

## New evidence for a depleted Hawaiian Plume component in Cretaceous Emperor Seamounts

Kaj Hoernle, Maxim Portnyagin, Folkmar Hauff, Reinhard Werner

GEOMAR Helmholtz Center for Ocean Research, Germany

E-mail: [khoernle@geomar.de](mailto:khoernle@geomar.de)

Depleted (MORB-like) geochemical compositions have been found at the Meiji and Detroit Seamounts, oldest in situ products of the Hawaiian Hotspot, located at the northwestern end of the Cretaceous Emperor Seamount chain. The origin of these depleted compositions is controversial. It has been proposed that the depleted component was derived either through melting of depleted (MORB source) upper mantle interacting with the Hawaiian plume near a spreading center (Keller et al. 2000, *Nature* 405), or through melting of a depleted component in the plume sampled due to enhanced melting beneath thin lithosphere (Huang et al. 2005, *G-cubed* 6: Q01L06; Regelous et al. 2003, *J. Petrol.* 44). During two of the R/V SONNE 201 cruises, relatively fresh shield stage tholeiites were recovered from the NW Emperor seamounts (Suizei, Tenji and Meiji). New major and trace element and isotope (Sr, Nd, Pb) investigations of whole rocks and major and trace element compositions of olivine phenocrysts provide new insights into the origin and evolution of the Hawaiian plume volcanism in the Late Cretaceous. The recovered samples range from enriched tholeiites on Meiji and Tenji Seamounts with high La/Yb (1.5 to 6.5) to depleted tholeiites at Suizei Seamount with low La/Yb (0.7 to 1.2), nearly indistinguishable from MORB tholeiites. Initial Pb and Nd isotope ratios from the seamount samples form a very tight inverse linear array, consistent with mixing of two mantle components. The enriched endmember, represented by a sample from Meiji, has, e.g., high initial  $^{206}\text{Pb}/^{204}\text{Pb}$  (18.7), unradiogenic Nd (0.51295) and high La/Yb (6.5) and is similar to the Kea component in present day Hawaiian tholeiites (Abouchami et al., 2000, *Chem. Geol.* 169) and has also been found in Early to Mid-Cretaceous Hawaiian plume-related rocks in Kamchatka (Portnyagin et al., 2008, *Geology* 36). The more depleted endmember, represented by a sample from Suizei, has, e.g., low initial  $^{206}\text{Pb}/^{204}\text{Pb}$  (17.6), radiogenic Nd (0.51302) and low La/Yb (0.7). An extension of the mixing array to less radiogenic Pb, however, does not intersect the Pacific MORB field (Nd isotope ratios in MORB being higher at a given Pb isotope ratio). Trace elements in olivine suggest that the melts were derived from mantle peridotite with only a minor addition of eclogite. Therefore, we believe that the Suizei endmember was a component in the Hawaiian plume: either a depleted component, e.g., recycled oceanic lithospheric mantle, (Regelous et al. 2003; Huang et al. 2005; Portnyagin et al., 2009, *EPSL* 287) or possibly ancient primitive mantle (Jackson et al., 2010, *Nature* 466; Jackson and Carlson, 2011, *Nature* 476). In conclusion, the new data from the NW Emperor Seamounts confirm the presence of both an enriched Kea type and a depleted or primitive mantle component in the Late Cretaceous Hawaiian plume.