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The Annually Laminated Bottom Sediments of Lake Gościąż and Neolithic Settlements in the Western Part of Gostynin Lake District (Central Poland). An Outline

The Lake Gościąż is located in the western part of the Gostynin Lake District (Fig. 1). It is one of very few European lakes with laminated bottom sediments reflecting annual depositing. They constitute a year-after-year record of environmental changes around the lake during Late Pleistocene and Holocene periods.

Interdisciplinary research of the bottom sediments of the Lake Gościąż were started in 1987 (Ralska-Jasiewiczowa 1993; Ralska-Jasiewiczowa, Goslar, Madeyska, Starkel 1998). One of the important goals of this program was investigation on relations between human activities and natural environment.

The first stage of archaeological research (surface survey and small scale excavations) was carried out in 1991–1994 (Pelisiak, Rybicka 1993, 1998, 1998a; Rybicka, Pelisiak 1998; Pelisiak, Rybicka, Jasiewiczowa 1994) in radius of 10 km around the Lake Gościąż. It did not clarify precisely relations between settlement and economic activities of the prehistoric man and anthropogenic disturbances in botanical complexes recorded in a pollen diagram (Ralska-Jasiewiczowa, van Geel 1998; Pelisiak, Rybicka 1998; Rybicka, Pelisiak 1998). In 1995–2005 the Gostynin Lake District was an area of research focused on settlement and economies of Neolithic and Early Bronze Age communities (Rybicka 2004; Pelisiak, Rybicka, Ralska-Jasiewiczowa 2006). Results then obtained constitute the basis for assessment of human activities on the area in question, including related to them environmental changes. Well recognized Neolithic colonization of the Gostynin Lake District, together with precise dating of multiple sediments, have opened new possibilities to correlate individual settlement phases (related to increased economic activities) with phases of anthropogenic environmental changes identified in palynological material (Ralska-Jasiewiczowa, van Geel 1992, 1998). There are not sites of Danubian cultures in this area. “Neolithisation” of Gostynin Lake District can be attributed the early communities of the Funnel Beaker culture (later abb. FBC) that settled the territory occupied earlier by Mesolithic groups (Schild, Marczak, Królik 1975). Almost 240 sites from various FBC phases have been

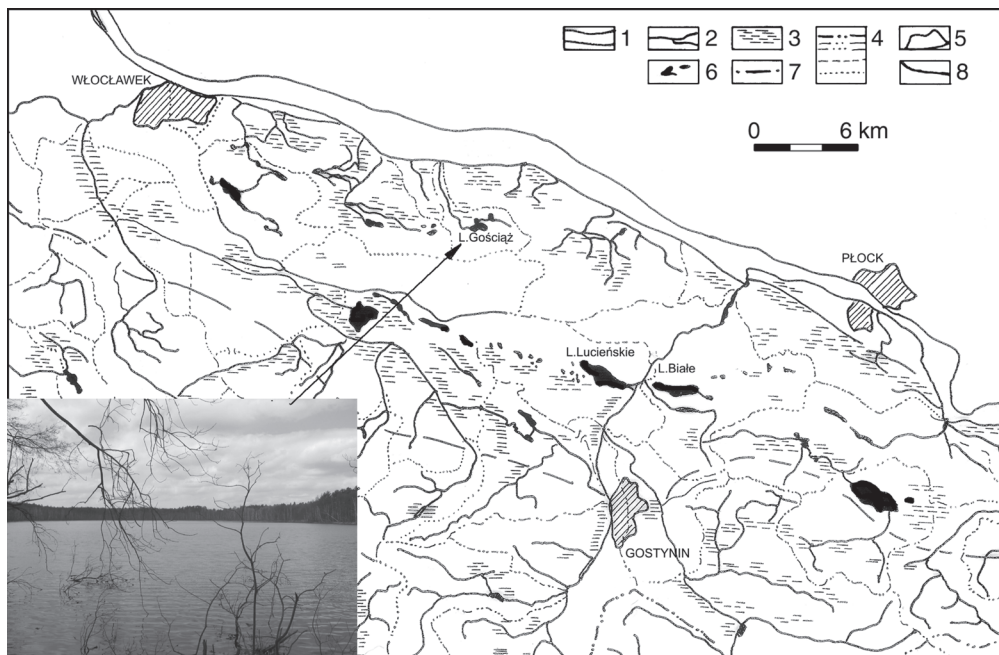


Fig. 1. Hydrology of the Gostynin Lake District (after Z. Churski 1998). 1: Vistula 2: streams; 3: lakes; 4: bogs; 5: Vistula-Odra watershed; 6: watersheds of lower orders; 7: scarp of morainic plateau.

discovered in the eastern part of the area of our interest (Fig. 2). Besides numerous settlement traces left by “Sub-Neolithic” communities (Fig. 3), 10 sites of the Globular Amphora culture (Fig. 3), and few sites related to the Corded Ware culture were recognized (Rybicka 2004; Pelisiak, Rybicka, Ralska-Jasiewiczowa 2006).

