

# **Lower mantle rehydration and core-mantle water exchanges from ab initio proton diffusivity in bridgmanite and post-perovskite**

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Proton diffusivities in bridgmanite and post-perovskite in lower mantle lithologies are calculated from ab initio molecular dynamics simulations. From these results we constrain loss of water from downgoing wet slab peridotite to ambient lower mantle, analyse the nature of possible primordial lower mantle water reservoirs as well as investigate core-mantle water exchanges processes over the age of the Earth. We find that protons diffuse on the size of 5-10 km in about 200 million years (lower mantle slab lifetime) - suggesting that rehydrated water is far from homogenously distributed in the lower mantle and that cold wet slabs lose less than 10 % of their total water content on their journey to the lowermost mantle. This is in line with recent studies suggesting that the upper and middle lower mantle is essentially dry. Over the age of the Earth, protons diffuse a few tens of km which places constraints on the size of possible primordial water reservoirs isolated from convective mixing in the lower mantle.