

## Halite-sylvite thermoelasticity

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### ABSTRACT

Unit-cell volumes of four single-phase intermediate halite-sylvite solid solutions have been measured to pressures and temperatures of ~28 kbar and ~700 °C. Equation-of-state fitting of the data yields thermal expansion and compressibility as a function of composition across the chloride series. The variation of the product  $\alpha_0 K_0$  is linear (ideal) in composition between the accepted values for halite and sylvite. Taken separately, the individual values of  $\alpha_0$  and  $K_0$  are not linear in composition.  $\alpha_0$  shows a maximum near the consolute composition ( $X_{\text{NaCl}} = 0.64$ ) that exceeds the value for either end-member. There is a corresponding minimum in  $K_0$ . The fact that the  $\alpha_0 K_0$  product is variable (and incidentally so well behaved as to be linear across the composition series) reinforces the significance of the complementary maxima and minima in  $\alpha_0$  and  $K_0$  (significantly, near the consolute composition). These extrema in  $\alpha_0$  and  $K_0$  provide an example of intermediate properties that do not follow simply from values for the end-members.

Cell volumes across this series show small, well-behaved positive excesses, consistent with K-Na substitution causing defects through lattice mismatches. Barrett and Wallace (1954) showed maximum defect concentrations in the consolute region. Defect-riddled, weakened structures in the consolute region are more easily compressed or more easily thermally expanded, providing an explanation for our observed  $\alpha_0$  and  $K_0$  variations. These compliant, loosened lattices should resist diffusive transfer less than non-defective crystals and, hence, might be expected to show higher diffusivities. Tracer diffusion rates are predicted to peak across the consolute region as exchange diffusion rates drop to zero.