There are several phases of human disturbance of the natural environment were recorded in pollen diagrams from Lake Gościąż sediments. Phases 1–3 are related to the activity of Mesolithic man in this area. Neolithic settlement of the Gostynin Lake District is related to four phases of environmental transformation (Phases 4–7) identified in the pollen diagram from the Lake Gościąż (Ralska-Jasiewiczowa, van Geel 1998; Pelisiak, Rybicka, Ralska-Jasiewiczowa 2006). Younger changes in natural environment were caused by Bronze Age, Iron Age, Roman Period, Medieval and modern people.

The earliest manifestation of human activities in laminated sediments of the Lake Gościąż are dated to the period 7350–6400 conv. BP (6100–5330 BC) and 6200–5770 conv. BP (5145–4550 BC) (Phases 1 and 2 of anthropogenic disturbances) (Ralska-Jasiewiczowa, van Geel 1992, 1998a). There are observed the rise of pollen of *Pteridium aquilinum*, *Melampyrum*, *Calluna vulgaris*, *Rumex acetosella* appearance

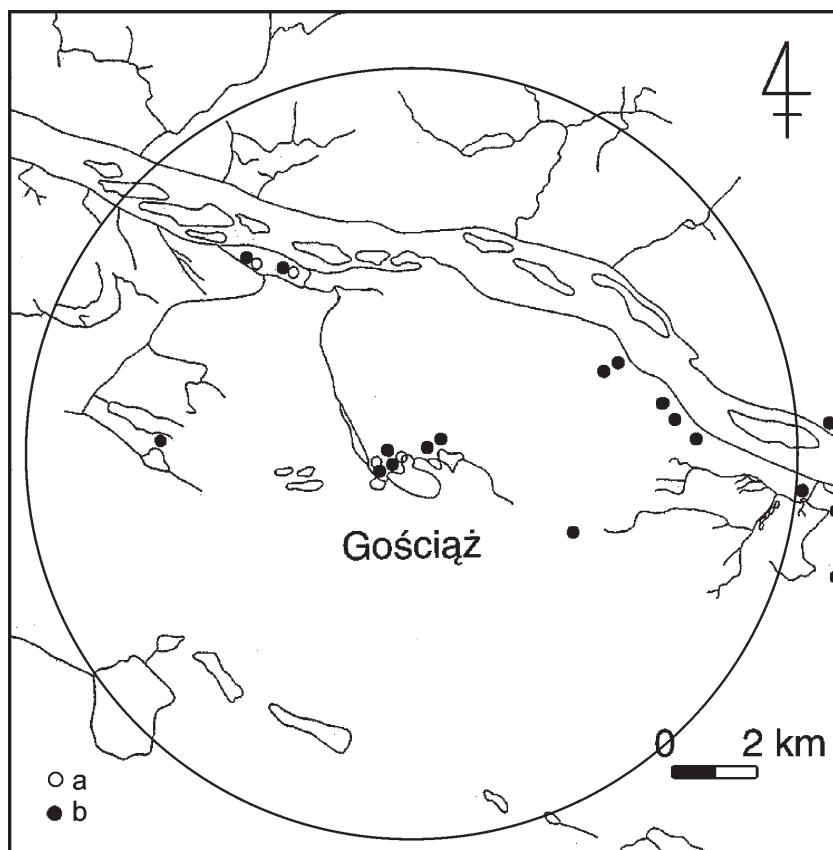


Fig. 2. Location of Mesolithic sites in the vicinity of the Gościąż Lake (after Pelisiak, Rybicka 1998a).

of *Polypodium vulgare*, presence of *Humulus lupulus*, *Urtica sence dioica*, *Thalictrum*, *Cirsium*, *Filipendula*, *Valeriana*, and *Calystegia sepium*. Distinctive are plants typical for wet meadows: *Sanguisorba officinalis*, *Trollius europaeus*, *Rumex acetosella*, and *Lythrum*. In these phases appears *Urtica dioica*, *Artemisia*, *Chenopodiaceae*, and *Sambucus nigra*. Very high value of the *Pteridium aquilinum* curve indicated forest fires.

