Realization of a borehole for the installation of geomagnetic instruments

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The preparation of two deep wells of 140 and 240m depth are an essential component in the construction of the geomagnetic observatory on the Trafelberg at Muggendorf. The construction of an underground tunnel system about 30m below ground level with longitudinal and transverse tunnels for measuring the x- and y-direction are complemented with two deep boreholes for the implementation of geomagnetic measurements in the third dimension, i.e. the z - direction. The company Züblin Foundation Engineering, a subsidiary of Austrian construction company STRABAG was awarded the contract for the execution of these deep wells in October 2011 by the BIG (Federal Real Estate Company).

Special Technical challenges:

According to the client planning two deep boreholes (TB1A and TB2A) with drilling depths of 140m and 240m were required. Furthermore, the installation of a protective casing with an inner diameter of 240mm was provided. Special requirements of this tender were the adherence of verticality with a drilling accuracy of <1%, the injection of the annular space between the borehole wall and casing tubes, as well as the guarantee of absolute water tightness of the finished borehole. Another challenge was presented by the demand for a "anti-magnetic production", i.e. all built-in and remaining materials in the borehole are non-magnetic.

Figure 1: Borehole with casing.

Execution of drilling operations:

The execution of the drilling was done with a so-called "truck - rotary - drilling rig" with a weight of approximately 60 tons. With this rig, both the required core drilling, as well as the necessary “Rotationsspülbohrungen” and the pilot holes could be carried out with the down-the-hole hammer. The borehole No.TB1A was drilled without major problems, made up to 140m depth and the well casing was installed.

However, while drilling the borehole No.TB2A a karst cave was struck at a depth of about 110m below ground. This led to a significantly additional expenditure by backfilling with cement grout, bentonite and finally gravel grit 4/8 in the amount of about 150m³ and a considerable time delay regarding the completion of the drilling operations.

Installation of the well casing:

After pumping out the well casing the shallow borehole No.TB1A demonstrated no problems regarding tightness in the 240-meter-deep hole. However, in borehole No.TB2A a low but constant water influx was observed.

Ultimately, this led to the decision to remove the built-in PVC pipe of borehole No.TB2A by “überbohren” with a special tool over the entire length. The borehole was further widened to a larger diameter of about 440mm and a GRP piping DN280mm was placed.

Figure 2: Magnetic control measurements of No.TB2A.

This work was successfully carried out in the summer of 2013 and borehole No.TB2A was handed over to the client after a pressure test and 8 weeks of control measurement, in order to detect potential leaks, on 14 October 2013.

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