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RADIOCARBON AGE OF ORGANOGENIC SEDIMENTS IN LAKE JASIEŃ SUBGLACIAL CHANNEL AND THEIR PALAEOGEOGRAPHICAL SIGNIFICANCE

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Abstract. The dating of 26 deposit samples taken from the Lake Jasień subglacial channel and from its immediate vicinity made it possible to determine when the floor set of peat deposits, commonly occuring at the bottoms of lakes and peat bogs, was formed. Spatial and altitude differentiation of replacement time of the palustrine-peaty accumulation by the limnic accumulation gave a chance to settle the range of Lake Jasień reach changes and their chronology. Also the dating of peat layers in top parts of the organogenic sets filling the hollows neighbouring the lake served this purpose. The attempts to use the gyttja dating to solve the stratigraphic problems of investigated area have failed.

1. INTRODUCTION

For several years researches by the University and other sources were carried out in the Department of Geomorphology and Quaternary Geology of the University of Education at Słupsk. Radiocarbon dating was widely used to explain the stratigraphic questions connected with the analysis of transformations of subglacial channels and valleys situated in the territory of Polanowska Highplain, in Lake Jasień area. It was possible thanks to the constant cooperation with the Radiocarbon Laboratory of the Institute of Physics of the Silesian University of Technology in Gliwice. In the last two years this cooperation proceeded within the framework of grant of Polish Scientific Research Committee No. 6 P04E 026 10 "Geochronology of the Upper Quaternary of Poland in the light of radiocarbon and luminescence dating".

During the realisation of the project 10 deposit samples taken from the Lake Jasień channel were dated. Earlier, 16 deposits samples taken from the bottom of this lake channel and its immediate vicinity were dated. The sum of these achievements constitutes a basis for preparing the first attempt of radiocarbon stratigraphy of organogenic deposits occuring in Lake Jasień channel and for defining their meaning in description of the channel environment evolution in Late Glacial and Holocene. The dating comprised various kinds of peat, gyttja, organic silt and fossil soil. These deposits are situated at the bottom of Lake Jasień and also in the area of melt-out hollows, some of which in the past were the part of the lake. The dating also comprised the deposits building the delta formed by one of the streams flowing into the lake.

2. AGE OF THE BOTTOM PEAT LAYER

Lake Jasień is a classical, notable sized (575 ha area) channel lake, nowadays filling form, which originated in Late Pleni-Vistulian, during the transgressive Cashubian-Warmian Sub-phase (Sylwestrzak, 1978). The evolution of the channel vicinity, soon conserved by dead-ice, then continued by extension of out-wash plain terraces, which buried some of the earlier created forms. It is difficult to say now if the eskers extending in the channel axis originated as crevasse forms in the block of the dead-ice, or earlier, in the course of forming its mineral bottom.

In the closing period of the extraglacial drainage system formation the lowest placed part of the channel made a vast and probably shallow reservoir, the bottom of which was lined with varve clays subsequently covered by calcareous gyttja, found near Łupawsko on level 112-116 m a.s.l. (Florek, 1991, 1992). At that time the excess water outflow from the lake straight northwards in the Zawiaty area, where also today exists the outflow of Łupawa river from the lake. This episode lasted for a fairly short time, as the channel edges are commonly

filled with peat, the bottom of which was dated as from 10,050±120 to 8510±150 BP (**Table 1**). In the face of such a considerable dispersion of dates, and with the peat layer occuring almost commonly on the channel edges, at the bottoms of melt-out hollows and in upper part of the main lowering of channels, it is impossible to state today whether this peat originated commonly on the surface of the dead-ice blocks or on the humid but abandoned by lake waters (Florek, 1991, 1992 and 1996). If we accept the latter concept, then we have to admit consistently that the reduction of smaller dead-ice blocks was accomplished in Late Vistulian and at the beginning of Holocene, when at the same time a reservoir with the water surface situated much lower than today, existed on the channel axis. The data collected so far indicate that this decrease reached a level of 108 m a.s.l., possibly was even higher.

Different is the meaning of the age of top parts of lower peat layer. The dates here are disposed rather regularly, the sample taken from the lower level is older than the sample taken from the higher place. This may mean that the change of peat (terrestial) accumulation to the limnic one ensued gradually, as the water level in the lake rose.

