CASE STORY: GROUNDWATER MAPPING IN BURIED PALEO CHANNELS

CLIENT

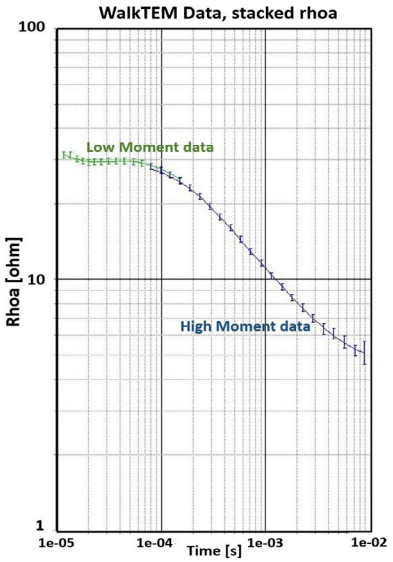
Authorities as well as commercial enterprises and individuals are initiating investigations in order to find and protect both national and local groundwater resources.

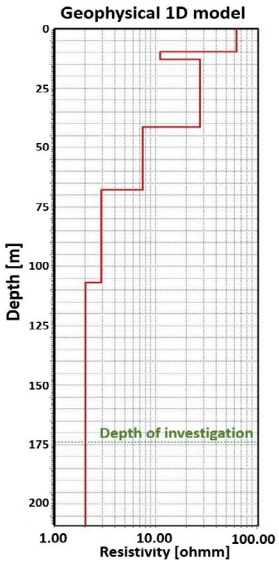
CHALLENGE

The supply of fresh water in Denmark is entirely based on groundwater resources, and it only passes through a very simple filtration and aeration process before being distributed to the consumers as drinking water. In order to maintain this low level of water treatment, high quality standards must be maintained on the extracted groundwater.

Groundwater quality in deeper aquifers in Denmark is generally good, especially where capped by a reasonable thickness of clay, but with no indication at the surface, deep aquifers can be hard to find. The survey area is located near the village of Tinning in the central part of Denmark and is characterized by open farmland. The terrain is relatively flat and holds no indications of the deep geological structures that may represent a valuable groundwater resource.

Information from local boreholes within the survey area indicated the potential for a groundwater aquifer of significant thickness. However, neither the lateral extension of the aquifer nor the presence of protective geological barriers were known.





SOLUTION

In search for geological structures holding groundwater resources, geophysical methods are widely used. The TEM (Transient ElectroMagnetic) method has proven extremely efficient in mapping deep palaeochannels, which can be pathways for groundwater.

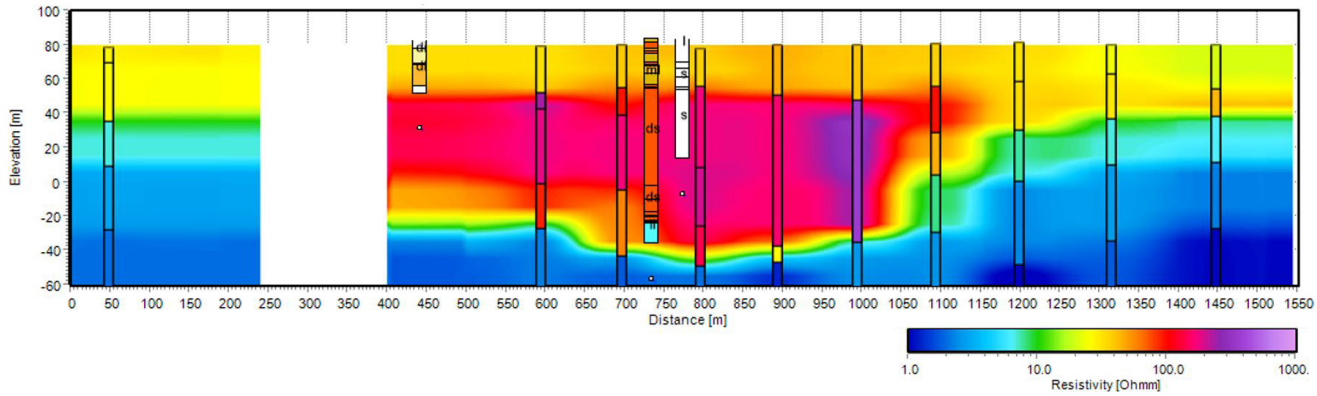
For this survey the ABEM WalkTEM was used together with an RC-5 receiver antenna and a 40x40 m transmitter (Tx) loop. The antenna and Tx loop were chosen as they are relatively small and quick to set up in the field but still offer a fairly large depth, making it possible for even a small field crew to work quickly and efficient. The crew of two managed to achieve a daily production of 16 soundings.

RESULTS

The data measured in the field were processed and inverted in Aarhus SPIA TEM software and visualized in sections and horizontal sliced maps in Aarhus Workbench, both software from Aarhus Geosoftware. Aarhus Workbench also allows the inclusion of local borehole data for comparison and as an aid to interpretation.

