

Exploration and Risk Assessment of Solution and Caving Caverns in the Old Mining of the Stassfurt Area

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1 Stassfurt's anticline: The cradle of the potash industry

When the Prussian minister-president FREIHERR VON MANTTEUFEL described the sinking works on the shaft named after him and firstly used for the rock salt extraction in the city of Stassfurt, that was influenced by its agricultural environment with the words:

“... now it is time to break up the shaft, from which we will wrest the precious treasure from the bowels of the Earth one day...”

neither he nor the numerous guests had the idea, that with these sinking works and the works at the engine shaft named after the Prussian trade minister *VON DER HEYDT*, that had begun one month earlier, a new industrial branch had its beginnings leading the whole region to economic growth during the “potash boom”. Neither both of these political supporters of the undertaking, nor the secret mountain councillor DR. RUDOLPH A.W. VON CARNALL, who was the actual initiator and creative expert, could estimate at this point of time, which difficulties would accompany the early years of the potash mining. After the potash mining started in 1861 and sinking works also began at shafts in Leopoldshall nearby, soon rock mechanical problems aroused leading to upper zone inflows and micro-earthquakes. So the mine of Leopoldshall I/II had to be given up in 1899. Nevertheless, next to fiscal plants also numerous private mining undertakings came up (figure 1), which mined kainitic and carnallitic ore especially at the SW flank and later also the NE flank of the anticline.

Due to the lack of experiences in the rock mechanical handling of these potash salt rocks and owing to ignorance of the complex interactions between rock deformation and solution processes during this pioneer era of the potash mining mistakes were made with consequential effects still affecting the city of Stassfurt and the surrounding area until today. These effects can be described by two scenarios:

- extraction induced ground deformations resulting in a surface lowering as well as hydraulic connections between the (all but one) solution filled mine structures and the multiple-aquifer formation.
- a resulting reactivation/acceleration of natural subsidence and/or solution processes of girder pillars and eventually a salinization of the ground water. In the Stassfurt area the ground waters had been salty before the times of mining and were already used for salting in the Mid Ages.

For guaranteeing the public safety the Landesamt fuer Geologie und Bergwesen Sachsen-Anhalt (LAGB) carries out extensive monitoring and exploration works for risk assessment of old potash shafts, which have been executed at the shaft Leopoldshall III (mentioned here as case study) by a bidding consortium led by ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau mbH.