Totally different is the meaning of the date from Kozin. The bottom of the filling of the deep lowering of marginal channel is composed of sands and gravel with numerous organic intercalations. They are the evidence of existing here intensive deposit transport and the flowing of melt-out and river waters in the Late Vistulian (possibly at the time when the ephemeral reservoir still existed in the area of today Lake Jasień and its vicinity).

3. AGE OF THE OTHER PEAT LAYERS OCCURING IN LAKE JASIEŃ CHANNEL

A specific meaning is conveyed in the datings of the bottom of fillings from Łupawa paleomeanders occuring in the sector shown on **Fig. 1**. The conclusion drawn from the analysis of geomorphologic and stratigraphic situation on the Zawiaty site (**Fig. 2**) is especially important. Fluvial deposits here are placed on the limnic ones. The age of the filling bottom of the river channel situated here may indicate that *ca* 6500 BP the Lake Jasień waters anew (after the breake persisting about 3500 BP; Florek, 1991, 1992) overflowed northwards, which gave rise to the River Łupawa Neo-Holocene stage of existence. The remaining datings of the bottom of paleomeanders filling (Dębe and Kozin sites), have no notable paleogeographic and stratigraphic meaning.

On some sites placed in littoral zone of the lake and also on the areas of present peat-bogs and gyttja-bogs, which where part of the lake in the past, in limnic deposits occur the intercalations of telmatic and peat-bogs deposits (mainly peat), the age of which may be used to define the consecutive stages or rapid changes of the water level in the lake. This concerns both the rising and the lowering of the water level, described by the age of the next peat layer tops and bottoms. The age of the bottom of upper peat layer, dated in two sufficiently distant sites for 500±80 BP (Łupawsko site, **Fig. 2**, **Table 2**) and 580±160 BP (Obrowo site, **Fig. 3**, **Table 2**), convinces us that this instrument is convenient and sufficiently sensitive. This gives encouragement for using other datings, presented in **Table 2**, to define space and chronological range of water level changes in Lake Jasień.

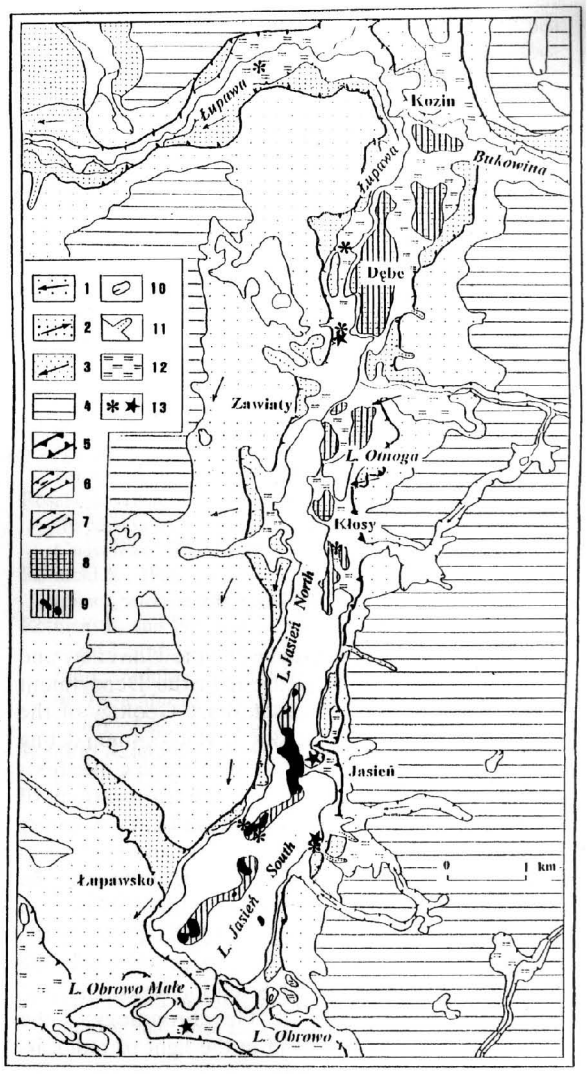

Fig. 1. *Geomorphological situation of Lake Jasień subglacial channel; outwash morphological levels and direction of meltwater outflow: 1 – 125-135 m a.s.l., 2 – 115-120 m a.s.l., 3 – 95-105 m a.s.l., 4 – morainic plateaux, 5 – subglacial channels, 6 – subglacial channels used by river and partly transformed them, 7 – meltwater valleys, 8 – kems, 9 – eskers, 10 – melt-out hollows, 11 – denudational and erosional valleys, 12 – organogenic accumulation areas, 13 – location sites of radiocarbon dating samples took before and in frames Project No 6 P04E 026 10.*

