A High Pressure XRD Study of Structural Changes in Anglesite

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As part of understanding the global sulfur cycle, we need to understand the behavior of sulfates in the deep Earth. Previous spectroscopic studies have suggested anglesite undergoes structural changes at about 14 and 21 GPa (Lee et. al., 2013, Sawchuk et. al. in preparation). A recent X-ray diffraction study shows no evidence of a phase transition up to 21.6 GPa. Here we report new measurements describing the high-pressure structural evolution of anglesite ($PbSO_4$) to 45 GPa. Powder X-ray diffraction data were obtained at beamline 12.2.2 at the Advanced Light Source (ALS). Natural samples of anglesite were ground into a powder, loaded into a diamond anvil cell with a Ne pressure medium, using the gas loading system at the ALS. In the first experiment the sample was pressurized in ~5GPa steps to 30 GPa, after which the sample was laser heated and quenched. In the second experiment the sample was pressurized to 45 GPa in ~2GPa steps and decompressed in steps of ~5-10 GPa. Diffraction patterns were analyzed using Dioptas and APEX (UCLA's in-house software for quantitative powder diffraction analysis). Diffractions peaks were indexed as anglesite and their position was measured as a function of pressure. Each of the diffraction peaks varies smoothly as a function of pressure, indicating no reconstructive phase transition. However, at least two new peaks appear above 21.5 GPa, indicating a change in symmetry. We interpret the changes in the diffraction patterns in terms of structural evolution of the lead and sulfate polyhedra within the sulfate structure.