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Ultrasonic survey of the Altaussee SCH1 cavern

Abstract

Subsurface ultrasonic surveys of caverns in the Haselgebirge are associated with a number of specific characteristics— in addition to the queries and special features that generally occur in ultrasonic surveys. The restricted headroom above the borehole and the narrow access routes to the caverns necessitate the use of special equipment and special ways of working in order to carry out surveys here.

In the Haselgebirge the deposit conditions are extremely inhomogeneous. The salt content varies greatly with depth and there is a large proportion of insoluble constituents. A description of these general conditions and how they are dealt with is given here by referring to the Altaussee SCH 1 cavern of Salinen Austria AG.

In the case of this cavern a borehole was drilled and equipped underground from a sublevel drift in the Altaussee salt mine in Austria. The cavern was leached with a compressed air blanket. Up until the end of leaching three surveys were carried out; the third survey was performed approximately six months before the end of leaching.

As the air-brine interface is somewhere in the roof zone or has dropped just below it, reflections of the ultrasonic beam occur at the interface and these prevent the roof from being fully surveyed. As a result of the pressure in the cavern being released gas bubbles are produced in the brine and these increasingly absorb the emitted ultrasonic energy when rising from the floor to the roof. At the time of the survey the upper part of the cavern was filled with significantly unsaturated brine, which led to large depth-dependent variations in the acoustic velocity. The acoustic beams were diffracted when they passed through zones with such variations.

The interpretation was correspondingly complicated and it was not possible to directly determine large parts of the roof due to the air-brine interface being just below the roof. A subsequent survey was therefore carried out using a borehole laser tool after the cavern had been partially emptied. The aim of this survey was firstly to determine the roof and the upper part of the cavern without being affected by the previously mentioned problematic measuring conditions, and secondly to enable 3D modeling.