



Deformation of sediments with salt and shale layers in marginal parts of a basin – a natural example from Miocene deposits in Wieliczka region, Poland

Stanislaw Burliga

University of Wrocław, Institute of Geological Sciences, Poland (stanislaw.burliga@uwr.edu.pl)

The presence of salt and shale layers in deposits accumulating in marginal parts of sedimentary basins commonly triggers deformation of overlying sediments, primarily due to density unstable rock arrangement, high content of porous water in shales and salt, increasing load, topographic gradient and gravity. Examples of large-scale thrust-and-fold tectonics developed in such a rock setting are well known from seismic sections acquired e.g. in the Gulf of Mexico and Niger Delta regions. It is less known about the real record and style of sediment deformation in smaller scales, since these sequences can typically be observed in core-size specimens. This study focuses on analysis of sedimentary sequence deformation recorded in Miocene deposits accumulated in marginal area of a foreland basin at the front of an advancing orogenic thrust belt. The investigations were carried out in Wieliczka salt deposits, southern Poland, in an underground salt mine.

A salt series deposited in the Badenian/Serravallian in the Carpathian Foredeep basin in the Wieliczka region comprises interlayering rock salt and claystones, with minor sulphate and other clastic rock intercalations. At present, these deposits occur within a thrust-fold complex and contain abundant tectonic structures, indicative of several stages of deformation of this sedimentary sequence. The earliest, soft-sediment deformation is documented by tectonic structures related to redeposition of sediments, slumps, slides and sediment liquefaction. These were superimposed by tectonic structures developed during thrust-folding triggered by advancing Carpathians thrust-sheets. Sets of folds, faults, thrusts, boudinage and veins originated during both stages. There are also examples of reactivation of some soft-sediment deformational structures during large-scale thrusting, although it may be challenging to decipher timing of the deformation due to superposed selective recrystallization of halite in rock salt, phase changes in sulphates and occurrence of secondary cements in rocks. The latest deformation is related to brittle fracturing and fluid circulation in this lithified, deformed rock complex, being evidenced by sets of fractures and veins filled with secondary minerals. The studies imply that in marginal parts of basins deformation is progressive and the early soft-sediment deformational structures can become incorporated and evolve in large-scale thrust folds during the development of the latter. At each stage of deformation fluids played an important role, therefore, their influence on both rock salt and shale rheology should be considered, if deformation of sediments near continental margins is to be simulated by numerical or analogue models.