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The fusion curve of albite revisited and the compressibility of $NaAlSi_3O_8$ liquid with pressure

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ABSTRACT

The 1bar, thermodynamic properties of crystalline and liquid $NaAlSi_3O_8$ are used to calculate the fusion curve of albite to 10 kbar. The calculated temperatures ($\pm 2\sigma$) of the melting reaction are 1152 (± 7) °C at 3 kbar and 1247 (± 24) °C at 10 kbar. The location of the calculated fusion curve to 10 kbar is in excellent agreement with phase-equilibrium constraints on the *maximum* and *minimum* temperatures of the fusion curve at 3 and 15 kbar, respectively. Calculation of the melting reaction at pressures >10 kbar requires that the pressure dependence of the liquid compressibility ($K_0' = dK_{T,0}/dP$, where $K_{T,0} = 1/\beta_{T,0}$) be known. On the basis of five half-reversal, crystallization experiments in the literature, which collectively provide *minimum* temperatures of the fusion curve between 12 and 32 kbar, K_0' (derived from the Birch-Murnaghan relation) is constrained to be ≥10 for liquid $NaAlSi_3O_8$. A comparison with other silicate liquids shows that there is a strong, positive correlation between the compressibility at one bar ($\beta_{T,0}$) and K_0'. In addition, data on the water-saturated fusion curve of albite are used to quantify the effect of small amounts of H_2O (≤1 wt%) on lowering the melting temperature of albite (≤68 degrees).