Role of impurities within the salt layers on the long-term rheological variations within the evaporite sequence. A case study from the Ocnele Mari salt mine, Romania

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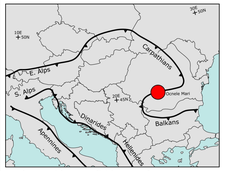
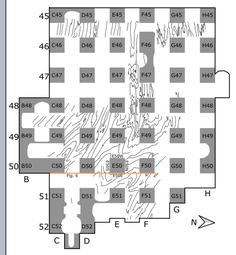
Ocnele Mari Salt Mine, Romania



Location of the mine



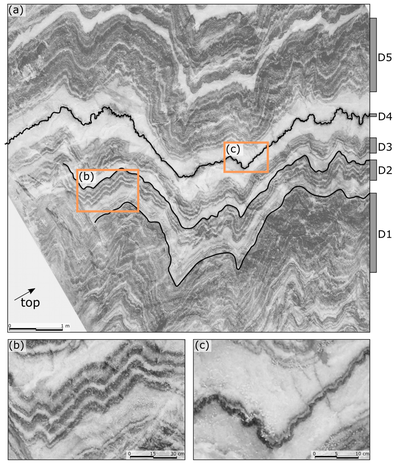
Map of the mine

3D digital model of the pillar D49

Excellent 3D exposure of layered, folded rock salt in Ocnele Mari salt mine, Romania.

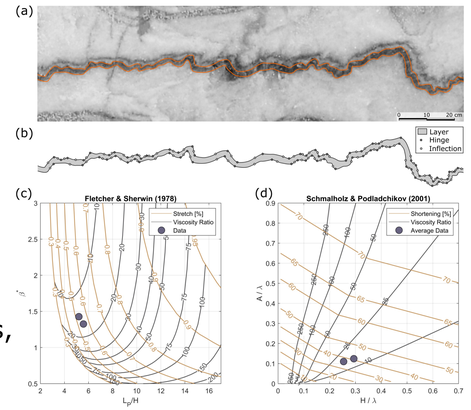
Regularity in the fold pattern at various scales clearly indicates that the sequence must be mechanically stratified.

Fold shape analysis



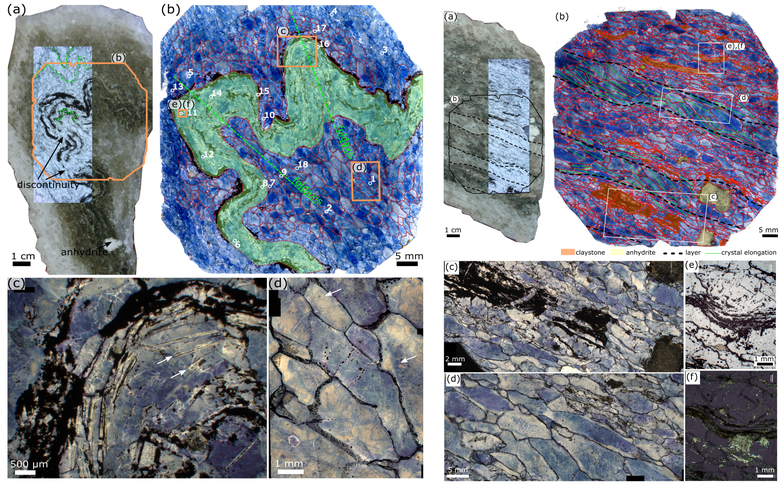
Folds occur on various scales ranging from centimeters to tens of meters and and form spectacular polyharmonic structures.

Development of polyharmonic folds requires a range of geometrical and mechanical conditions to be satisfied. Thus, for a given configuration of layers, it can be used to constrain mechanical properties of the layers. The field observations allow us to design such a model.



Single layer fold shape analysis allowed to estimate viscosity ratio.

Microstructural analysis

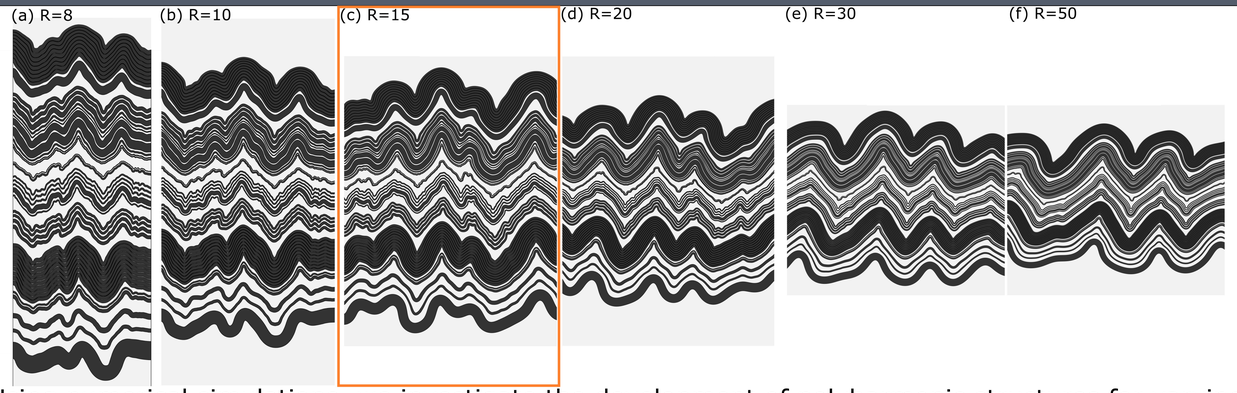


Thin sections and optical microscopy of gamma-decorated samples.

Distinct layering is caused by variation in the fraction of impurities.

Microstructures show evidence for solution-precipitation creep indicated by dislocation-free grains with truncation and overgrowth structures. The strucutes are indicative for linear (Newtonian) viscous rheology.

Numerical modelling



Using numerical simulations, we investigate the development of polyharmonic structures for varying viscosity ratios between the stiff and soft layers. Through the comparison of the field data and numerical results, we estimate that the effective viscosity ratio must vary between 10 and 20. The results show that impurities can change the viscosity of rock salt and introduce anisotropy.