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The structural evolution of soft K-Mg salts in the Veendam Pillow, northern Netherlands.

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The aim of this work is to understand the structural evolution and the role of soft K-Mg salts imbedded in rocksalt, and to study the mechanical effects of this high mechanical heterogeneity on salt deformation. The complex, internal geometries of salt structures in the Dutch Zechstein are related to long-term creep and complex folding of layered evaporites. To understand the interaction of mechanically strong anhydrite and rocksalt layers with the much weaker K-Mg salts, with a viscosity contrast of up to five orders of magnitude, thereby is of high interest. Our study area is the Veendam Pillow, a large Zechstein salt structure on the southern Groning High. The salt structure is used for Mg-rich bischofite ($MgCl*6H_2O$) squeeze and solution mining. For our structural study we use high resolution interpretations of industrial 3D seismic data and well logs as well as core data for chemical and microstructural analysis of the Z3 and Z4 sequences. The 3D seismic interpretation reveals a good overview of the internal salt structure due to the sonic contrast between anhydrite, halite and K-Mg salts. Thickening of the soft Z3 salts in the crest of the saltdome and strong folding of the Z3 anhydrite is visible. On basis of our results, we designed numerical simulations using the finite element package ABAQUS to estimate the displacement field of K-Mg salts during tectonic movement. First results revealed that brittle, mechanically strong anhydrite layers have a high impact on the surrounding softer salts by folding with amplitudes of several hundred meters, and that the K-Mg salts are easily squeezed and fold on a much smaller scale.