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Melting Phase Relations and "Stishovite Paradox" in Lower-Mantle System MgO – FeO – SiO_2 at 24 GPa

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Stishovite is missed in model composition of the ultrabasic lower mantle (Akaogi, 2007; Stixrude, Lithgow-Bertelloni, 2007). It is due to the fact that mineralogy of the lower mantle is estimated by experimental study of phase relation of the pyrolite composition up to 50 GPa. It was found that ultrabasic assemblage magnesiowustite+Mg-perovskite+Ca-perovskite is stable at *PT*-conditions of the lower mantle. However, stishovite is a representative phase in basic assemblage stishovite+Ca-perovskite+Mg-perovskite+Al-bearing resulted in similar experiments with basaltic compositions. But in this case stishovite should be subducted into the lower mantle. Meanwhile, paradoxal intergrowths of stishovite with magnesiowustite, indicatory mineral of the ultrabasic lower mantle, were found out as inclusions in "super-deep" diamonds (Kaminsky, 2011, for review). Physicochemical reasons for *in situ* formation of stishovite and assemblage of stishovite and magnesiowustite ("stishovite paradox") at the primitive lower mantle were earlier discussed (Litvin et al, 2014). The discussion was based on preliminary data for melting phase relations of the lower mantle system MgO – FeO – SiO_2 – Ca-perovskite.

The goal of this work is experimental investigation of phase relations on the ternary MgO – FeO – SiO_2 join of the lower mantle system MgO – FeO – SiO_2 – CaO at pressure of 24 GPa. The sections $(MgO)_{70}(FeO)_{30}$-$(SiO_2)_{70}(FeO)_{30}$ and $(MgO)_{30}(FeO)_{70}$-$(SiO_2)_{30}(FeO)_{70}$of the ternary join were studied and melting phase diagrams for them constructed.

Melting relations of the MgO – FeO – SiO_2 join are characterized by formation of invariant peritectic point (Mg,Fe)-perovskite+(Mg,Fe)O+stishovite+L(liquid) and monovariant cotectic curve (Mg,Fe)O+stishovite+ L at compositions richer in FeO. Thus, peritectic reaction of (Mg,Fe)-perovskite and Fe-richer liquid is responsible for magnesiowustite (Mg,Fe)O + stishovite SiO_2paragenesis. Origin of model primary ultrabasic magma is under control of magnesiowustite+Mg-perovskite+L invariant eutectics. By scenario of fractional crystallization, a figurative point of the magma composition is moving along the monovariant curve magnesiowustite+Mg-perovskite+L towards the invariant peritectic magnesiowustite+Mg-perovskite+stishovite+L where "stishovite paradox" is first realized. After disappearance of Mg-perovskite in peritectic reaction a further change of the basic residual magmas and stable existence of stishovite and magnesiowustite is regulated by the monovariant curve magnesiowustite+stishovite+L. The role of magnesiowustite as a "through mineral" for the lower mantle ultrabasic and basic materials and, evidently, for the "super-deep" diamond parental media is justified by this. Thus, experimental evidences of existence of assemblage magnesiowustite+stishovite were obtained. The results described above demonstrate that stishovite is *in situ* mineral of the lower mantle.

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