ELASTIC BEHAVIOR OF INTERMEDIATE PLAGIOCLASE AT HIGH PRESSURE

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Feldspars are one of the archetypical families of framework alumino-silicates. They not only comprise around 60% volumetrically of the Earth's crust, but are among some of the most structurally complicated minerals. Research is being carried out on intermediate plagioclase with the intent of determining their Equations of State (EoS; changes in volume with pressure), and establishing a conceptual model to characterize feldspar compression with pressure.

Equations of State are used to derive many of the primary thermodynamic properties of minerals that are factored directly into geologic models. Complex behavior has been observed in the EoS for plagioclase feldspars in excess of 3 GPa (Angel 2004), including an anomalous softening of ordered albite in excess of 8.4 GPa (Benusa et al 2005). It has been predicted that such behavior would occur at pressures within the metamorphic regime for some intermediate plagioclase compositions. I am currently measuring the unit cell parameters of plagioclase of compositions An37 and An50 using high-pressure single-crystal X-ray diffraction in order to determine their Equations of State.

Mineral elastic constants are important in both the interpretation of seismic data and in mathematically characterizing how hydrostatic strain is accommodated structurally. Brown et al (2006) have determined the 21 independent triclinic elastic constants for albite by measuring surface wave velocities with ISLS. Compliance moduli sums calculated from the data of Benusa et al (2005) were used to greatly reduce the uncertainty in these results. I am computing the sums of the elastic compliances for the current samples being measured and for archived data of other plagioclase sample. These sums will be used to constrain the results of further ISLS measurements by Dr. Brown's group. The relation between the triclinic elastic constants and composition should explain part of the mechanism for the observed structural changes in plagioclase feldspars.

Structural characterizations of other plagioclase feldspars under pressure are needed to define the scope of how minerals accommodate increased stresses and identify the causes. However, very few structural studies have been done on feldspars at high-pressure, limiting the understanding of why certain structural changes occur. Recently, Benusa et al. (2005) have described the structural evolution in ordered albite with pressure accompanying the observed anomalous EoS behavior. I am collecting intensity data for both An37 and An50 which will be used to determine their structures at various pressure intervals up to 10 GPa.

References Cited:

Angel, R.J. (2004) Equations of state of plagioclase feldspars. Contributions to Mineralogy and Petrology, 146, 506-512.

Benusa, M.D., Angel, R.J., and Ross, N.L. (2005) Compression of albite, $NaAlSi_3O_8$. American Mineralogist, 90, 1115-1120.

Brown, J.M., Abramson, E.H., and Angel, R.J. (2006) Triclinic elastic constants for low albite. Phys. Chem. Minerals, 33,256-265.

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