MINERAL EQUILIBRIA IN MANTLE

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Solid diffusion acts to return mantle mineral assemblages to chemical equilibrium,but it may be too sluggish to reach an ambient equilibrium under the PT conditions of subduction or mantle convection. The mineral equilibrium state can be accessed by the analysis of radiogenic isotopes in mantle minerals, Although they are very low in trace elements and difficult to analyze. Furthermore, there is often considerable contamination of mantle samples caused either by tectonic uplift or by the erupting magma transporting the sample to the surface. Consequently, reliable isotopic mineral data exists for only a hand full of mantle samples. Using the Nd isotopes, we find that mineral equilibrium is actually the exception and normally the minerals are out of equilibrium. In order to access the cause of disequilibrium, we analyzed the REE partitioning between garnet and clinopyroxene in fife of eclogitic xenoliths from kimberlites. Some of those eclogites contain diamonds. Two eclogites are in isotopic equilibrium between garnet and clinopyroxene, while all the others are out of equilibrium. From the Nd isotopic systematic found in eclogites “end-member samples” are chosen for this study. The REE partitioning ranges over several orders of magnitudes. From the REE pattern and the partitioning ratio we can conclude that most of the disequilibrium is a pre-metamorphic relict. In one group of samples for example garnet actually replaces feldspar and the REE pattern in the garnet still has a positive Eu anomaly and the REE concentrations are lower than expected for equilibrium with the coexisting clinopyroxene.