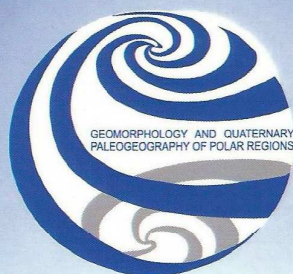


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GEOMORPHIC AND SEDIMENTARY SIGNATURES OF GLACIAL MELTWATER ACTIVITY DURING THE LAST GLACIATION IN THE LUBAWA UPLAND (NORTH POLAND)

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The Lubawa Upland, located close to the last glacial maximum extent in northern Poland, reveals spectacular morainic landscape of highly elevated glacial insular height (cf. Ber 2009). Most studies of this area (e.g. Marks 1979, Gałazka 2006) suggest intensive glaciotectionic processes occurring between two ice lobes on southern margin of the last Scandinavian Ice Sheet – Vistula Ice Lobe and Mazury Ice Lobe. Here we present geomorphic and sedimentary signatures which may indicate a significant influence of glacial meltwater action on the ice sheet dynamics in this region and dispute its interlobate location during the last glaciation.

Geomorphologic analyses of high resolution digital elevation model reveal the occurrence of meltwater channels dissecting the highest parts of the study area. Two systems of channels have been identified, one consisting incisions oriented consistently NW–SE and second with valleys oriented mostly NE–SW. Based on spatial distribution, geomorphometric indicators and relation to superficial geology, NW-SE oriented incisions have been interpreted as subglacial and proglacial channels and NE-SW oriented valleys as marginal/submarginal channels (cf. Greenwood et al. 2007). Subglacial channels have been possibly formed time–transgressively during the last ice sheet advance and decay whereas proglacial and marginal channels have developed subaerially as a result of progressive ice sheet decay (cf. Syverson & Mickelson 2009). Therefore we argue both NW-SE and NE-SW sets of channels were likely formed during the last ice sheet advance-decay cycle. Some sedimentary data such as: lenses of sorted sediments within basal till layers, hydrofracture structures, melt-out facies of subglacial till as well as thick sequences of ice marginal fluvio-glacial gravel, reported at investigated field sites may also indicate subglacial and marginal meltwater activity. Till fabric data do not confirm convergent ice flow pattern of the last ice sheet in this region what is also consistent with ice flow direction inferred from spatial distribution of subglacial channels.

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PALAEOECOLOGICAL SITUATION OF THE KLAIPĖDA STRAIT AREA IN THE LATE
GLACIAL AND HOLOCENE (WESTERN LITHUANIA)

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Lithuanian coast began to take shape after the last glacier melting, when the recent Baltic Sea basin became free of ice. The beginning of the Curonian Spit formation is related to the Litorina Sea stage in the Middle Holocene. The final structure of the present spit was formed about 3 500 yr BP (Kabailienė, 1998). As a result, the Curonian Lagoon was formed after formation of the spit. The lagoon has connection with the Baltic Sea via the Klaipėda Strait. The Curonian Spit and coastal area developed under different palaeogeographical conditions. A large thickness of deposits in the northern part of the Curonian Spit was formed during the relatively short time from the Middle Holocene. Emerging lagoon had influence to the coastal area at that time.

Investigation of two boreholes in the Klaipėda Strait area, located on the opposite coasts (Fig. 1), gave possibility to follow palaeoecological conditions in the Late Glacial and Holocene. Complex studies (pollen, diatom, and carbonate analyses) of boreholes 65a and 90c were used for reconstruction of postglacial environment in the Klaipėda Strait (Western Lithuania). Boreholes 65a and 90c were drilled during the detail geological mapping at a large scale (1:50000) in 2005.

According to palaeobotanical data the oldest sediments (the Late Glacial) were found in the northern part of Curonian Spit (borehole 65a) and the Preboreal – in the Lithuanian coastal area (borehole 90c).

The birch was dominant in forest in the northern part of Curonian Spit (borehole 65a) during the Younger Dryas. Signs of typical cold and dry climate, unstable soils, open habitats of tundra vegetation were found (*Artemisia*, *Salix*, *Juniperus*, *Ephedra*, *Selaginella selaginoides*). Planktonic freshwater diatoms were characteristic of the Baltic Ice Lake (Kabailienė et al., 2009).

Pollen data of both boreholes (65a and 90c) demonstrate, that forest was not very dense in Preboreal. They consisted almost entirely of birch and pine. The amount of herbs was not significant. Previous investigations prove that Yoldia Sea level was low and Lithuanian coastal area was the land (Kabailienė, 1995; Gelumauskaitė, 2002).

Warming of the climate in Boreal time characterizes with dense pine forest, decreasing in birch, *Artemisia* and *Chenopodiaceae*. The latest investigations show, that the Ancylus Lake level was low and didn't reach Lithuanian coast (Damušytė, 2011). Organogenous sediments (gyttija and peat) represent Boreal time in sections. Freshwater planktonic (*Aulacoseira* sp.) diatoms characteristic for the Ancylus Lake were found. It support the idea, that sediments could be deposited in a very shallow bay of the Ancylus Lake and oncoming transgression of the Litorina Sea redeposited freshwater planktonic diatoms from deeper part of the basin.