Table 1. *Dating results of the bottom peat layers.*

Site	Lab. No.	Altitude [m a.s.l.]	^{14}C Ages [BP]	Remarks
Zawiaty	Gd-1766	106.26-106.34	9360±70	Bottom of layer
Kłosy	Gd-2836	108.22-108.31	9630±130	Bottom of layer
Jasień (Łupawsko)	Gd-2838	111.20-111.27	9200±140	Bottom of layer
Jasień (Łupawsko)	Gd-5323	111.70-111.81	7960±90	Bottom of layer
Jasień (Łupawsko)	Gd-2834	112.08-112.15	7410±140	Bottom of layer
Jasień Północny	Gd-10459	108.73-108.80	10050±120	Bottom of layer
Jasień Północny	Gd-9625	108.88-108.94	8220±320	Bottom of layer
Jasień (Łupawsko)	Gd-2837	111.94-112.02	8510±150	Bottom of layer
Kozin	Gd-2251	99.48-99.65	10490±200	Organic intercalation in gravel

Table. 2. *Dating results of the peat layers from different sites.*

Site	Lab. No.	Altitude [m a.s.l.]	^{14}C Ages [BP]	Remarks
Jasień (Łupawsko)	Gd-6084	112.25-112.3	500±80	Bottom of layer
Jasień (Łupawsko)	Gd-2835	111.44-111.50	8640±140	Top of the one of inner layer
Jasień (Łupawsko)	Gd-4148	110.29-110.35	7570±130	Bottom of the one of inner layer
Zawiaty	Gd-9861	108.72-108.80	6610±200	Bottom of the upper layer
Zawiaty	Gd-2245	109.22-109.30	6570±130	Bottom of the paleomeander filling
Dębe	Gd-2242	108.94-109.02	5 600±130	Bottom of the paleomeander filling
Kozin	Gd-2244	103.74-103.83	1520±110	Bottom of the paleomeander filling
Jasień (Obrowo)	Gd-10698	112.36-112.46	2520±170	Bottom of the one of inner layer
Jasień (Obrowo)	Gd-10705	112.9-113.0	1090±140	Top of the one of inner layer
Jasień (Obrowo)	Gd-10704	113.02-113.10	580±160	Bottom of the upper layer

