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Numerical simulation of the experiment on the measurement of salt creep

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In this research, we collect data on salt creep and establish a database for creep of evaporite rocks at temperature up to 250°C, and compare different published creep laws based on solution-precipitation creep, and dislocation creep. The largest differences stem from lithological variations, with bischofite and epsomite being the weakest, carnalite intermediate, halite, sylvite and anhydrite being the strongest ductile evaporite. Under the same conditions, different halites can creep at two orders of magnitude different rates at a given differential stress, in agreement with observations of small scale folding in salt mines.
We support this work by finite element simulations of the uniaxial compression of a cylindrical sample with variable rheologies and comparison of the computed stress-strain response with measurements, for different values of friction at the pistons. We use the commercial finite element package ABAQUS(tm), and model salt as a power-law creep material including elasticity.
We find that friction at the piston produces different barreling profile for different power law exponents of the creep law, and a small but significant effect on the stress-strain response as compared to frictionless piston with homogeneous deformation. We discuss different methods to compensate for this effect and to extract the optimum creep law from such measurements.