

Phase relations among garnet, ilmenite and perovskite in the system $\text{Mg}_4\text{Si}_4\text{O}_{12}$ - $\text{Mg}_3\text{Al}_2\text{Si}_3\text{O}_{12}$, based on thermodynamic data

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Ilmenite solid solutions in the system $\text{Mg}_4\text{Si}_4\text{O}_{12}$ - $\text{Mg}_3\text{Al}_2\text{Si}_3\text{O}_{12}$ were synthesized at high pressures and high temperatures, and the enthalpies of the ilmenite samples were measured. Combining the enthalpy data of ilmenite with those of garnet and perovskite measured previously, phase relations on the garnet-ilmenite-perovskite transitions were calculated. The results show that stability field of ilmenite shrinks to MgSiO_3 -rich side with increasing temperature. By applying these results to the mantle, it is concluded that majorite garnet transforms directly to perovskite at the top of the lower mantle, and that it transforms to perovskite via ilmenite in subducting slabs.