Melting experiments of hydrous peridotite under the uppermost lower mantle conditions

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Seismological low-velocity anomalies have been observed at the uppermost lower mantle, and results from a mantle melting due to dehydration decomposition of ringwoodite to bridgmanite and ferropericlase. For better understanding of the melting phenomena at the top of the lower mantle, melting experiments of hydrous peridotite with 2.0 wt.% H_2O have been conducted at 26 GPa and at temperatures from 1673 K to 2023 K. As starting materials, peridotite composition with different iron valence were used. All recovered samples from the melting experiments showed the quenched melt texture. The difference between ferric iron (Fe^{3+}) system and ferrous iron (Fe^{2+}) one is the melt fraction. The melting temperature of the Fe^{3+}-bearing hydrous peridotite is lower because its melt fraction is larger. The solidus temperature of the hydrous peridotite with 2.0 wt.% H_2O is below 1673 K, which is lower than normal mantle geotherm. This result strongly supports the H_2O-induced melting at the top of the lower mantle. The composition of partial melt coexisted with brigmanite is SiO_2-poor and MgO-rich, and is inconsistent with that of dry peridotite system. The water content of the partial melt is about 30-50 wt.%, and the melt is less dense than surrounding lower mantle. The H_2O-rich melt goes upward and the mantle transition zone can be kept hydrous condition.

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