

A model of mantle plume: inference from Hawaiian volcanoes

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Based on the melting experiments and the field observation, we propose a model that the Hawaiian plume had a potential mantle temperature (PMT) of only 1350-1400C in the Koolau stage (ca 2.5 Ma). This PMT is much lower than the estimate for the modern Hawaiian plume by Watson & McKenzie (1991, PMT=1558C) assuming homogeneous peridotite source. Our experiments show that only slight increase in PMT (10-50deg) will shift the Koolau type melts (SiO₂=53, MgO=6wt%) to the parental Mauna Loa and Kilauea type melts (SiO₂=49, MgO=15) in the plume head. Based on this study, we propose that excess temperature of the mantle upwelling flow is much lower than previous estimates and the role of recycled oceanic crust in magma genesis is far more important in the modern Earth.