

The Fate of Deeply Subducted Volatiles in Earth's Deep Mantle

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Carbon and water are volatile components that are crucial for long-term surface habitability. These components are transported into earth's mantle at subduction zones and understanding where and in what form they can reside in the mantle is important for modeling their control on the surface environment through deep time. Here I will present our recent work using natural samples, experiments and theory to place constraints on the fate of these volatile components in the transition zone and lower mantle. Perhaps most revealing are so-called superdeep diamonds and their mineral inclusions and I will discuss recent observations from these samples that provide direct evidence for carbon and water subducted into the deep mantle. I will also present computational results on the effect of water on mineral elasticity that are used to constrain the amount of water that may reside in the transition zone, as well as new results on the density of hydrous melts at transition zone conditions that elucidate the fate of such melts above the 410 km discontinuity.