

GPR SURVEYS SUPPORTING SALT CAVERN CONSTRUCTION

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Abstract

Especially in domal salt Ground Penetrating Radar (GPR) surveys are increasingly applied in the field of geological exploration for cavern locations. GPR measurements are primarily conducted in cavern wells which penetrated interbeds within the evaporite succession that are not suitable for cavern construction, such as anhydrite, mudstone or potash seams. The contrast of the dielectric permittivities of these lithologies to rock salt results in more or less intense reflections of the electromagnetic waves. A directionally sensitive borehole system with a receiving antenna at a center frequency of 50 MHz allows to infer the azimuth of reflectors in relation to the borehole. Measurements of distances in combination with reflector azimuth data then facilitates a three dimensional mapping of structures representing limits for solution mining within the salt formation, in particular where reflectors can be tied to borehole intersections, as evident from mud logging, coring or wireline logging data. This often results in a sound understanding of what cavern diameters can be realized at certain depths under consideration of a safety pillar width of rock salt between the cavern wall and the respective unfavorable lithology. In this context, GPR data sets are facilitating the definition of a rock mechanical envelope in which the cavern is to be constructed. The development of the cavern and the compliance with the minimum safety pillar width can be monitored from sonar survey to sonar survey. Though the effort to prepare a borehole for a GPR survey is significant, the GPR method is having a high potential to successfully support the definition of low-risk target locations for cavern wells in bedded salt deposits which were affected by the emplacement of steep intrusive dykes.

Key words: GPR (ground penetrating radar), cavern design, cavern development