Phase 3 (5610–5450 conv. BP; 4460–4300 BC) is reflected in the pollen diagram by the rise of *Urtica dioica* -t., *Rubiaceae*, and *Pteridium aquilinum*. For the first time there appears *Plantago lanceolata*, *Campanula*, *Hypericum*, *Rhinanthus*. The type of *Potentilla* suggests the presence of small grassy clearings. The increased amount of pollen of *Alnus*, *Picea*, and *Frangula alnus*, and *Humulus lupulus*, is related to brief openings in forests. Moreover we observe a temporary drop of pollen of dominating trees. Results of recent archaeological research in the Lake

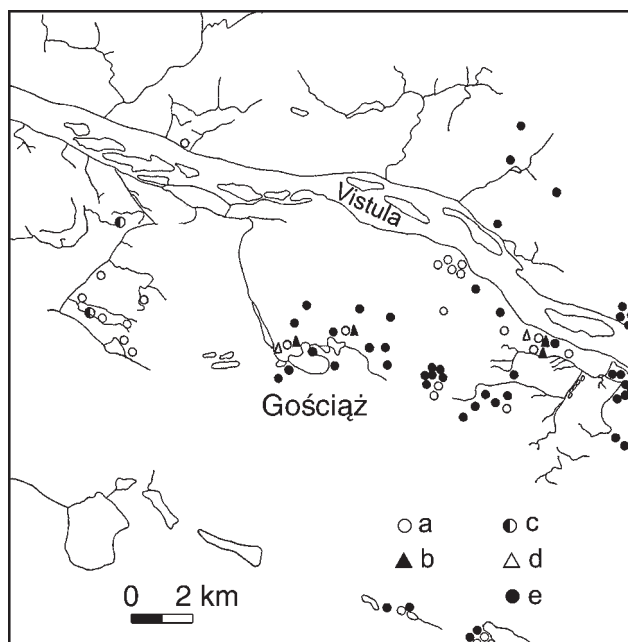


Fig. 3. Location of Neolithic sites in the vicinity of the Gościąż. a – FBC, b – Sub-Neolithic sites, c – GAC, d – CWC, e – Neolithic undefined culturally.

Gostynin District suggest that environmental changes registered in Phase 1–3 are related to settlements and activity of Mesolithic people on this area (18 Mesolithic sites were discovered in the vicinity of Gościąż; Fig. 2).

Phase 4 (conv. 5450–5150 BP; about 4300–3960 BC). Changes in pollen diagrams related to the beginning of this phase indicate new forms of human economic activities in the vicinity of the Gościąż Lake (Ralska-Jasiewiczowa, van Geel 1998). The pollen diagram registers an abrupt increase of hazel (*Corylus*), alder buckthorn, yew (*Taxus*), spruce, poplar, and asp. A short maximum AP index corresponds with increase of pollen of birch and oak.

These changes are interpreted as results of husbandry based on grazing animals in forests and collecting animal fodder (*cf.* Rasmussen 1989, Fig. 12). The beginning of the dogs' mercury (*Mercurialis perennis*) curve suggests the presence of openings in wet deciduous forest. The existence of such features in coniferous forests are ever more evident due to axseed (*Coronilla varia*), viper's grass (*Scorzonera humilis*), ship's-bit (*Jasione montana*), polypody, and heather, i.e. plants related to openings in pine wood. There appears plantain (*Plantago lanceolata*) and the amount pollen sorrel (*Rumex acetosa -t.*) increase. Frequency of ruderal plants increase but the grass (*Gramineae*) curve is not

indicative. There have been registered first pollen of wheat (*Triticum*) and barley (*Hordeum -t.*).

Phase 5 (conv. 5150–4830 BP; about 3960–3600 BC). It's beginning (Ralska-Jasiewiczowa, van Geel 1998a) corresponds with a drop of the elm (*Ulmus*) curve. It is accompanied by changes in floral communities not necessarily related to human activity. We observe an increased presence of hazel, oak, asp, and linden (*Tilia platyphyllos*), a temporary drop of spruce, and the appearance of juniper (*Juniperus*). The share of birch and linden drops. Curves of oak and hazel constantly fluctuates. NAP index grows due to increasing amount of grasses and motherwort, ruderal (nettle, plantain) and chenopodiaceous plant. Increasing share of alder buckhorn, buckthorn, hop, and meadow rue may indicate opening in alder forest. Cow-wheat and dog's mercury rise eagle fern, and heather appears. The presents of medium plantain, anthericum, gypsophila (*Gypsophila fastigiata*), thrift (*Armeria*) and juniper conform dry meadows. Described changes suggest forest grazing of herds and collecting food for animals (Ralska-Jasiewiczowa, van Geel 1998). Important for this phase is the appearance of single wheat grain.

