Shear-Induced Modification of Layering in Rock Salt Complexes

Stanisław BURLIGA

Institute of Geological Sciences, Wrocław University, Pl. M. Borna 9, 50 – 204 Wrocław, Poland

Layering in rock salt complexes dominantly results from seasonal changes in chemical composition of brine from which salts precipitate. In rock salt deposited in the Polish Zechstein basin, layering is mostly visible due to darker colour caused by the presence of dispersed anhydrite or clay among halite grains. Less frequently it is marked by discrete layers of potash. However, observations carried out in the Kłodawa salt diapir and in salt bodies on the Fore-Sudetic Monocline indicate that layering may also develop or be significantly modified long after the deposition in response to superposed shearing. Three types of such modification are observed: (i) secondary potash layers developed in originally potash-free rock salt; (ii) massive anhydrite or clay layers developed by segregation within rock salt beds; (iii) rock salt layers developed within salty clays in result of halite precipitation from migrating solutions.

New, secondary potash layers formed in a layered rock salt with anhydrite - bearing laminae that occur in stratigraphic and tectonic vicinity of the Z3 Younger Potash complex. They are seen as mixed potash-anhydrite laminae at the borders of rock salt layers or thin potash laminae inside the rock salt layers. Their post-diagenetic, tectonic origin is proved by tectonic structures preserved at some localities of the salt complex. In many rock salt layers, there are sets of evenly spaced tension gashes filled with potash. They make up an angle of about 45° with the layer boundaries. In places, the gashes have become connected by joints that are also filled with potash. All these features indicate that the potash laminae in this complex resulted from simple shearing and layer-parallel movement of salt and they evolved from tension gashes. The adjacent Z3 Younger Potash complex was most likely the source of K-Mg - bearing brines, which penetrated the neighbouring complexes after their deposition.

Thin laminae of anhydrite or clay have developed in rock salt complexes, which contain dispersed anhydrite or clay. The layers result from a spatial rearrangement of bed constituents rather than from migration of elements. These weakly soluble minerals became concentrated in tectonically preferred zones during salt flow, making up layers of 0.1–15 cm in thickness. In meso-scale it is best visible in the hinges of sheath folds and in narrow shear zones developed close to major lithological boundaries, and is marked by local depletion or increase of colour intensity in rock salt and anhydrite/clay layer, respectively. Micro-scale observations show that the rearrangement is due to dynamic recrystallization of rock salt under shear stress conditions. It led to reduction of halite grain size, elongation and rotation of halite grains, and to mineral segregation along the shear-induced displacement zones.

Post-diagenetic rock salt layers occurring in salty clays are less regular than the above types and it is often impossible to assess their actual origin. They developed from halite veins which formed within a salty clay bed during its brittle deformation. Geometry of these veins and fractures indicates that again simple shear was the mechanism responsible for building up strain within the bed, as a layer-parallel tectonic displacement is indicated. Preserved tectonic structures suggest that the development of a new rock salt layer begins with a formation of sets of cracks, oriented parallel and obliquely to layering, and growth of fibrous halite crystals parallel to the displacement direction. As the cracks open, crystals of fibrous halite gradually fill in the space and eventually make up a continuous vein of fibrous halite. Subsequent recrystallization of fibrous halite into more isometric forms of crystals causes that layer-parallel veins become similar to sedimentary laminae.

The above observations show that simple shear strain may significantly modify layering or even bring to the existence new, secondary lamination in rock salt complexes. New layers develop due to a range of processes accompanying progressive simple shear, such as pressure solution, grain boundary slip and solution transfer amongst the most important.

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Tectonics of the Northern Part of the Moravian Karst

Vojtěch DVOŘÁK and Rostislav MELICHAR

Department of Geology and Paleontology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic

A quite complex tectonic structure of the northern part of the Moravian Karst is also reflected in papers of various authors. The latest investigations in the northern part of the Moravian Karst indicate the presence of a polyphase thrust tectonics.

No small-scale structures corresponding with the oldest phase were discovered because of their difficult identification and because of significant presence of the younger phase of thrusting. It is accompanied by formation of brittle-ductile cleavage or ductile foliation. This planes strike NNE-SSW, their dip ranges from moderate to steep. An exception is an area north of Holštejn village and another area in the surroundings of Petrovice village where the cleavage turns into the N-S strike. NNE-SSW