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Rock of ages

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Another way of getting rid of carbon dioxide

IF HUMANITY is to continue burning fossil fuels in large quantities and yet curb the climate-changing effects of the resulting carbon dioxide, then somewhere other than the atmosphere will have to be found to put that CO2. The leading candidates at the moment are geological traps of the sort that hold natural gas in place; old coal mines; and carbonised plant matter (so-called biochar), which cannot rot and may help improve soil quality. There is even talk of dumping the stuff at the bottom of the sea.

There is, however, another possibility. That is to short-circuit the natural geological process of weathering and use the CO2 to convert volcanic rocks into limestone. A pilot project called CarbFix, intended to test this idea, is under way in Iceland.

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Hell is where the gas gets buried

Iceland is not overendowed with natural resources. It has fish in its seas, and hydro and geothermal power in its rivers and volcanoes (though only a small market for the resulting electricity). But one thing it is not short of is volcanic rock—and CarbFix may turn this, too, into a resource.

Most of Iceland's rock is basalt, a type that is rich in both calcium and magnesium. The actual chemical make-up of rocks is complex, so the conventions of petrological analysis pretend that these metals are present in basalt as their oxides. Measured like that, each oxide forms about 10% of standard basalt. Since these "conventional" oxides consists of equal numbers of metal atoms and oxygen atoms, adding CO2 creates a carbonate—calcite ($CaCO_3$) in the case of calcium, magnesite ($MgCO_3$) in the case of magnesium, and dolomite in the case of a mixture of both.

Basalt thus presents a good theoretical opportunity to store a lot of carbon dioxide in a way that would keep it put for quite a long time. And to turn theory into practice the University of Iceland, Columbia University's Lamont-Doherty Earth Observatory, France's National Centre for Scientific Research and Reykjavik Energy (one of Iceland's main power generators) have come together in a collaboration.

The first three organisations are providing the scientists. Reykjavik Energy is providing the holes in the ground into which the CO2 will be injected. The firm is also providing the CO2 itself. This CO2 is, ironically, a by-product of geothermal energy, which is normally thought of as an "emissions free" technology. There is, however, a lot of carbon dioxide underground, and when you drill for superheated water to turn your turbines, you often release it. The plan is that instead of being released, the gas will be redissolved in cooler water and injected to a

depth of up to 800 metres, into suitable basalt formations where, the hope is, it will react to form calcite or dolomite.

Preliminary studies have shown that the rock in the area of the experiment (the Hellisheidi geothermal plant) is open enough for the injected water, with its gaseous load, to spread—and thus give the CO2 a chance to react. The next phase, which will be scrutinised by an international conference on carbon sequestration that is being held in Reykjavik this week, is to test the apparatus that captures CO2 from the geothermal power station. If that goes well, injection trials will start in October.

Not everywhere is blessed with basalt, of course. And no one is suggesting shipping CO2 to Iceland just to get rid of it. But the rock is reasonably widespread, being both the underlying stuff of ocean floors and a common outpouring of terrestrial volcanoes. A system of pipelines might therefore take CO2 to suitable burial sites if CarbFix and projects like it produce positive results. Moreover, after recent events in their financial industry, Icelanders may welcome some positive coverage of their country.