Lu-Hf and Sm-Nd isotope systematics of Korean spinel peridotites: A case for Nd-Hf decoupling

SUNG HI CHOI[1,*] AND SAMUEL B. MUKASA[2]

[1]Department of Geology and Earth Environmental Sciences, Chungnam National University, Daejeon 305-764, S. Korea (*correspondence: chois@cnu.ac.kr)

[2]Department of Earth Sciences, University of New Hampshire, Durham, NH 03824 (sam.mukasa@unh.edu)

We have determined the Hf and Nd isotopic compositions of spinel peridotite xenoliths in alkali basalts from Baengnyeong (BR) and Jeju (JJ) islands, South Korea, in order to constrain the timing of melt depletion events. Equilibration temperatures estimated by two pyroxene thermometry range from 780 to 950ºC, and 960 to 1010ºC for BR and JJ peridotites, respectively. The BR peridotite clinopyroxenes are characterized by extremely radiogenic Hf in association with isotopically less extreme Nd, resulting in strong Nd-Hf decoupling compared to the mantle array. This is in stark contrast to the observation of well-correlated isotopic compositions of Hf and Nd in the JJ peridotite clinopyroxenes, plotting along the Nd-Hf mantle array. The Hf abundances and isotopic compositions of the BR clinopyroxenes were less affected by relatively recent secondary enrichments that overprinted the LREE abundances and Nd isotopes, which caused decoupling of Nd-Hf isotopes. In the case of JJ peridotites, the Nd-Hf isotopic compositions are considered to have been re-equilibrated, probably because of efficient diffusion at relatively higher temperature than the BR peridotites.

Lu-Hf tie lines for clinopyroxene and orthopyroxene from four of the Korean peridotites have negative slopes on the Lu-Hf isochron diagram, yielding negative ages. This is interpreted as indicating recent isotopic exchange of orthopyroxene by reaction with metasomatic agents having low $^{176}Hf/^{177}Hf$ components. Secondary overprinting in orthopyroxene was facilitated by the fact that this mineral has considerably lower Hf concentrations than does the co-located clinopyroxene. BR lherzolite clinopyroxenes yield a Lu-Hf isochron age of 1.9 ± 0.1 Ga, which is independently supported by a model Os age (T_{RD}) of 1.8 Ga on a refractory BR peridotite. We interpret this age range to mark the time of stabilization of the mantle section beneath this area by major melt extraction. This Proterozoic melt removal coincided in time with widespread ca. 2.1 to 1.8 Ga tectonothermal events documented throughout the Korean peninsula.

Kinetics and mechanism of antigorite dehydration: Implications for subduction zone seismicity

M. CHOLLET[1], I. DANIEL[1], K. T. KOGA[2], G. MORARD[3] AND B. VAN DE MOORTÈLE[1]

[1]Université Lyon 1, ENS de Lyon, CNRS, UMR 5276, Laboratoire de Géologie de Lyon, France (isabelle.daniel@univ-lyon1.fr)

[2]Laboratoire Magmas et Volcans, UMR CNRS 6524, IRD – M163, Université Blaise Pascal Clermont-Ferrand, France [3]MARUM, Center for Marine Environmental Sciences, Bremen, Germany

[3]Institut de Minéralogie et de Physique des Milieux Condensés, Paris, France

Properties of serpentine minerals are thought to influence the occurrence and location of intermediate-depth seismicity in subduction zones, which is often characterized by two dipping planes separated by ca. 30 km defining a double seismic zone. The seismicity of the lower plane is believed to be provoked by the dehydration of serpentine since the experimentally determined stability limit for antigorite matches hypocenters location. This requires that the fluid produced by dehydration is released much faster than the typical time-scale of ductile deformation mechanisms. Here we measured the kinetics of antigorite dehydration *in situ* at high pressure and high temperature by time resolved synchrotron X-ray diffraction in a closed system. Antigorite dehydrates in two steps. During step (1) it partially breaks down into olivine and a hydrous phyllosilicate closely related to the 10Å phase. The modal abundance of the intermediate assemblage is described by 66 wt% antigorite, 19 wt% olivine, 12 wt% 10Å phase. During step (2) at higher temperature, the remaining antigorite and the 10Å phase fully dehydrate. From the analysis of reaction progress data, we determined that the major release of aqueous fluid occurs during step (2) at a fast rate of 10^{-4} $m^3_{fluid}.m^{-3}_{rock}.s^{-1}$. This exceeds by orders of magnitude the typical time scale of deformation by ductile mechanisms of any mineral or rock in the subducting slab or in the overlying mantle wedge. These results suggest that the fast dehydration of antigorite may well trigger the seismicity at intermediate depth in subduction zones.

[1] Chollet *et al.* (2011) *Journal of Geophysical Research*, **116**, B04203.