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Recent geodynamic processes in Schleswig-Holstein – Cause and influence on (energy supply-) infrastructure of the country

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Recent movement potentials were quantified for the area of Schleswig-Holstein (Germany) in order to investigate connections between deep tectonic and halokinetic structures and the development of recent topography (Lehné 2005). The quantification has been carried out on the basis of the following five parameters: a) salt structures, b) tectonic faults, c) near surface faults, d) lineaments on satellite images and e) GIS-based correlations between different stratigraphic horizons of the deep Northwest German Basin according to the "Geotektonischer Atlas von NW-Deutschland" and surface topography of Schleswig-Holstein.

The pattern of recent movement potentials is mainly caused by tectonic faults and salt structures within the Glückstadt Graben. Highest movement potentials are concentrated in the border areas of the Glückstadt Graben, i.e. the areas Sterup, Schwarzenbek, Plön, to the north of Tellingstedt and to the north of Oldensworth.

Active faults are located in the areas Sterup, Schwarzenbek and Plön. Their activity is documented by lineaments on aerial photographs/satellite images, and crop outs of near surface faults that cause local depressions of 5 – 200 m length. In addition, precise levelling data document recent activity of the fault zone Segeberg/Plön on the eastern margin of the Glückstadt Graben. We observe an uplift of 0.6 mm/year east of the fault zone and subsidence of 0.4 mm/year west of the fault zone. Extreme local sinking rates, as documented for a recently subsiding, NW-SE trending, axial depression in the area Plön, show values rates up to several cm/year.

The cause for recent activity of fault zones and salt structures is not yet clear. Two

processes are possible:

1. An interaction between subsurface structures and Quaternary ice load. Such an interaction is documented for the area Oldensworth, where cross sections illustrate the dependence between salt rise and the deposition of Quaternary sediments (Lehné 2005).

2. Subsidence within the Glückstadt Graben with modern sinking rates of about 0.4 mm/year.

The extrapolation of recent movement rates for the next 30 years leads to offset rates up to 2 cm within the fault zone Segeberg/Plön, and up to 70 cm within local areas of extreme subsidence. Accordingly a threat of both the (energy supply-) infrastructure (crude oil, natural gas, water) and dikes is given within areas of strong modern uplift/subsidence.

References:

- Lehné R (2005) Bodenbewegungspotenziale in Schleswig-Holstein – Lokalisierung und Quantifizierung durch GIS-Analysen, seismische Interpretation, Fernerkundung, statistische Auswertung und Feldarbeit