Geophysical Research Abstracts
Vol. 20, EGU2018-17652, 2018
EGU General Assembly 2018

Glaciotectonic deformation structures and landforms in Western Latvia

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The western part of Latvia consists of glacial uplands and lowlands formed mostly by the Baltic Ice Stream (BIS) and successive ice lobes and tongues, which were active during the last deglaciation of the Scandinavian Ice Sheet (SIS). The Eastern Kursa Upland formed in the interlobate zone between the BIS and Riga Ice Stream and is composed of interlobate ridges in the central part. The most prominent glacial landforms in the largest lowland of Western Latvia (Kursa Lowland) are mega-scale glacial lineations (MSGL) superimposed by very closely spaced small transverse ridges. These ridges have been previously described as De Geer moraines but on the basis of the newest LIDAR DEMs, they resemble washboard moraines (Cline et al., 2015) or crevasse-squeeze ridges as defined by Evans et al. (2016). The internal structure of these subglacial bedforms are influenced by subglacial deformation, and even rafts of bedrock sandstone occur in MSGLs.
Numerous sand and gravel quarries in Western Latvia are located along the slopes of the Western Kursa and Northern Kursa Uplands, where glaciotectonic deformation was particularly pronounced due to marginal compression. In these quarries, the deformed outwash sediments underlie subglacial and sometimes supraglacial till. The most abundant structures are asymmetric and recumbent folds, numerous faults and if silty sediments are present, clastic diapirs.
Prominent glaciotectonic structures are found along the bluffs of the Baltic seashore in western Latvia. During the deglaciation of the SIS, a small Apriķi ice tongue advanced from the WNW, and due to fluctuating pore-water pressure, clastic diapirs consisting of clayey silt formed at the ice bed (Saks, 2012). We used a ground penetrating radar (GPR) Zond 12-e with 75 and 300 MHz antennas to survey the morphology, distribution, and spacing of diapirs. Combining GPR observations with investigations at the outcrops, it is clear that diapirs show a great variety of their height, width, and symmetry. Some of them are inclined in the direction of ice flow suggesting moving ice during their formation. Only slightly concaved sandy sediments between diapirs suggest the frozen state during the injection of diapir structures and the narrow dyke-like structure in the upper part of some diapirs point at hydrofracturing.
The research was supported by the ERAF project No. 1.1.1.2/VIAA/1/16/118.

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