Studying Earth's Mantle and Crust

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Growing up, Marc Spiegelman dreamed of one day being the next Jacques Cousteau. The only problem was he enjoyed hiking more than diving and he excelled at math and physics rather than oceanography. Two summers spent working as a ranger for the United States Forest Service and the discovery that the planet often reveals its secret inner workings through calculus sealed his future.

Spiegelman now studies the interior of the planet using the tools of a computational physicist to understand how Earth's crust and mantle behave in tectonically active regions of the world. More recently, he has begun considering a problem that has traditionally attracted scientists with a more airy focus: what to do with all the carbon dioxide in the atmosphere.

Spiegelman's principle expertise involves applying theories that describe the migration of magma and fluids in the solid earth, and the behavior of solid materials under the immense heat and stress of the deep earth. His efforts are helping create a more general understanding of the interactions between solids and fluids in the mantle and crust. This work has applications to understanding the behavior and output of volcanoes around the globe like Eyjafjallajökull, the volcano in Iceland that erupted in early 2010 and shut down air travel over much of Europe for nearly one month. His work also provides insights into such problems as the interactions between reactive fluids and a variety of minerals found in the earth.

His expertise is attracting attention from new circles because it turns out that one of the more promising ideas for dealing with excess carbon emissions involves the solid earth. Geological carbon sequestration, a problem that Spiegelman's colleagues at the Lamont-Doherty Earth Observatory are actively investigating, entails injecting carbon dioxide into certain mineral formations found in many places around the world.

Spiegelman's ability to work between the worlds of observation and modeling may one day prove crucial in understanding what happens when carbon dioxide under immense pressure reacts with mineral formations containing magnesium. Such reactions produce extreme heat, which cracks the rock, and form solid magnesium carbonate, locking the carbon dioxide away safely and permanently.

It is this ability to model unobservable interactions between solids, fluids and heat deep underground that gives him a leg up on his old hero, Jacques Cousteau. Instead of a view into the depths of the ocean, Spiegelman has been able to see through his equations and models into the deepest recesses of the upper Earth.

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