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Subsolidus and melting experiments of a K-rich basaltic composition to 27 GPa: Implication for the behavior of potassium in the mantle

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ABSTRACT

Subsolidus and melting experiments of a K-rich basaltic composition have been performed to 27 GPa. Pyroxene and majoritic garnet contain significant amounts of K_2O (1–2 wt%) at 6–12.5 GPa and above 22.5 GPa, respectively. Both pyroxene and garnet may act as main reservoirs for K in the mantle. Sanidine ($KAlSi_3O_8$) or its polymorph potassium hollandite is the first phase to be melted up to 20 GPa, but potassium hollandite becomes a liquidus phase at $P \geq 22.5$ GPa. In contrast to its typical incompatible behavior at low pressures, potassium is a compatible element in the deep mantle, at least in basaltic systems. This compatible behavior implies that a K-rich melt like kimberlite is difficult to generate at lower mantle conditions.