Anthropogenic changes noted in phases 4 and 5 corresponds with the Late Sarnowo and Early Wiórek Phases of FBC people activates (Fig. 3). Several small (up to 0,5 hectare), short-lasting FBC settlement sites inhabited probably by Kuyavian immigrants (Rybicka 2004) have been found in the Gostynin Lake District. Settlements were occupied by very small groups of people. Their farming activities were only supplementary to hunting and gathering and the impact of FBC people on natural environment was not significant (small clearing in alder and dry forest).

Phase 6 (conv. 4830–4500 BP; ok. 3600–3200/3100 BC). Its beginning is marked by the growth of the frequency of pollen of plantain, motherwort and chenopodiaceous plants (Ralska-Jasiewiczowa, van Geel 1998). Initially we observe a clear drop of the hazel curve, followed by it's increase, and the increase of curves oak, elm, and ash-tree (*Fraxinus*). Deforested pastures are indicated by present sorrel, burnet, cornflower (*Centaurea jacea*), white clover (*Trifolium repens*), thisle, and herbs, such as buttercup (*Ranunculus acris -t.*), cockscomb, cinquefoil (*Potentilla -t.*), *Anthemis -t.*, *Campanula*, and pink (*Dianthus*). Very distinct is the presence of plantain (1,5% of all pollen). Deforestation of dry habitats are confirmed by the maximum of sorrel and the appearance of sheep's-bit, pasque-flower (*Pulsatilla vulgaris -t.*), rock-rose (*Helianthemum nummularium -t.*), axseed (*Coronilla varia*), and scabious (*Knautia arvensis*). The above changes are related to human settlement and economic activities (especially grazing animals) in a close

vicinity of the lake. Great amount of charcoal registered in sediments may indicate intentional forest burning (Ralska-Jasiewiczowa, van Geel 1998, Fig. 9.8). Within Phase 6 three cycles of human activities were distinguished (Ralska-Jasiewiczowa, van Geel 1998): (1) arrival of people and settling the area (spreading motherwort, chenopodiaceous plants, and plantain pollen), (2) increasing deforestation and appearance of grazing grounds (high AP index, drop of tree pollen, increased amount of pioneer trees, maximal indexes of grassland and nettle), (3) decreased intensity of animal grazing and overgrowing abandoned grazing grounds (increased frequency of motherwort, eagle fern, yew, and juniper) and regeneration of trees (ash-tree, elm, and later oak and hazel). The end of Phase 6 is marked by a depression of the ruderal plant curve and temporal disappearance of *Plantago lanceolata* and sorrel. Concluding, the extensive use of the burn-and-slash technique by the FBC people caused deforestation visible in the diagram. Traces of fire can be observed in the palynological profile (Phase 6) in Gościąż (Ralska-Jasiewiczowa, van Geel 1998, Fig. 9. 8. Extensive farming is confirmed by numerous settlement sites (several excavated settlement sites are linked with this period), and archaeological finds such as axes, sickle blades, millstones, and archaeobotanical evidences (*Triticum monococum*) registered in FBC settlement in the vicinity of the Lake Gościąż. Changes in plant covers, coexistence of distinctive curves of plantain, sorrel, and herbs, appearance of white clover and the rise of hazel are interpreted as indicators of increasing grazing of big herds, mainly cattle (Kruk 1980, 138). Although no cattle remains have been recognized in analyzed bone assemblages from excavated sites (Rybicka 2004), it does not necessarily mean the absence of cattle. Instead, there have been identified remains of pig and sheep/goat. Phase 6 in the Gościąż diagram is also marked by a drop of hazel. It can be related to animal growing, as pigs, sheep, and goats can very destructive for plant communities of this kind (Kruk 1980, 187). The environmental changes are related to the Classic and Late Wórek phase of FBC, *i.e.* with Kuyavian Phases IIIB–IIIC after A. Kośko (1981) (several excavated settlement sites are linked with this period).

