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Hydrated Silica and Bridgmanite in Lower-Mantle Subducting Slabs

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Subducting slabs can transport water into the topmost lower mantle. This can have significant geophysical, geodynamic, and geochemical consequences including dehydration melting, formation of excess mantle minerals, and seismic anomalies. Seismic observations have indicated the existence of melt layers at topmost lower mantle likely associated with the slab subducting processes. In this presentation, we will examine the water solubility in mantle stishovite and bridgmanite and discuss how water affects the mineralogy and geophysical properties of subducting slab materials at the topmost lower mantle conditions. Al,Fe-bearing bridgmanite and Al-bearing stishovite, two major constituent minerals in subducted oceanic crust, can contain up to approximately 1000 ppm of water in relevant slab environments. When subducted crust undergoes partial melting and releases water, bridgmanite can become unstable and decompose into stishovite and ferropericlase in cold subducting slabs at the topmost lower mantle conditions. This can lead to formation of excess hydrated silica and the amount of stishovite will increase substantially in local regions. This can help explain the mineralogy of diamond inclusions from the lower mantle. We will also use modelled elasticity and sound velocities to address how the partial melting-induced dissociation and formation of minerals can lead to large velocity contrasts (particularly the contrast in V_S) that can help explain seismic observations of the region.