

High-Pressure Phase Transitions of the Feldspars and Further Characterization of Lingunite

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Abstract

All known high-pressure phase transitions of the feldspar end-members of albite ($\text{NaAlSi}_3\text{O}_8$), anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_8$) and orthoclase (KAlSi_3O_8) are reviewed and summarized. Although all these end-members crystallize in the feldspar structure at ambient conditions, the high-pressure phase behavior of these feldspars is rather different from each other except for the formation of the pair of $\text{NaAlSi}_3\text{O}_8$ -hollandite and KAlSi_3O_8 -hollandite. Yet, the maximum solubility of $\text{NaAlSi}_3\text{O}_8$ -hollandite in KAlSi_3O_8 -hollandite was found to be limited to ~ 51 mol% at 22 GPa and 2200 °C. Among all high-pressure Na^+ , K^+ and Ca^{++} aluminosilicates found in the feldspars (6 in total), only $\text{NaAlSi}_3\text{O}_8$ -hollandite (or lingunite), KAlSi_3O_8 -hollandite, and slightly Ca-rich hollandite ($\text{An}_{52}\sim\text{An}_{56}$) have so far been discovered in shocked meteorites. Raman spectrum is available only for natural lingunite, and it has been compared with those of synthetic KAlSi_3O_8 -hollandite, $\text{NaAlSi}_3\text{O}_8$ -glass and stishovite.