

Melting relations of the primitive mantle composition in the CMAS-H₂O system at high pressures

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The hydrous phase relations of primitive mantle in the CMAS-H₂O system with 1, 2 and 5 wt.% H₂O have been investigated at 4, 6.5, and 8 GPa. The dissolution temperatures of garnet decreases more rapidly than that of the other crystals at 4 and 6.5 GPa. The dissolution curves of garnet and pyroxenes cross at 6 GPa and 1700C in the 2 wt.% H₂O-bearing system. The stability field of orthopyroxene in the residue increases with increasing H₂O content at 4-8 GPa. Liquids formed by low degree melting become depleted in SiO₂ with increasing H₂O contents at 4-8 GPa. Composition of liquid becomes poor in Al₂O₃ with increasing H₂O contents at 8 GPa. Cratonic peridotites and the secular variations in geochemistry of komatiites can be explained by a reduction in H₂O contents in the mantle through time.

The hydrous phase relations of primitive mantle compositions in the CaO-MgO-Al₂O₃-SiO₂-H₂O system with 1, 2 and 5 wt.% H₂O have been investigated at 4, 6.5, and 8 GPa. The dissolution temperatures of garnet decreases more rapidly than that of the other crystals at 4 and 6.5 GPa. The dissolution curves of garnet and pyroxenes cross at 6 GPa and 1700C in the 2 wt.% H₂O-bearing system. The stability field of orthopyroxene in the residue increases with increasing H₂O content at 4-8 GPa. Liquids formed by relatively low degrees of melting become depleted in SiO₂ with increasing H₂O contents at 4-8 GPa. Garnet becomes stable until high degree of melting and composition of liquid becomes poor in Al₂O₃ with increasing H₂O contents at 8 GPa. Cratonic peridotites can be formed as residue of more than 40% degree of melting in pyrolitic mantle with less than about 5 wt.% H₂O at 4-6.5 GPa. Compositions of aluminum depleted komatiite consistent with liquid formed by more than 30% melting in the 5 wt.% H₂O-bearing system at 8 GPa. Aluminum undepleted komatiite can be formed by more than 60% melting of 2 wt.% H₂O bearing pyrolite at around 6 GPa. Compositions of Mesozoic komatiites are consistent with liquids formed by low degree of partial melting at 4 GPa in the dry system and the hydrous system up to 2 wt.% H₂O. Cratonic peridotites and the secular variations in geochemistry of komatiites might be explained by a reduction in H₂O contents in the mantle through time.