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Pattern Formation in a NaCl Crystal undergoing Strain-enhanced Dissolution ZVI KARCZ, DENIZ ERTAS, RICHARD POLIZZOTTI, ExxonMobil Research and Engineering, EINAT AHARONOV, Weizmann Institute of Science, CHRIS SCHOLZ, Lamont Doherty Earth Observatory — Observations of an initially circular contact ($\sim$300μm in diameter) between the [100] face of a single-crystal NaCl shaped as a truncated cone and a flat silicate plate immersed in saturated solution indicate that the crystal deforms in two sequential stages under constant normal load. The first is characterized by contact area reduction and slow convergence rates, and the second by fluctuations in contact area and fast and fluctuating convergence rates. Fluctuations are on a timescale of $\sim$14 hours. The transition between the stages occurs at the maximum contact stress, which shortly precedes the maximum convergence rate. Confocal images indicate that the crystal dissolves coaxially during the first stage, producing a decreasing static contact. During the second stage, the contact shape is highly irregular, with channels and ridges forming inside the contact. These observations reflect a system evolving towards a non-equilibrium steady state, controlled by the interaction between strain-energy driven undercutting dissolution and plastic flow. Undercutting dissolution reduces the area of the contact, and preferentially removes regions with high dislocation density, while plastic flow increases the contact area by mobilizing dislocations that strain harden the crystal. The feedback between these two mechanisms drives the system towards a dynamic steady state.

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