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Structural control on displacive phase transitions in minerals at high pressures

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High-pressure phase transformations resemble discontinuous thermodynamic and structural changes of materials, which can be assigned to configurational instabilities and lattice-related boundary conditions. In particular transformations, which are predominantely displacive in character, reveal structural control across the critical transition pressures through the structures of the polymorphs involved. Three examples of high-pressure phase transitions will be presented, which have been subject to a series of experimental studies at high pressures using diamond-anvil cells. The first example deals with clinopyroxenes, their static elasticities and elastic anomalies associated with occuring first-order transition. The example of spodumene will demonstrate in particular the structural role of the silicate-chain units, and exemplifies the pronounced deviation from conventional equation-of-state behaviour in the proximity of the critical transition pressure. The second example deals with the high-pressure phase transition of behoite and the structural control of hydrogen bridging on first-order transformations in simple (hydr)oxide phases. The third example will present the second-order transition in the silicate mineral benitoite, which has been chosen to demonstrate the need for high-precision single-crystal techniques in order to track down subtle structural changes related to high-pressure transitions.