Projecting Mineral Elasticity Across Scales and Disciplines

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Minerals react to changes in the external physical conditions, such as temperature and stress, by elastic deformation. Fluctuations in stress and temperature can arise from a wide spectrum of processes. The propagation of seismic waves, for example, is controlled by the elastic properties of rocks. Seismic observations can therefore be integrated with mineral elasticity to infer the structure and composition of planetary interiors. Differences in the elastic relaxation between a mineral inclusion and the host phase can give rise to residual stresses that can be analyzed to reconstruct the pressure and temperature when the host–inclusion pair first formed. The disparate thermal expansion properties of mineral grains translate temperature fluctuations on the surfaces of Earth and other planets into thermal stresses within rocks that drive mechanical rock weathering. In addition to these natural examples, elastic properties are central to the application of minerals, or mineral-like materials, in construction and insulation materials, as optical and electronic components, and in other technologies. On the microscopic scale, the elastic properties reflect the atomic architecture of the crystal structure and can be affected by phase transitions and structural instabilities. As a consequence, domain structures of crystals often tend to minimize elastic strain energy. With this session, we aim at showcasing recent advances in the study of mineral and rock elasticity with applications spanning from earth and planetary sciences to modern-day technologies. We are looking forward to experimental, computational, and theoretical contributions to mineral elasticity from atomic to planetary scales.