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Ultra-Deep Drilling to the Oceanic Mantle: towards understanding the deep carbon cycle

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The Integrated Ocean Drilling Program (IODP), an international scientific research program supported by 24 countries, advances scientific understanding of the Earth by monitoring, drilling, sampling, and analyzing seafloor environments. One final goal of IODP is full penetration of oceanic crust and the first sample return from the Earth's mantle in history, known as MoHole project. We here emphasize that MoHole could contribute greatly to understanding the whole-mantle-scale carbon cycle. One reason for believing so is recent discovery of diamond and other ultra-high-pressure minerals from podiform chromitites in ophiolites, i.e., fossil oceanic crust/mantle. A possible scenario of these diamond-bearing chromitites is that they were originally formed at the Moho transition zone via melt/harzburgite reaction, transported to the lower mantle and recycled to the uppermost mantle by convection. The recovery of diamond from the in situ oceanic mantle, together with characterization of carbon and other volatiles in high-pressure phases, should provide new insights into geochemical evolution of the solid Earth.

Keywords: IODP, MoHole, oceanic mantle, diamond, deep carbon cycle