The garnet/cpx ratio and melting depth in the Hawaiian mantle source

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The proportions of garnet and cpx in the magma source provide important evidence about the melting depth. The results of geochemical studies show that the garnet/cpx ratio for the submarine Hana Ridge (Haleakala volcano) lavas's source is less than 0.5 (Ren et al., accepted) which is lower than the ratio for the magma source of Mauna Ulu stage of Kilauea volcano (from 0.5 to 2; Hofmann et al., 1984), but is higher than the ratio for the transition tholeiite to alkalic basalts of Kohala volcano (~0; Feigenson et al., 1983). Feigenson et al. (1983) suggested that the transition from tholeiitic to alkalic stage from Kohala volcano has been formed in the presence of residual clinopyroxene; the presence of residual garnet is also possible but is not required by the data (Feigenson et al., 1983). This difference of the garnet/cpx ratio between the sources of those volcanoes may reflect the different depths of melt generation. With pMELTS algorithm (Ghiorso and Hirschmann, 1998), we have calculated the proportions of minerals of the source that has as the possible bulk compositions of the magma source, a peridotite (KR4003), mixed 90% peridotite (KLB1) +10% MORB (average), and mixed 80% peridotite (KLB1) + 20% MORB (average). It is found that the garnet/cpx ratios in the source increase from less than about 0.23, 0.34 to 0.55, and finally greater than 0.42 at pressures 3, 3.5, and 4 GPa, respectively. If this result is compared with the garnet/cpx ratio estimated with the trace element inversion model (Hofmann and Feigenson, 1983) in the Hawaiian magma source, it is suggested that the depth of the source for Kilauea, submarine Hana Ridge, and the transition from tholeiitic to alkalic basalts of Kohala changes from deeper to shallower (greater than 4 GPa, from 3 to 4 GPa, lower than 3 GPa).