Sulfur solubility to basaltic magma and fractional crystallization of silicate minerals: Clues to the origin of HIMU and FOZO sources

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It has been widely accepted that subduction of oceanic crust and growth and recycling of continental crust produced at least three enriched and one depleted components in the mantle (HIMU, EMI, EMII and DMM), and thus these processes are essential to understand the chemical evolution of the Earth (Zindler and Hart, 1986). The origins of enriched components are usually explained by recycling of oceanic crust (HIMU) with variable amounts of crustal materials (EMI and EMII). The depleted component (DMM) is commonly explicated by melt extraction during the production of continental crust. As the continental crust is inferred to be formed at subduction zone, the chemical compositions of OIB sources and continental crust could potentially be connected.

For the comprehensive understanding of the relationship between OIB source and continental crust, we conducted geochemical modeling using trace element composition and Pb, Nd and Sr isotopic ratios. The result suggests that dehydration melting of oceanic crust at shallow level can produce melt of which trace element composition is similar to bulk continental crust. In addition, the residual oceanic crust can produce Pb, Nd and Sr isotopic composition that could be consistent with FOZO component at the age of 10-20 billon years. HIMU component can only be produced by the dehydration melting of oceanic crust that suffered strong crystal fractionation when it formed at the mid-oceanic ridge. During the fractional crystallization, U and Th concentration are increased. Sulfur solubility may also be enhanced during the crystal fractionation. High sulfur content in the evolved magma leads to distribute much more lead into sulfide compared to less evolved oceanic crust. This geochemical feature could be suitable to produce HIMU source via dehydration melting. We will present a geochemical model that is focused on origin of HIMU and FOZO sources and the relationship between continental crust and OIB sources.

[1] Zindler & Hart (1986) *Annu. Rev. Earth Planet. Sci.* **14**, 493-571.

Petrological and geochemical characteristics of the Hongcheon carbonatite-phoscorite, Korea

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The Hongcheon carbonatite, which is embedded in Precambrian gneiss consisting of hornblende-biotite gneiss and biotite gneiss, has been known as one example of Precambrian iron mineralization as well as REE mineralization in Korea. It has been paid attention not only on its economic importance but also on its petrological characteristics as a carbonatite body. Careful investigation of the carbonatite bodies revealed that they can be divided into carbonatite and phoscorite body based on their mineralogical and petrogical characteristics. Phoscorite consists typically of magnetite infilled by various carbonate minerals in its matrix such as siderite, calcite, magnesite, ankerite, strontianite, and accompanied pyrite, chalcopyrite, apatite, columbite, monazite as accessories. Carbonatite shows similar mineral species to phoscorite, but carbonate minerals including ankerite, siderite, magnesite and strontianite occupy most of the matrix and minor phases such as magnetite, monazite, columbite, pyrite, and barite occur as phenocryst. Chondrite-normalized REE patterns of monazite for phoscorite and carbonatite show similar patterns to each other. LREEs including La, Ce, Pr and Nd are highly enriched and each concentration is quite unifrom for various samples. However, Gd and HREEs such as Tm, Yb and Lu show relatively broad ranges of concentration in each element. Ce_2O_3, Pr_2O_3, Nd_2O_3 and Eu_2O_3 variations against La_2O_3 for monazite show that La_2O_3 is typically enriched in carbonatite whereas other elements are more abundant in phoscorite, suggesting that monazite from carbonatite seems to be produced later than that from phoscorite. As for REE patterns for whole rock samples, both of phoscorite and carbonatite are highly enriched in LREE and become depleted toward HREE. If the data are plotted on the ACF diagram to know the degree of fractionation, both of them belong to the similar ranges, though some of phoscorite samples are plotted in more evolved zone. Geochemical as well as petrographic evidences suggest that phoscorite and carbonatite in Hongcheon area were produced by liquid immiscibility rather than by fractional crystallization.