Photo: Alan Orling

Carbon-Eating Rocks

Photo: Courtesy of Sam Krevor

"What attracted the Lenfest Foundation to the Earth Institute was how it studied the connected challenges of energy, climate change, poverty alleviation and other critical world issues."

Lenfest Foundation

"Imagine, for a moment, a world in which energy is cheap, plentiful, and environmentally sustainable," wrote Klaus Lackner, who is the Maurice Ewing and J. Lamar Worzel Professor of Geophysics, in 2005. Now imagine new and exciting ways of capturing carbon dioxide emissions before they reach the atmosphere and warm our climate—like rocks that absorb carbon.

Sound strange and novel? It is one of the many exciting climate change mitigating strategies Lackner and his colleagues at the Earth Institute's Lenfest Center for Sustainable Energy and the Lamont-Doherty Earth Observatory are pursuing as they push the envelope on how we approach energy. One of the areas they work on is known as mineral sequestration, the permanent binding of carbon dioxide into rocks, which is considered safer than other methods of carbon capture because it permanently changes the carbon dioxide into a harmless solid.

Keen to study "energy technologies that have the potential to play an important and large-scale role in the way we manage energy in the future," engineering doctoral student Sam Krevor was drawn to the Lenfest Center. Even as an undergraduate, he had "started to understand the importance of energy in the greenhouse gas problem and how difficult it was to manage in an effective way." What especially interested him was the way certain rocks react with carbon dioxide.

But where could these useful "carbon-eating" rocks—some of which are also known as ultramafic rocks—be found? "It was frustrating," says Krevor. "We did not have a definitive reference to hand to people." When the U.S. Geological Survey (USGS) called, Krevor and his colleagues jumped at the opportunity for collaboration; the Lenfest Center supplied the knowledge of what rocks would be useful in capturing carbon dioxide, and the USGS supplied the expertise in the evaluation and mapping of mineral resources.

The results showed that there is a lot of this rock out there and that "the sequestration process would not be limited by the amount of rock," says Krevor. The accessible ultramafic rock in the United States, much of it clustered along the mountain ranges of the East and West Coasts, would be enough to stash at least 500 years' worth of the carbon dioxide produced in the country.

This information will help researchers like Krevor back in the lab. Knowing what minerals are most common will guide their research on how to fine-tune the reaction of carbon dioxide with rocks. "The most important issue facing mineral carbon research right now is to find cost-effective solutions to making these carbonation reactions happen quickly," says Krevor.

Carbon mineralization has great potential, but is expensive to execute. Earth Institute scientists are exploring ways to make it more practical. In Iceland, Jürg Matter, Doherty Associate Research Scientist, and Wallace Broecker, Newberry Professor of Geology, are working to sequester carbon dioxide produced by a geothermal energy plant in nearby basalt rock formations. In a Columbia University lab, Alissa Park, Lenfest Junior Professor in Applied Climate Science, is fine-tuning the capture of carbon by grinding rocks into small pieces and attempting to accelerate their sequestration potential using chemical engineering processes. ■

Finding ways to mineralize carbon dioxide and permanently store it in the form of rock is an important focus of work by graduate students and scientists at the Lenfest Center for Sustainable Energy.