

## **SHORT-RANGE, LONG-RANGE CATION ORDER AND PHASE RELATIONS IN PLAGIOCLASES.**

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Plagioclase feldspars exhibit various phase transitions which are associated with Al,Si order-disorder. Understanding these phenomena requires the consideration of at least three order parameters  $Q_{ab}$ ,  $Q_{an}$  and  $s$ , which describe variations in long-range order (LRO) for the albite and anorthite schemes and short-range order (SRO). LRO and SRO correspond to statistically distinct strategies by which Al and Si can achieve a decrease in the configurational free energy. Phase transitions correspond to abrupt changes in the ordering strategy. To determine which strategy is most favored at given temperature and composition requires an expression which describes the free energy as a function of  $T$ ,  $X_{an}$ , SRO and LRO parameters, and interaction constants. The enthalpy term of the free energy is described considering both short-range and long-range interactions between Al and Si and short-range interactions between Al,Si and Ca,Na atoms. The Al,Si entropy as a function of  $Q$  and  $s$  is described using a new version of the Cluster Variation Method (CVM) which is adapted for lattices of complex topology. The calculations suggest that the degrees of SRO and LRO vary significantly in  $T$ - $X_{an}$  space producing sharp order-disorder transitions. The model predicts the development of albite-type and anorthite-type LRO at albite-rich and anorthite-rich compositions, while at intermediate compositions, in the low temperature range, a structure with a very high degree of SRO is stable. This accords with the available experimental information.