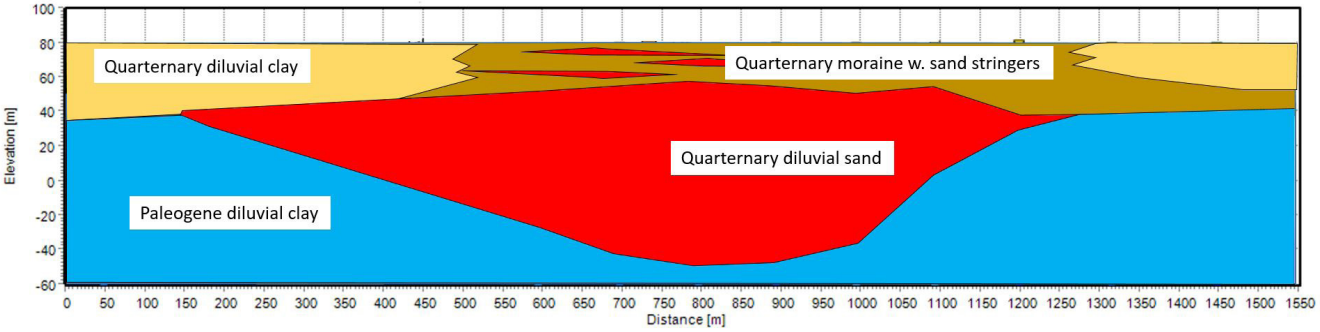
The geophysical 2D model from the survey is visualized in the section below Compiled from a series of 1D TEM soundings, indicated by the vertical bars along the section line. Nearby borehole logs have been projected onto the section and show very good correlation with the geophysical data.

Geophysical results



Based on the geophysical results, a preliminary interpretation of the limestone bedrock interface is produced:

Geological results



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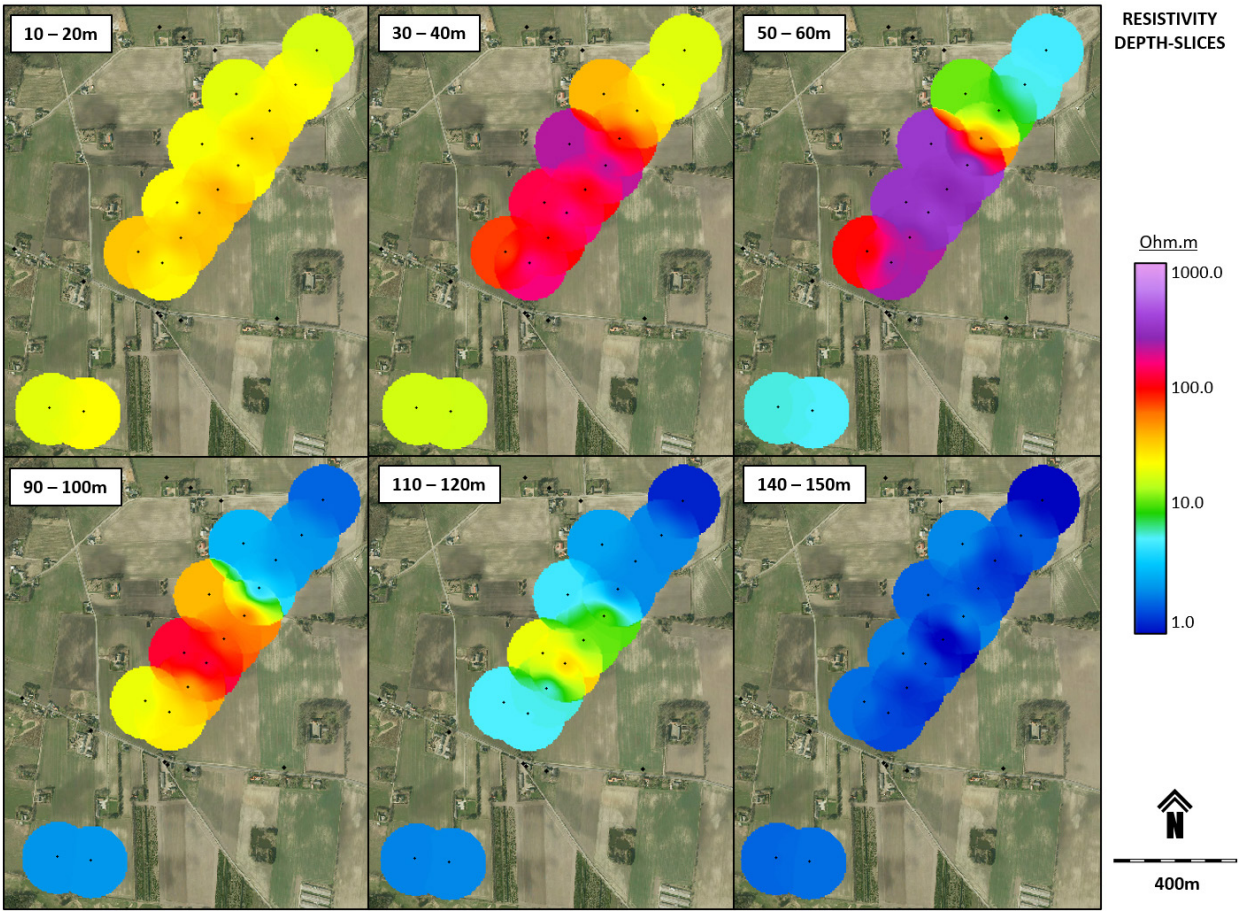
It shows there is a significant volume of aggregate (red) which will act as a reservoir for groundwater. The capping material is not pure clay, as seen on either side, and there may be potential for some contamination from agricultural pollutants but this would only be confirmed by water sample testing.

Below is a series of “depth slices” giving an impression of the lateral resistivity variation at increasing depth over a small area; it shows the channel narrowing with depth:



ACKNOWLEDGEMENT
Guideline Geo wishes to thank the staff from Aarhus Geosoftware for help in collecting the data for this example.

WANT TO KNOW MORE ABOUT THE PRODUCT?

guidelinegeo.com/product/abem-walktem