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Dehydration of chlorite and formation of a new hydrous phase

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Subducting slabs are supplying water into the deep mantle, so the stabilities of hydrous minerals under high pressure and high temperature are important issue to clarify the water transportation mechanism into deeper part of the Earth's mantle. Dense hydrous magnesium silicates (DHMS) have been well constrained in the MgO-SiO_2-H_2O system, while few researches have been done in the MgO-SiO_2-H_2O-Al_2O_3 system under relatively high pressure (i.e. higher than 6 GPa). Previously we have reported the existence of a new aluminum-bearing hydrous phase named 23A phase, which shows a quite unique structure among the mantle minerals in having an extraordinarily long c axis (~23A). This new hydrous phase can be stable as deep as the lower part of upper mantle. Here we conducted high pressure and high temperature experiments on the decomposition of natural chlorite. At 6 GPa 700oC, we found the coexistence of chlorite, pyrope and Mg-surssasite, while at 7 GPa and 800oC the chlorite decomposes into 23A phase plus pyrope, chondrodite and fluid. The discovery of 23A phase in the chlorite composition extends the stability region of hydrous phases in the subducting slabs, and may also open a new field on studying the structure of hydrous phases under high pressure. This 23A phase may play an important role in transporting water into the deep Earth along the subducting slabs.

Keywords: chlorite, new hydrous phase, subduction, high pressure and high temperature