Magmatic evolution in Haleakala Volcano, Maui, Hawaii

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Little is known about the shield building stage of Haleakala, because of poor expoure of its shield stage tholeiites only near the eastern shore line of Maui Island (Honomanu series lava). In order to investigate the petrological and geochemical evolution of Haleakala shield, 108 rock specimens have been collected from the submarine Hana Ridge through three ROV Kaiko dives and three dives by Shinkai 6500 submersibles, durine joint Japan-US Hawaiian cruises in 2001 and 2002 by JAMSTEC. All of the rocks (76 bulk rock analyzed) from the six dives are tholeiitic basalts or picrites, and their MgO contents range from 5.55 to 28.88 wt.%, and SiO2 contents vary from 43.3 to 50.37 wt.%, similare to those of lavas forming Kilauea shield building stages.

Relatively small range in highly incomatible trace elemets rations of the submarine Hana Ridge lavas implies that they have derived from relatively homogenous source. Most of trace elemets ratios (La/Yb, La/Nb, Ba/Zr, Sr/Zr) from submarine Hana Ridge are nearly constant, showing no correlation with MgO content and sample locality (Dive position and water depth). These ratios are similar to those of tholeiitic lavas from subaerial Honomanu. However, Sr/Nb, Zr/Nb, and Ba/Nb ratios show Kilauea-like composition (e.g. lower Sr/Nb, Ba/Nb, and Zr/Nb) in the submarine lavas. The subaerial Honomanu shield lavas on the contrary are more Mauna Loa like charaters (higher Sr/Nb, Ba/Nb, and Zr/Nb).

The Sr, Nd, and Pb isotope compositions of submarine Hana Ridge lavas are also similar to those of Kilauea compositios, whereas those ratios from subaerial Honomanu are in the Mauna Loa field.

The concept of two isotopically distinct tectonic has validity, it cannot be extended beyond the island of Hawaii. Because, both 'Kea'-like component and 'Loa'-like component are existing at a single shield, such as Haleakala and Koolau volcano.

The secular variation of Haleakala magma system from Kilauea like to Mauna Loa like indicates that the geograhical distribution of the shield magma types in Hawaii (Kea trend and Loa trend volcanoes) is due to the exposure of shield volcanes at diffrent stage of their growth history.

The systematic variation of Pb, Sr, and Nd isotope rations and trace elements ratios in Haleakala shield lavas require chemically heterogeneous source for the volcano's paretal magma. The correlation between trace element ratios and isotiopic ratios can be explained in the context of chemical heterogenety if the submarine Hana Ridge lavas (with relatively high 206Pb/204Pb, 143Nd/144Nd and low 87Sr/86Sr) were derived from a source with lower Sr/Nb, Ba/Nb, Zr/Nb, and subaerial Honomanu tholeiitic lavas (with relatively lower 206Pb/204Pb, higher 143Nd/144Nd, 87Sr/86Sr) were derived from a source with higher Sr/Nb, Ba/Nb, and Zr/Nb.