Isotopic geochemistry of the shield-stage lavas of Hualalai volcano, Hawaii

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The Hawaiian volcanoes are distributed in two parallel trend (‘Loa-‘ and ‘Kea-trend’) whose shield-stage lavas are charaized by general geochemical differences. Hualalai volcano, the third youngest on the island of Hawaii and located on Loa trend, has been in the post shield alkalic stage for >100 ky, and its subaerial surface are covered with post-shield alkalic lavas. Previous studies revealed that the shield-stage lavas of Loa-trend volcanoes have wider isotopic variation than those of Kea-trend volcanoes, and have a large-scale temporal isotopic evolution. However, no studies have ever concerned the temporal evolution including Hualalai shield-stage lavas, because there were only few data previously reported due to the difficulty of accessing submarine and buried tholeiitic basalts at Hualalai.

We present Hf, Pb, Nd, and Sr isotope compositions for 32 tholeiitic basalts collected from deep submarine portions of the west flank of Hualalai volcano. Isotopic compositions of the submarine tholeiitic basalts of Hualalai shield stage are similar to those reported for Mauna Loa lavas. The temporal Pb and Sr isotope trends for the Hualalai shield stage tholeiitic basalts seem to successive to the observed temporal variation for Mauna Loa. The successive Hualalai-Mauna Loa isotopic trends reveal temporal fluctuations in the Hawaiian plume’s radiogenic isotope signature that argue against a concentrically zoned plume models. Instead, the data imply that heterogeneous material in the plume conduit is distributed chaotically, with variable density and length scale.

Geochemical constraints on the Hainan mantle plume from Cenozoic alkali basalts from the South China Sea

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The South China Sea is one of the largest marginal basins in the west Pacific, which lies at a triple junction among three large plates, i.e., Eurasian plate, Indo- Australia plate and Pacific plate (or Philippine plate). A large scale intraplate volcanism after the cessation of seafloor spreading, affects a broad areas. A comprehensive study on Cenozoic alkali basalts dredged from the South China Sea is not only helpful to understand the deep mantle process of the intraplate volcanism occurred in the South China Sea, but also understand of the deep geodynamical setting for the formation and evolution of the South China Sea and a series of oil-bearing basins within it.

The whole rock K-Ar/Ar-Ar ages for basaltic rocks from the South China Sea range from 3.8 Ma to 7.9 Ma. Petrographic studies suggest that the mineral assemblage is consistent with common mineral assemblage of a typical alkali basalt. The average value for mantle potential temperatures (Tp= 1661℃), implies that there may exist thermally anomaly in the mantle beneath the South China Sea, and provides important evidence for the existence of Hainan Plume.

Major element compositions suggest that rocks studied belong to alkali series.The distributional patterns for trace elements and rare earth elements are similar to those of global intraplate OIB average value. Sr-Nd-Pb isotopic data of these basaltic rocks strongly imply there exists a binary mixing in origin with Dupal Pb anomaly, one is a depleted mantle end-member (DMM), and the other is EM2 component which may not result from subcontinental lithospheric mantle, but the Hainan plume originated from core-mantle boundary.

Hainan plume introduced into a preliminary, conceptual model about the formation and evolution of the South China Sea.