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Geomorphometry of cyclical semicentric and semicurvate till ridges in Rajgród (NE Poland) as a record of the last ice sheet dynamics

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Subglacial landforms are key elements of reconstructing ice sheets dynamics and processes. Among less studied are transverse and elongated glaciogenic ridges (TEGRs) perpendicular to ice flow usually classified as Ribbed (Rogen) Moraines (Barchyn, 2016; Cline, 2015). Their shape is closely connected to low ice movement speed as distinct from drumlins and large scale lineations that were formed under condition of a higher ice movement velocity. Typically, they are straight, up to 30 m high, up to 1000 m long and 150-300 m wide. Rajgród ridges, although similar to classic case, have unique features, both individual and related to their mutual position.

For the purposes of research XYZ LIDAR data with resolution of 4 points per sq meter was used to calculate high accuracy DEM, on the base of which hillshade model and topographic position index map were prepared. Initially all TEGRs were indicated and subsequently sent to and evaluated independently by three researchers to determine their ridgelines and borders. For further steps only ridges with similar parameters within all researchers were examined and used for parameter calculation: (1) area, (2) length measured by ridge line, (3) height as a differential between highest and lowest elevation, (4) mean width calculated as ratio area to perimeter and (5) vertical sinuosity defined as the ratio of topographic length to length. All TEGRs were divided into five fields (clusters), similar in ridges number.

TEGRs located near Rajgród lie close to the former ice margin and have the highest vertical sinuosity and mean width. They are fragmented, with doughnut landforms visible on TEGRs surface, whereas TEGRs located in cluster proximal part are better preserved, have higher area and lower mean width than those in distal part. The cross-profile through all the fields shows a clear arrangement of morphological levels referring to the stages of ridges formation. First level is connected to initial stage when certain areas had undergone quicker ice movement. The second one is correlated to creation of ridges in ice crevasses. The third and last one is the sign of deglaciation and creation of doughnut features.

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