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Liquefaction potentials and utilization - the Swedish case

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At present, our Swedish Paleoseismic Catalogue includes 54 high-magnitude (>M5.5) events. 50% of the events occurred during the peak of uplift 11-9 ka BP. The magnitude was high (43% estimated at M7-8) and so was the frequency (5 events recorded in 80 years at Stockholm). In the last 5 ka, nine M6-7 events were recorded. The key to the recording of paleoseismic events in Sweden is the application of multiple criteria; faulting and fracturing of bedrock, deformation of sediments with special attention to the character of liquefaction and its spatial distribution, occurrence of tsunamis and turbidites, slides and rock falls. Thanks to the varve chronology, the events could often be dated as to a single year (sometimes even to the season of a year). The firm dating control allowed us to record the spatial distribution of individual liquefaction events; the autumn 10,430 BP event covering 320x100 km and the 9,963 BP event covering, at least 80x40 km, providing new means of estimating the magnitude. At several sites and events, our liquefaction records revealed multiple phases of the same event (e.g. 5 phases at the 9663 BP event) corresponding to shocks and after-shocks. The fluid motions within the liquefaction structures were recorded by the orientation of magnetic particles (measured paleomagnetically). Very much work has been exercised by our P&G-research group in Stockholm to the recording and interpretation of liquefaction features. At 33 of the paleoseismic events in Sweden, we have recorded liquefaction. Thanks to the time-resolution, we were often able also to record the spatial distribution of individual liquefaction events. This is a powerful tool in the estimation of magnitudes. The shape of individual structures and the mode of deformation were recorded. Multiple interacting phases provide were often observed (and reconstructed). The mode of venting and the grain size of the material vented provide important information on the forces operating. The ground shaking seems well documented in cases when the primary bedding structure has become partly or full erased. The

occurrence of a structure-less sand, into which covering sediments have sunk down (under additional deformation), in which blocks and fragments seem “swimming”, and out of which material has vented and injected upwards, play a central role in our observations and interpretations. The whole base material is extensively presented in the 2003 book, printed in colour for the emphasis on fine structural details.

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