A New Experimental Approach for Study Metasomatism of Peridotite in the Earth's Mantle

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Experiment Purpose Inside the earth’s mantle, chemical reactions take place between different rocks via a fluid-rock reactions which in turn influence their chemical properties. These reactions are called metasomatism and they influence a variety of geological phenomena (e.g., diamond formation). The purpose of the study is to better understand and characterize the products from by the reaction between two mantle rocks called Eclogite and Peridotite. Procedures The experiments are conducted in high-pressure and high-temperature conditions, simulating the conditions in the mantle at ~120 kilometers under the earth’s surface. Thus, mimicked the interactions between the two mantle rocks in a special apparatus called “Rocking Multi Anvil”, that rotates at a constant frequency to maximize the interaction between the rocks. The products, were analyzed using Laser-Ablation ICP-MS and Electron Probe Micro Analyzer to determine the chemical composition of the fluid and the solid phases. Results The results showed that the reaction between the melted Eclogite and the Peridotite created modified mineral phases (Orthopyroxene, Clinopyroxene). The melted phase was rich in Mg, Si, K and H2O. In addition, the rotation frequency of every 15 min was found to be optimal to avoid a creation of a barrier between the different rocks that can stop the reaction. Conclusions The fluid composition that was created via the interaction between the Eclogite and Peridotite was similar to Type II Kimberlite, a volcanic rock that can be found in the earth crust. Kimberlites originate deep in the mantle and in many cases contain diamonds. This study is a fundamental study that can shed light on processes that naturally take millions of years at depths that are unreachable for direct study.

Awards Won:
Third Award of $1,000
Geological Society of America &amp
American Geosciences Institute: Third Award of $750