High pressure melting of MgSiO3-H2O system at pressres corresponding to the Earth's mantle transition zone.

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Melting relation of MgSiO3 enstatite has been clarified in the pressure range from 0 to 12 GPa under hydrous conditions. The congruent melting behavior to form Mg2SiO4 forsterite and SiO2 enriched liquid at

0-3 GPa, and the congruent melting behavior at further high pressure to 12 GPa has been recognized. We conducted the melting experiment in the systems MgSiO3-15.2 wt % H2O and 8.2 wt % H2O at above 12 GPa to clarify the effect of water on melting phase relation of MgSiO3 in the pressures corresponding to the Earth's mantle transition zone.

I found that melting behavior changes from congruent to incongruent melting at around 13 GPa. The generated liquid is enriched in MgO composition because SiO2 stishovite coexists with the liquid. At 15 GPa, the solidus temperature is about 1173K, while at 13 GPa the temperature is about 1673K. This shows that the solidus temperature suddenly decrease with changing melting behavior at about 13 GPa. Moreover it is expected that the liquidus phase change from clinoenstatite to stishovite with increasing pressure and water content.

One of most important results is that the generated liquid has variations with increasing pressure. At 0-3 GPa, the liquid is enriched in SiO2 composition (Andesite magma), at 3-13 GPa that is MgSiO3 composition, and above 13 GPa that is enriched in MgO composition, which is opposite to that at 0-3 GPa.

MgSiO3 is one of the major constituent minerals in the Earth's mantle, and it is expected that the MgO enriched liquid should be generated in the depth of the transition zone if water is present.