Melting Process in the Hawaiian Mantle Plume

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Genesis of magmas in large hot spot is very important to understand the temperature, chemical composition of the hot mantle plume. Compared with the magmatism under the mid oceanic ridges and those in the subduction zones, magma genesis related to mantle plumes is poorly understood. In order to study the origin and dynamics of mantle plumes, we have carried out both filed works and experimental work on several volcanoes in Hawaii, which is the most magma productive hot spot on our planet. The important role of recycled old oceanic crust in magma genesis in large hot spots (particularly that in Hawaii) has become clear in our study (e.g., Tanaka et al, 2002; Takahashi & Nakajima, 2002).

In order to understand the condition of melting and the source rocks for the various primary Hawaiian magmas, melting experiments with MORB/peridotite and Fe-MORB/peridotite sandwich starting materials. It was found that silica-rich Koolau-type primitive melts can be produced by extensive partial melting of basaltic source rock alone at 2.5-3.0 GPa and 1350-1400°C; conditions slightly below the dry solidus of mantle peridotite. At conditions on or above the peridotite solidus, melts become saturated with olivine and are similar to picritic olivine tholeiite in Kilauea. Accordingly, we propose that the high-silica Koolau primary magma is produced by almost entirely from the recycled oceanic crust (cf. ca. 10% by Hauri, 1996). Changing isotope compositions found in Koolau volcano may indicate variety of mixing ratio between eclogite derived melts and the ambient peridotite derived melts.

In the basalt/peridotite sandwich melting experiments, melt proportion within the basalt domain decreases as temperature increase near the peridotite solidus. This is due to the enhanced chemical reaction between the basalt domain and the ambient peridotite. Due to this effect, bulk melt proportion in the sandwich starting material records minimum at a temperature near the peridotite solidus. Accordingly, melts produced in the peridotite at temperatures above the peridotite solidus are more enriched in incompatible elements K, Ti and LREE than those produced at lower temperatures in the basalt domain. This may explain the difference in trace element characters among Hawaiian shield volcanoes.

Observation of Radon for earthquake prediction research

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Since 1978, Geological Survey of Japan, AIST (National Institute of Advanced Industrial Science and Technology) has been observed Radon concentrations for earthquale prediction research. Radon consentration in soil air had been serveyed for searching active faults covered by soils, and disolved radon in groundwater have been observed for monitoring the supposed Tokai earthquake. Some anomalous changes had been detected during radon observation. Fig.1 shows one of those radon anomaly, which is observed at Fujieda in 1983.

In 1978, we had started continuous observation for radon consentrations in groundwater at 7 wells in Shizuoka prefecture. At that time, measuring instruments had been set on the surface, and sampling water had been pumped up. But it is difficult to get accurate data, because of difficulty for pumping rate control. For elimination of influence by pumping rate fluctuation, we have changed observation wells to flowing well, and have been developing submersible type instrument. Now we have been observing 3 flowing wells, and testing submerged instluments at aquifer depth in 2 wells.

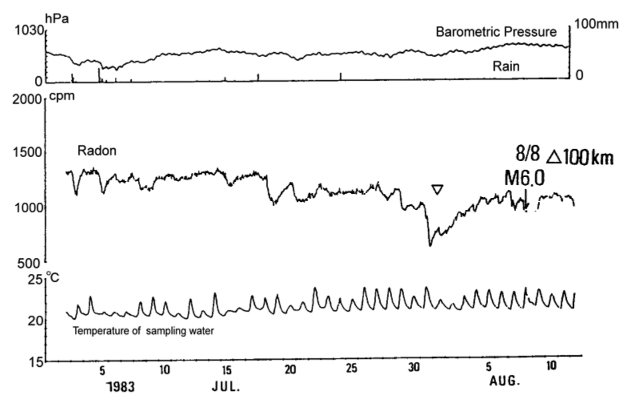

Figure.1 Anomalous change in Radon concentration at Fujieda observation site.