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Glacial Isostatic Adjustment as a key to understand the neotectonics of northern Central Europe

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Northern Central Europe is generally regarded as aseismic, however, several historic earthquakes with intensities of up to VII occurred in this region during the last 1200 years (Leydecker, 2009). In a pilot study we analysed the Osning Thrust, which is a one of the major Mesozoic fault zones in northern Central Europe. Several soft-sediment deformation structures like fault-arrays and a sand volcano developed in aeolian sediments, were caused by earthquakes along the Osning Thrust. The growth-strata of faults was dated with the OSL method and showed that the deformation took place between 15.9 ± 1.6 to 13.1 ± 1.5 ka (Brandes et al., 2012, Brandes & Winsemann, 2013). Numerical simulations support the results regarding the timing of the the seismicity and imply that the Late Pleistocene activity of the Osning Thrust was an effect of glacial isostatic adjustment (Brandes et al., 2012). In a second step we analysed more faults in northern Central Europe. It is evident that the historic seismicity was concentrated along major reverse faults that formerly played an important role during a tectonic contraction phase that effected Central Europe in the Late Cretaceous. Between these faults, the seismic activity was almost absent. Many of the historic earthquakes concentrated for a certain time along one fault and there is even evidence for distinct earthquake clusters in northern Central Europe e.g. along the Osning Thrust, the Aller Valley Fault and the Tornquist Zone. The spatial and temporal distribution of earthquakes (clusters that shift from time to time) implies that northern Central Europe behaves like a typical intraplate tectonic region. To analyse, if the faults that show pronounced historic seismicity are postglacial faults, we used the Fault Stability Margin (FSM), which is described in more detail in Wu & Hasegawa (1996). The Fault Stability Margins for the major reverse faults that showed historic seismicity in northern Central Europe reach the δFSM=0 between 14 ka BP and 10 ka BP. This is similar to the values along the Osning Thrust, We therefore assume that many of the other major reverse faults in northern Central Europe are also postglacial faults. The analysis of the Fault Stability Margin implies that faults in northern Central Europe were reactivated due to lithospheric stress changes caused by the deglaciation of Scandinavia.

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