

Integration of Seismics and SkyTEM in a Heterogeneous Geological Setting

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The topic of this presentation is to show the benefits of integrating seismic and SkyTEM data acquired in an area with a highly heterogeneous geological setting. The study area is situated close to the town of Oelgod in western Denmark and covers 100 square kilometres. In this area SkyTEM lines with a spacing of approximately 100 meters have been measured, and in addition to this 80 kilometres seismic profiling has been acquired in and in the vicinity of the study area. This dense data coverage of a geologically complex area is unique, and provides an optimal basis for assessment of the benefits from integrating the two methods.

The SkyTEM method is currently the most widely used geophysical method for groundwater mapping in Denmark. SkyTEM is an airborne transient electromagnetic method with which data are collected continuously along parallel lines. The method is especially good at mapping the distribution of conductive layers at depths to about 250 meters. By undertaking airborne SkyTEM surveys it is possible to collect dense data grids over large survey areas. Such data sets often form the basis for three-dimensional geological interpretations. In order to obtain a larger degree of detail and thereby improved reliability of geological interpretations we find it advantageous to combine SkyTEM results with high-resolution seismic profiling. Seismic profiles may contribute with important information on the specific structural setting.

The SkyTEM data show a highly complex setting with ridges, valleys, depressions and hummocks. These structures are found at depths down to about 200 meters. The structures are laterally well resolved due to the close line spacing. Resistivity levels and lithological information available from few, scattered groundwater wells suggest clay-sand lithologies. Detailed characterisation of the structural features in the sediments are not revealed in the SkyTEM data, but can be provided by the seismic data. Thus, combined application of the two methods will allow for construction of more exact geological models. High-resolution seismic surveying offers useful and detailed information along 2D sections, but as compared to the SkyTEM method it is expensive in use and difficult to carry out in areas of limited access. In order to resolve heterogeneous geology, dense areal data coverage is needed in combination with detailed insight in geological key features. The first demand is met by the SkyTEM method, and the second by the seismic method.

An investigation strategy starting with SkyTEM, and followed by seismics along profiles located on lines selected from SkyTEM interpretations, therefore, provides a strong cost-effective approach when dealing with complex geology.

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