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Phase relations in amphibole-bearing ultramafics: experimental results up to 2.2 GPa and 1000˚C.

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The presence of pargasitic amphibole as an ubiquitous phase in the uppermost mantle has been widely proved by several experimental works and natural evidences from amphibole-bearing mantle xenoliths and “alpine-type” peridotites. It has been shown that amphibole stability depends mainly on μH2O and alkali content. Constraining the amphibole stability relationship is of fundamental importance in order to understand metasomatic and melting processes occurring in the mantle.

Subsolidus phase relations in hydrous ultramafics have been investigated by piston cylinder experiments in the systems Na_2O-K_2O-CaO-FeO-MgO-Al_2O_3-SiO_2-H_2O (NKCFMASH) and TiO_2-Na_2O-CaO-FeO-MgO-Al_2O_3-SiO_2-H_2O (TiNCFMASH). Natural, slightly depleted, lherzolite composition was considered in the NKCFMASH system, while a MORB pyrolite has been investigated in the TiNCFMASH system. Starting materials have been prepared as seeded gels. Runs have been performed at pressure ranging from 1.5 to 2.2 GPa and temperature from 800˚C to 1000˚C. Most the experiments were carried out at fluid saturated conditions. The oxygen fugacity was controlled using NNO buffer.

At P-T conditions investigated amphibole is the ubiquitous hydrous phase; in the system NKCFMASH it coexists with phlogopite. The spinel-garnet transition, in both systems, has a negative slope between the breakdown of chlorite and the water saturated solidus. Coexisting garnet and amphibole show an inverse correlation betweeen xMg and Ti content: in amphibole Ti increases with T, while xMg decreases; the opposite is shown in garnet. These results suggest the possible use of Ti content in amphibole coexisting with garnet as a geothermometer for amphibole-bearing ultramafics.