field test in partnership with Canada Nickel Company. The field test is planned to take place in one of 20 newly discovered ore bodies near the U.S.-Canada border that are forecast to be an important new source of critical minerals in North America.

The project would also make low-grade deposits more economically viable, an important step in increasing the available supply of domestically produced critical minerals.

"The demand is high now, but we will see a huge increase in the next three to five years as we transition into lower-emission technologies, such as electric vehicles," Ukar said. "We need to meet the demand by finding creative ways to reduce costs and emissions, find new sources of metals, and make the mines of the future more sustainable. And we need to do it fast."

The project is part of the Mining Innovations for Negative Emissions Resource Recovery program, a new initiative that aims to develop market-ready technologies that will increase domestic supplies of critical elements required for the transition to low-carbon or carbon-free energy.

The research brings together the expertise of scientists from the UT Jackson School's Bureau of Economic Geology and Department of Geological Sciences, as well as researchers from the UT departments of Petroleum & Geosystems Engineering and Aerospace Engineering & Engineering Mechanics; Columbia University; the University of Bern; and Carbfix, an Iceland-based project using a similar method to store CO_2 in basalt.

Read the Q and A with Ukar.

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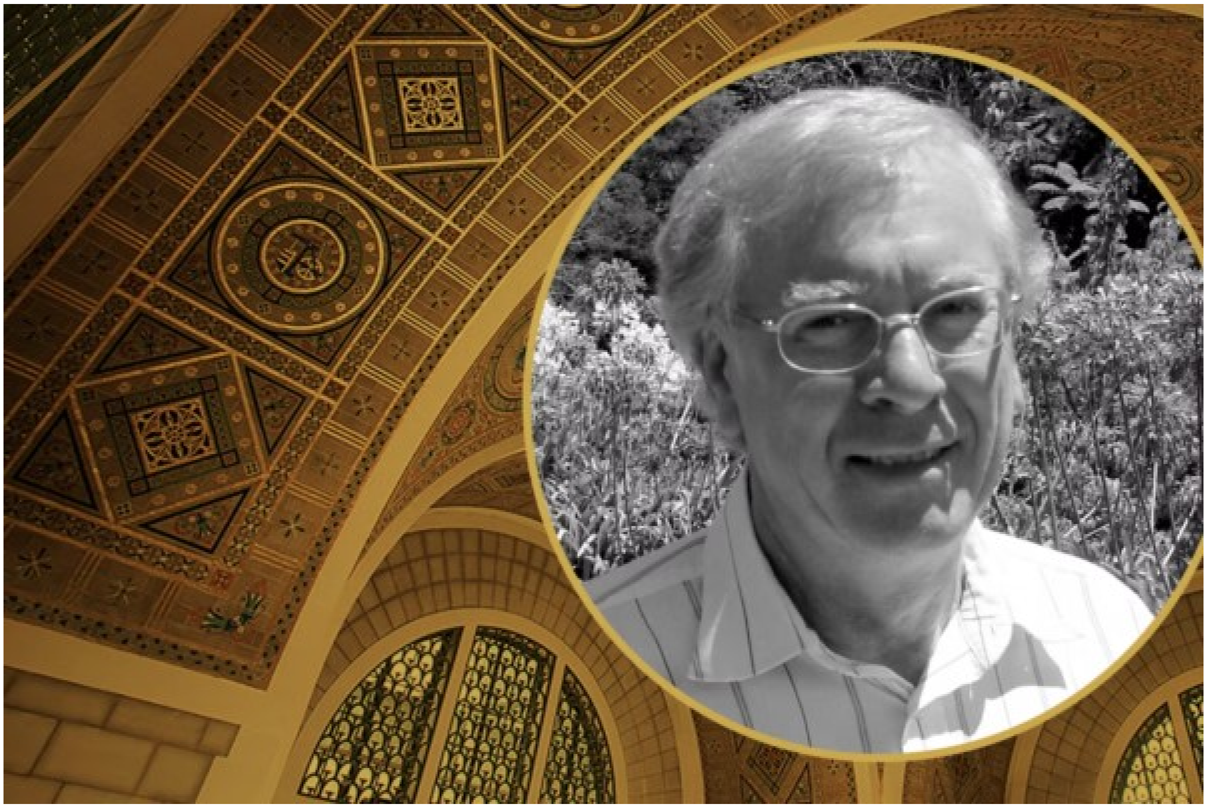

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