Phase 7 (conv. 4500–4160 lat BP; ok. 3180–2755 lat BC). It's beginning is distinctive by decreasing human influences on natural environment (Ralska-Jasiewiczowa, van Geel 1998, Fig. 9.8). Openings, especially on sandy soils, were abandoned, giving place to a natural plant succession (decrease of heather, sorrel, and cow-wheat, increase of asp). Oak reaches it's peak at the beginning, and then the index drops. Increased amount of hazel pollen, accompanied by drop in frequency of elm and linden (*Tilia platyphyllos*) is observed. The indexes suggest increasing deforestation in

deciduous forest already transformed by Neolithic people but indicators of forest fires are less distinctive than in Phase 6. The maximum of yew is observed in the mid of the Phase 7 and can be interpreted as expansion of this tree on abandoned fields and pastures (Ralska-Jasiewiczowa, van Geel 1998, 275). A similar occurrence took place towards the end of Phase 6 (increase of yew and increasing amount of spruce pollen). Slightly more frequent are pollens of plants of type of wheat and barley suggesting that fields were located in a close vicinity of the lake (Ralska-Jasiewiczowa, van Geel 1998, 275).

Anthropogenic environmental changes of the Phase 7 are related to the late FBC, Baden culture (Koško 1981; Rybicka 1995) and Globular Amphorae culture (GAC) people settlements and economic activity. Less fertile soils in the Gostynin region were not convenient for these communities. We assume that impacts of Baden FBC as well as GAC people on environmental changes registered in Phase 7 in the Gościąż diagram were not significant.

The region in question was also intensively occupied by Sub-Neolithic people of the Linin Type and Corded Ware culture people. They lived in relatively long-lasting settlements, such as Gościąż, Site 12, Włocławek district, Kujawsko-Pomorskie voivodship (Pelisiak, Rybicka 1998a) but the observed indicators of farming economy probably resulted from activities of small groups FBC, FBC/Baden and GAC, while other disturbances can be attributed to Sub-Neolithic and CWC groups.

Palynological and archaeological research in the Gościąż region has provided important data for reconstruction of economic and settlement changes of Neolithic communities that lived in the area of the Gostynin Lake District. Anthropogenic changes of natural environment registered in pollen diagrams appear to be complementary to the picture of Neolithic settlement. We have obtained answers for the several important questions related to environmental changes recorded in palynological diagram, due to (1) settlement in the closest vicinity of the lake, and (2) to settlement and economic events in a distance of a few or dozen kilometers from Gościąż.

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Rocznie laminowane osady denne Jeziora Gościąż i osadnictwo neolityczne w zachodniej części Pojezierza Gostyńskiego (środkowa Polska). Zarys problematyki.

Streszczenie

Jezioro Gościąż znajduje się w zachodniej części Pojezierza Gostyńskiego. Jego specyfika polega na specyficznej budowie osadów dennych – laminacji odpowiadającej ich rocznemu przyrostowi. Analizy takich osadów stwarzają jedyne w swoim rodzaju możliwości badania i datowania zmian środowiska naturalnego w otoczeniu jeziora, w tym przejawów aktywności człowieka. Badania osadów dennych były przedmiotem studiów multidyscyplinarnych, w tym paleobotanicznych. Jednocześnie z badaniami osadów jeziornych przeprowadzono w rejonie Gościąża systematyczne, wielokrotne prace powierzchniowe oraz wykopaliskowe na wybranych stanowiskach. Przedmiotem badań archeologicznych był obszar w promieniu 10 km od jeziora.

Niniejsze opracowanie stanowi szkic relacji człowiek–środowisko naturalne w rejonie Gościąża w neolicie. Dokonano próby odniesienia osadnictwa ludzkiego datowanego na neolit z chronologicznie odpowiadającymi tym czasom fazami antropogenicznych zmian środowiska naturalnego. Faza 3 zaburzeń środowiska (4460–4300 BC) odpowiada jeszcze osadnictwu mezolitycznemu, którego liczne pozostałości zostały zarejestrowane w trakcie badań powierzchniowych i wykopalisk. Faza 4 (4300–3960 BC) oraz faza 5 (3960–3600 BC) dają skorelować się z osadnictwem neolitycznych społeczności kultury pucharów lejkowatych z fazy sarnowskiej i wczesnej fazy wióreckiej. Faza 6 (3600–3200/3100 BC) odnosi się do klasycznego etapu fazy wióreckiej kultury pucharów lejkowatych, której odpowiednikami są fazy IIIB i IIIC według periodyzacji tej kultury na Kujawach. Faza 7 (3180–2755 BC) antropogenicznych przekształceń środowiska odnosi się do społeczności późnej kultury pucharów lejkowatych i kultury amfor kulistych. Na ten czas przypada również osadnictwo ludności z ceramiką typu Linin. Osadę tej ludności odkryto w bezpośrednim sąsiedztwie jeziora Gościąż (Gościąż, stan. 12).