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Comparative Study of Koolau and Mauna Loa Primitive Melts: Investigation of Melt Inclusions in Olivines

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Koolau lavas are shown to represent the end-member component within the Loa trend of Hawaiian volcanoes enriched in recycled crustal (oceanic sediments) material (Hauri, 1996). However, the available data on Koolau is restricted to lavas, which could be significantly affected by contamination, magma mixing, alteration and crystal fractionation and thus may not represent primary melts. Here we report results of systematic comparison of compositions of melt inclusions trapped in high Mg olivine phenocrysts in Koolau picrite (single sample) and picritic lavas from Mauna Loa (4 samples covering 100 ky of volcanic history).

Melt inclusions in olivines were heated till full homogenization in the optical heating stage and then quenched. Major element compositions of quenched inclusions and host olivines were studied by electron probe and trace elements by ion microprobe (SIMS). The following results were obtained:

1. The melt inclusions with chemical composition specific for Koolau (Figure 1) were found in olivine phenocrysts of entire composition range (Fo 84-88). They cover the MgO range between 8 -12 wt%.

2. Melt inclusions in olivines from single Koolau lava show compositional range which could not be produced by fractional crystallization and may thus indicate the original compositional range of parental melts.

3. Compared to "normal" Mauna Loa melts of the same MgO, Koolau melt inclusions are significantly enriched in Si, Na and almost all elements more incompatible than Sm (see figure 1) and depleted in Ca. Alumina and HREE are similar for both volcanoes indicating strong buffering effect of residual garnet.

4. Koolau melt inclusions show higher positive anomalies in Sr and K than "normal" Mauna Loa melts. The Sr concentrations of Koolau melts are similar to Sr-rich Mauna Loa inclusions (Sobolev et al, 2000)

The reported data suggests that single Koolau lava contains olivine phenocrysts, which have crystallized from different parental melts. These parental melts were significantly distinct from Mauna Loa primary melts. The modeling suggest that this difference could indicate the presence of K-rich component in the Koolau mantle source in addition to recycled crustal gabbro and MORB reported for Mauna Loa (e.g. Sobolev et al, 2000).

Hauri EH, *Nature*, **386**, 415-419, (1996).
Sobolev AV, Hofmann AV & Nikogosian IK, *Nature*, **404**, 986-990, (2000).

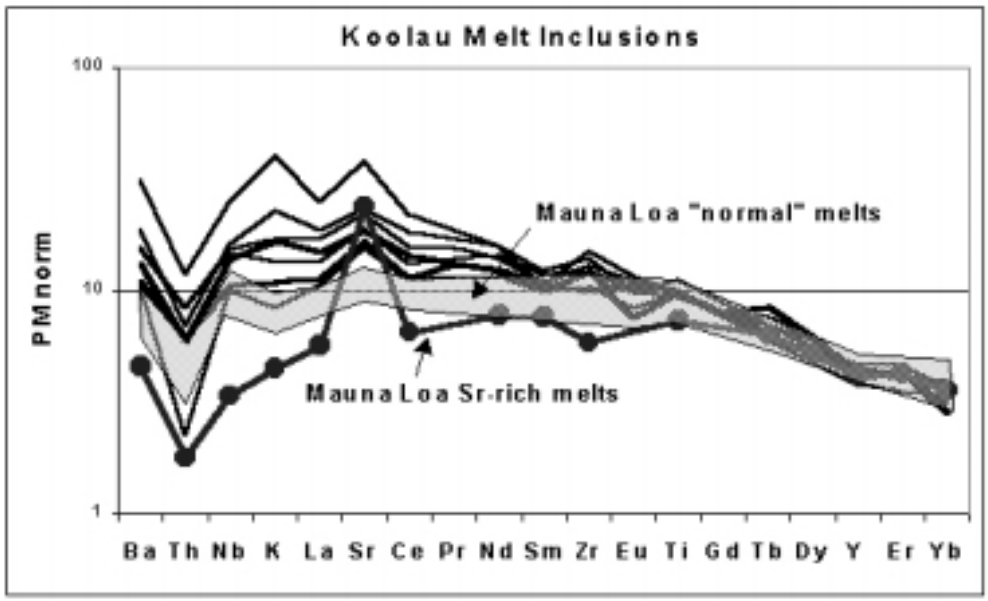

Figure 1: Trace element patterns of Koolau and Mauna Loa melt inclusions normalized to PM after Hofmann, 1988. Data on Mauna Loa after Sobolev et al., 2000.