Geophysical Research Abstracts, Vol. 8, 03915, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03915

Temporal Evolution of Pb Isotopes in Shield Lavas from Haleakala Volcano

W. Abouchami1, F.A. Frey2

1 Max-Planck Institut fuer Chemie, Postfach 3060, 55020 Mainz, Germany

wafa@mpch-mainz.mpg.de

2 MIT, Cambridge MA, 02139 USA, fafrey@MIT.EDU

Recent studies of Hawaiian shield lavas have led to alternative models for the spatial arrangement of geochemical heterogeneities in the Hawaiian mantle plume. High-precision Pb isotope data have revealed a left-right asymmetry of the Hawaiian plume in lavas from volcanoes along the Loa- and Kea- trend alignments (Abouchami et al., 2005). Studies of melt inclusions, on the other hand, indicate that both Loa- and Kea-trend components co-exist in single Hawaiian lavas (Ren et al., 2005). Thus, models for the Hawaiian mantle plume structure need to be refined by additional studies.

We report triple-spike (TS) Pb isotope data on a 250-m stratigraphic sequence of basalt in Honomanu Gulch which represents the late shield building stage of Haleakala Volcano, a Kea–trend volcano (East Maui) previously studied by Chen and Frey (1991). These data are compared with those for submarine Hana Ridge lavas which correspond to the early shield building stage of Haleakala and have been shown to share similarities with Kilauea lavas (Ren et al., 2005). The new Pb data show short-term fluctuations in Pb isotope ratios occurring at 3 m depth intervals, implying rapid changes in isotopic ratios. Comparison with TS data from other Hawaiian volcanoes show that (1) Honomanu, like Hana Ridge samples, lie along the Kilauea TS Pb isotopic array, though shifted towards lower ^{206}Pb/^{204}Pb ratios compared to Hana Ridge samples, (2) a few Honomanu lavas overlap the Loa-Kea Pb isotopic boundary, indicating affinity with Loa-type magmas. Both of these features also occur in the HSDP-2 record of Mauna Kea Volcano (Eisele et al., 2003), suggesting they may be typical of Kea volcano evolution. The fact that the “Kilauea” streak is also sampled by Haleakala volcano strenghtens the earlier interpretation that heterogeneities in the Hawaiian plume

are distributed as filaments vertically continuous over several km lengthscale (Eisele et al., 2003; Abouchami et al., 2005). A major difference between Haleakala and Mauna Kea, though, is that the occurrence of Loa-type features, specifically high ^{208}Pb/^{204}Pb ratios at a given ^{206}Pb/^{204}Pb, does not emerge at the same time during the building of these two Kea trend volcanoes. At Mauna Kea, the “hi-8” lavas are erupted during the early shield stage, but the Loa-type lavas appear in the late stage of Haleakala shield building. Thus, sampling of Loa vs. Kea geochemical heterogeneities do not occur in a systematic fashion during the evolution of a Kea volcano. Perhaps “Loa” heterogeneities are randomly sampled during the growth of a Kea volcano, while the “Kilauea” streak (Kea-type material) erupts mainly during the early shield building stage at both Mauna Kea and Haleakala, implying that it is a long-lived feature of the Hawaiian plume. It is clear that a longer-term Pb isotopic record of a Loa-trend volcano is needed to understand the spatial distribution of geochemical heterogeneities in the Hawaiian plume.