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Accumulation of hydrous oceanic slabs in the LLSVPs contributing to the formation of large igneous provinces

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The generation of large igneous provinces (LIPs) is closely associated with a water-rich component in the deep Earth. However, the location and nature of this component still remain under debate, as both the mantle transition zone (MTZ) and the large low shear-wave velocity provinces (LLSVPs) are potential candidates. In this study, by investigating the H_2O/Ce ratios in mantle plume-related basaltic magma of the Tarim LIP and combining the results with data from other Phanerozoic LIPs, we found that the water-rich component has characteristics of a hydrous oceanic slab, arguing against the possibility that the water-rich component was derived from dehydration/decomposition of wadsleyite/ringwoodite in the MTZ. The presence of hydrous oceanic slabs in mantle plumes is ubiquitous, but the stagnant oceanic slab only exists in parts of the MTZ and would soon sink into the lower mantle. Therefore, the most reasonable explanation is that the water-rich component comes from a hydrous oceanic slab accumulated in the LLSVPs instead of the MTZ. After calculation, the water content of LLSVPs can be up to 1 ocean. Hotspot basalts have lower H_2O/Ce ratios than LIPs, suggesting that the formation of LIPs consumes water quickly in the LLSVPs. The slow accumulation but rapid consumption of water in the LLSVPs is probably an important trigger for the pulsed formation of LIPs in the geological history.