MODELLING THE BASE OF QUATERNARY DEPOSITS IN NORTHWEST GERMANY

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In Lower Saxony (Northwest Germany) the base of the Quaternary deposits shows a very complex relief. One of the most prominent morphological structures are the numerous buried tunnel valleys, which are mainly associated with the Elsterian glacial stage. These subglacial meltwater channels are typically between a few tens of meters up to 400 m incised into the underlying Tertiary sediments and bedrock (e.g. Kuster & Meyer, 1995).

The Quaternary deposits host most of the groundwater reservoirs in Lower Saxony and are also used for mining sand and gravel. Besides influencing the groundwater movement in the underground, the large buried tunnel valleys also help to indicate erosion depths of past glaciations. This plays a role in predicting the erosion depth of future glaciations in the context of finding a site for a repository for radioactive waste in Germany. Therefore, it is crucial to provide a revised comprehensive geological model of the base Quaternary in order to allow further research and decision making for sustainable resource management.

Almost three decades ago, Kuster & Meyer (1995) published a contour map of the base Quaternary in Lower Saxony. Since then a vast number of new datasets were obtained, which include detailed borehole data, geological transects, seismic datasets and regional small-scale 3D-models of the Quaternary sedimentary layers. As a result, we started modelling a 3D surface based on the new datasets and the original contour map by Kuster & Meyer (1995) using SKUA-GOCAD™ (AspenTech). Here, we are presenting the first completed sub-region of this model with new insights into the Quaternary of Lower Saxony, pointing out the challenges of data harmonization. The heterogeneous spatial distribution as well as the varying quality of the borehole data makes the combination with available 2D and 3D geological interpretations towards a consistent 3D surface difficult and very time consuming. However, the integrated borehole data (core logs and geochronology) provides very detailed information about the base of the Quaternary sediments, which subsequently improves the precision of the model. Additionally, we are achieving major advances in determining buried tunnel valleys through interpreting seismic datasets (2D and 3D). Our new 3D-model reveals significant differences compared to the contour map by Kuster & Meyer (1995). We were able to identify tunnel valleys that were unknown before and to revise the geometry of known subglacial channels. The depth of the base Quaternary was adjusted by up to 150 m in certain areas. After the completion of the first sub-region, we expect that the shape of the Quaternary base will look significantly different in the new 3D model throughout most of Lower Saxony.

References

Kuster, H.& Meyer, K.-D. (1995): Karte der Lage der Quartärbasis in Niedersachsen und Bremen, 1:500 000; Hannover.