

Behaviors of Wet Plume Controlled by Olivine-Wadsleyite Phase Transition and Water Distribution

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Intraplate Volcanism in Northeast Asia

1. Quaternary intraplate volcanoes locate 1000 km away from Japan trench.
2. Pacific plate is stagnated in the mantle transition zone (MTZ) under Northeast Asia.
3. Water amount in the MTZ is the largest in Northeast China and decreases outward.
4. Isotope features of igneous rocks are thought to be contributed by EM1 (ancient sediments in partially hydrated MTZ) and/or EM2 (sediments on subducting slab).

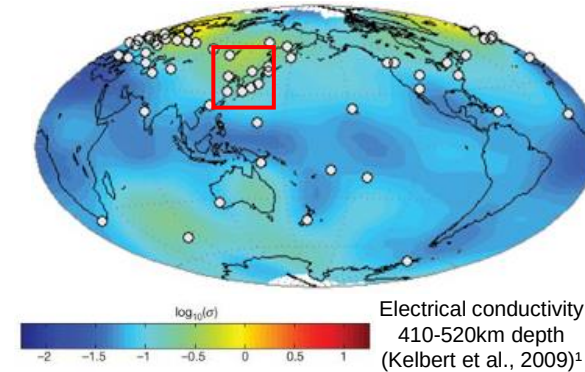
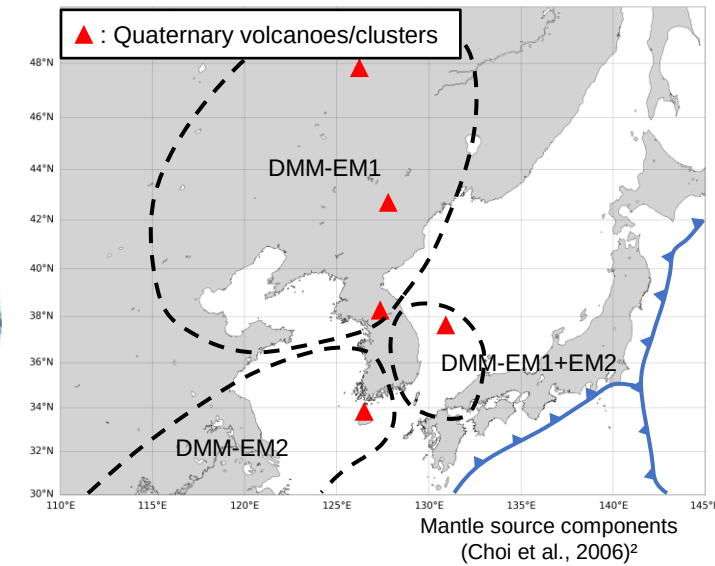
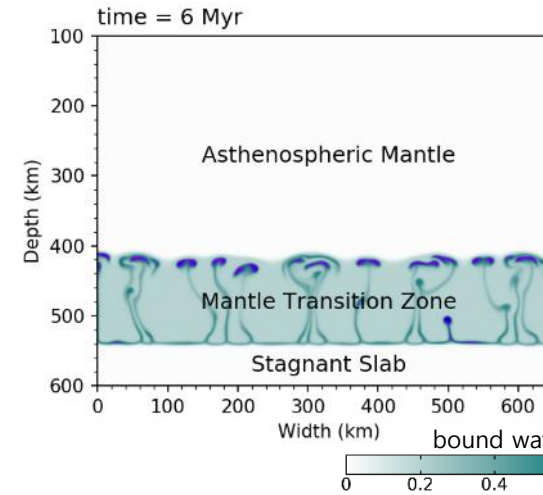
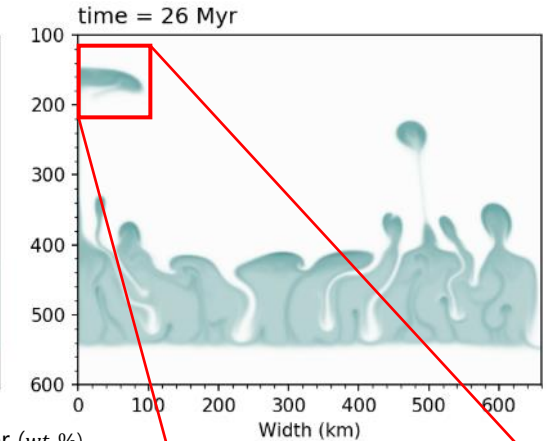
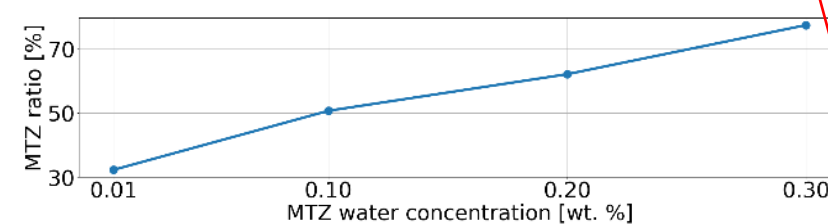
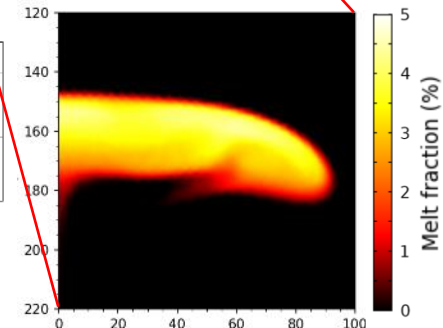
Wet Plume by Chemical Buoyancy

Hydrous layer atop the stagnant slab including

1. **Olivine-wadsleyite phase transition** (a positive Clapeyron slope and density jump).
2. **Partial hydration (bound-water) of the mantle** in the MTZ.

Results and Implications

1. Olivine-wadsleyite phase transition acts as a **barrier** which retards wet plume to enter the asthenospheric mantle.
2. Hydrated mantle in the MTZ enables **shorter onset time** and **increased spacing** of wet plumes (45 km → 480 km) than when absent. The **spacing** is comparable to the **distribution of intraplate volcanoes/clusters in Northeast Asia**.
3. The larger bound-water in the MTZ results in the larger incorporation of the mantle in the MTZ into the wet plume, consistent with the **isotope features**.
4. Wet plume experiences a **partial melting up to 4.6 wt.%,** similar to the value calculated from rock samples.



¹ Kelbert, A., A. Schultz, and G. Egbert (2009), Global electromagnetic induction constraints on transition-zone water content variations, *Nature*, 460(7258), 1003-1006, doi:10.1038/nature08257.

² Choi, S. H., S. B. Mukasa, S.-T. Kwon, and A. V. Andronikov (2006), Sr, Nd, Pb and Hf isotopic compositions of late Cenozoic alkali basalts in South Korea: Evidence for mixing between the two dominant asthenospheric mantle domains beneath East Asia, *Chemical Geology*, 232(3-4), 134-151.