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Geothermal exploration best practice in White Spot areas. A case study from Amsterdam Region

Best Practice bei der Exploration von Erdwärmegebieten. Eine Fallstudie aus der Region Amsterdam

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The energy transition in the Netherlands requires a sustainable and renewable supply of heat besides electricity that at present is still provided by fossil energy sources. A large portion of the heat demand in the Netherlands concerns temperatures between 40° - 100 °C for heating and low to mid temperature industrial processes. Geothermal energy is one of the renewable sources of energy that can supply that heat. Large areas of the Netherlands however are so-called "white spots" i.e., have sparse or no coverage with hydrocarbon exploration-legacy seismic and well data, the only two data sets generally used in geothermal exploration in the Netherlands.

To tackle this problem, Blue Gold Exploration Consultancy BV has developed a unique, innovative, and integrated exploration workflow specifically for geothermal exploration which makes use of proven and established exploration techniques. By means of well- and seismic data and interpretations constrained 2D gravity & magnetic structural geological models, a 3D structural geological model of the subsurface is constructed. This way, even in the "white spot areas" geothermal exploration can be successfully conducted. Not having to acquire expensive new seismic data sets, further makes our integrated workflow cost-effective.

The Blue Gold workflow starts with the unique SeismoLog PRO well log enhancement and completion technique. It not only corrects errors in density and velocity logs, but it also reconstructs these logs from surface to TD with help of checkshot/VSP data, GR-log, cuttings descriptions and compaction curves. These corrected high-quality subsurface data are input in the next step, reprocessing and depth-migration of the seismic data and in the construction of 2D gravity and magnetic models along transects of choice. The gravity & magnetic models rely on the corrected SeismoLog PRO formation density and velocity values. The output is a 3D structural geological model which contains faults and geothermal prospects, even in between 2D seismic lines that are often km's apart. Interestingly, our 2D and 3D gravity & magnetic models are confirmed by interpretations of the new but scarce data from the Dutch state-initiated SCAN 2D seismic campaign.

This unique workflow is key in making the heat transition in the Netherlands and abroad happening, also in regions which are currently still under-explored. In addition, it can also save precious seismic acquisition costs and reduce drilling risks in the most cost intensive part of a geothermal project, the drilling phase. Gravity and magnetics are namely the only techniques that can image faults deeper than 3 km, not only essential to know where to drill but also to understand the basement and migration pathways of hot fluids into reservoir formations.

In this presentation we will showcase examples of this cost effective and integrative workflow in the exploration for deep geothermal energy in one of the most significant "white spot" areas in the Netherlands.