Experimental investigations into the fate of subducted carbonates and origin of super-deep diamonds

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Carbonates are common rock-forming minerals in the Earth's crust and act as sinks of atmospheric carbon dioxide. Subduction of hydrothermally altered oceanic lithosphere returns carbon to the interior, where more than three quarters of Earth's carbon is stored. The contribution of subducted carbonates to the Earth's long-term deep carbon cycle is uncertain and has recently emerged as a topic of intense debate [1]. Moreover, mantle-slab interaction has been proposed as a mechanism to produce super-deep diamonds, thus questioning the use of certain mineral inclusions to infer lower-mantle origin [2]. Here we report new data on the chemical stability and reaction kinetics of carbonates in the mantle from multi-anvil and diamond-anvil-cell experiments. Our results suggest that carbon can be sequestered into deep Earth through reaction freezing and that the index minerals for super-deep diamonds are not reliable indicators for their formation depths.

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