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ABSTRACTS

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RELICT SAND WEDGES IN GLACIAL TILL SEQUENCES: INDICATORS OF LATE PLEISTOCENE PERIGLACIAL ENVIRONMENT IN NORTH-CENTRAL POLAND

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Relict sand wedges are valuable indicators of periglacial paleoenvironment, typically characterized by extremely cold and dry climatic conditions. Some field exposures in the Polish Lowland reveal Pleistocene glacial till sequences consisting of distinctive horizons of fossil primary sand wedges. In the current work, we present the results of the comprehensive studies conducted at four sites located in north-central Poland, some distance to the north of the maximum limit of the last Scandinavian Ice Sheet. Our aim is to present the relict sand wedges horizons in glacial till sequences and discuss their potential in paleogeographic reconstructions.

Three of the investigated sites (Barcin, Dulsk and Nieszawa) are located at the edges of the moraine plateaux and one (Rozental) is situated within the morainic hill covered by a glacial till. All exposures reveal basal till layers dissected by fossil sand wedges of different dimensions (up to 1.3 m deep and 50 cm wide) and shape. The wedges usually occur as one criostratigraphic level within the till sequence, except Rozental when two periglacial horizons are exposed in superposition. Fossil frost cracks are typically filled with vertically laminated fine sand containing significant amount of quartz grains with eaolian features on its surface. Most of the analyzed structures have been deformed, either as a consequence of density instability within the permafrost active layer or as a result of subglacial shearing during subsequent ice sheet overriding. The shape of the deformed structures often deviates significantly from the typical wedge-shaped geometry. Vertical lamination of the sand within deformed structures is usually disturbed to a different degree.

OSL dating of sand deposits from wedges suggests that infilling of the frost cracks took place between 43.8 ± 1.9 ka to 21.0 ± 1.4 ka (MIS 3-2) and between 17.3 ± 0.8 ka and 15.4 ± 0.7 ka (MIS 2). The obtained results show various distribution of paleodoses characteristic for individual aliquots within measured samples. Some of them reveal high degree of the replicability whereas multimodal distribution is characteristic for others. OSL dating of a few wedges gave clear underestimation of their age (13.8 ± 0.7 ka – 9.8 ± 0.4 ka) which could have been caused to some degree by relatively high water content in the sediments within the permafrost active layer or occurrence of ice lenses. This could have led to absorption of part of the radiation by the water or ice and therefore to an overestimation of the annual dose. Moreover subglacial shearing of the wedge structures during subsequent ice advances could have an impact on OSL signal resetting as well. However, such significant underestimation of the OSL ages (up to 50%) is still a matter of debate.

Investigated horizons of fossil wedges and their remnants, clearly indicate subaerial conditions with periglacial climates prevailing in northern Poland in the late Pleistocene. They are good paleogeographic markers indicating ice-free periods occurring between particular ice sheet advances. Having the relict sand wedges coexisting with other fossil periglacial features (involutions, frost segregation structures, ventifacts, etc.) it is feasible to trace the superposition of diverse paleoclimatic conditions: from extremely cold, dry and windy to relatively warmer and seasonally humid circumstances or vice-versa. Despite some uncertainties of the luminescence dating of periglacial wedges, we argue that testing of the OSL method with application of high-resolution techniques (e.g. "single grain" dating) seem to be valuable for reliable paleo-periglacial reconstructions