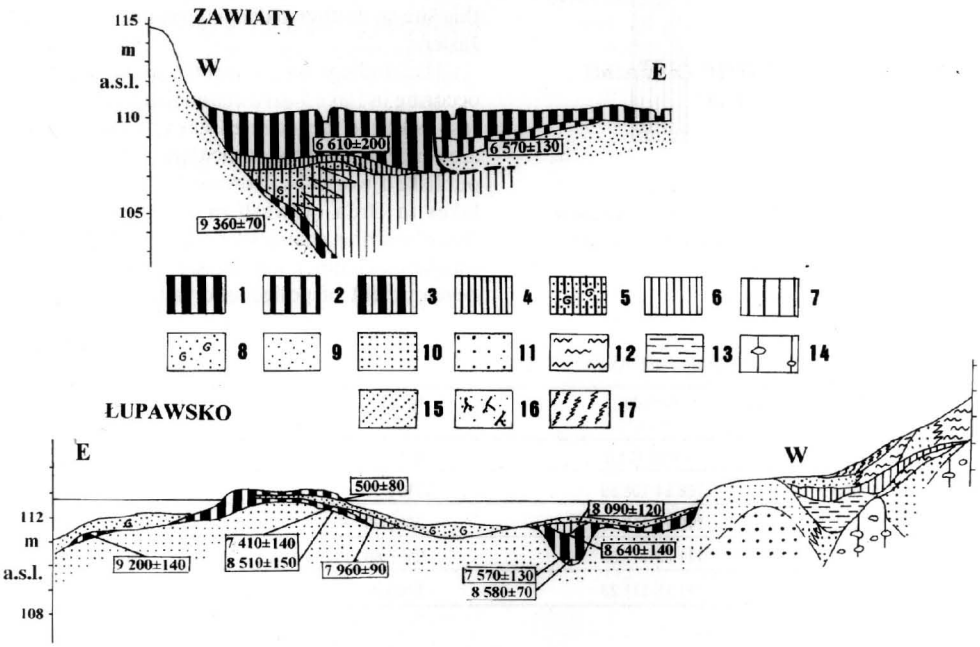

Fig. 2. Conventional radiocarbon age of organogenic sediments from Zawiaty and Łupawsko sites (location: see Fig. 1): 1 – peat, 2 – peat with sandy intercalations, 3 – peaty silt, 4 – peat with gyttja intercalations, 5 – gyttja with sand admixture and malacofauna, 6 – calcareous gyttja, 7 – detritus gyttja, 8 – limnic sand with malacofauna, 9 – fluvial sand, 10 – glaciofluvial medium- and fine-grained sand, 11 – glaciofluvial gravel and coarse-grained sand, 12 – glaciofluvial silt, 13 – varved clay, 14 – till, 15 – varying grained sand of alluvial fan, 16 – deltaic, varying grained sand with organic admixture, 17 – deluvial sand and silt.

4. THE MEANING OF THE DELTA DEPOSITS DATING

Investigations on the site located in the eastern part of Lake Jasień South were started with conviction that they concern the low placed terrace. During the detailed geomorphological mapping it turned out that we were dealing with a delta of small stream flowing from the morainic plateau slope. The complicated course of this stream channel, changing its location many times in consequence of the delta accumulation development and also in consequence of the lake water level changes, was the reason why the situation was not obvious for those carrying out the field reconnaissance in primary stages of investigations. Defining of the investigated form as rather typical, developing lake delta, on which apart from sand material accumulation we are dealing with rather abundant sedimentation of organic remnants, explains why the obtained dates are so young (the earlier developed fragment of delta had to tie to its lower situated part) and why they do not configurate in the classical stratigraphic order. This situation also implies that the obtained dates may have only a very limited application in investigations on Holocene changes of water surface level in Lake Jasień.

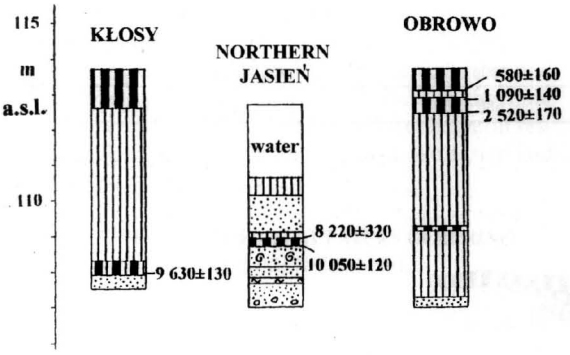

Fig. 3. *Conventional radiocarbon age of organogenic sediments from boreholes sites Kłosy, Northern Jasień and Obrowo (location: see Fig. 1); signatures like on Fig. 2.*

5. DATING OF CALCAREOUS GYTTJA

Dating of calcareous gyttja was attempted only once when a very promising site in Łupawsko was discerned (Florek, 1991, 1992, **Fig. 2**, **Table 4**). It turned out, however, that the shallow placed sequence of gyttja and peats contains the combination of "inverted" dates, which cannot be used in paleogeographic and stratigraphic interpretation of lake channel deposits.

6. DISCUSSION

The geological and geomorphological investigations carried out, and also radiocarbon datings, brought useful data for solving basic paleogeographical problems connected with the functioning of Late Glacial and Holocene drainage system in Pomerania Lakeland area. The datings answer the question: when, while the geological and geomorphological investigations answer the question: how and where. Thus we arrive at the explanation of basic paleogeographic questions.

It has been confirmed, that the datings of bottom, inner and top of peat layers appearing in the area of subglacial channel, the bottom of which is now occupied by Lake Jasień, afford the possibility to define precisely the range and chronology of changes of the lake water level. The deposits gathered in deltas area are not useful for this purpose, because most of them accreate laterally in this zone and, moreover, they undergo the, frequently repeated, redeposition. As we were unable to find the reasons for dates "invertion" of the samples taken in the Łupawsko site, we decided not to use this site in further paleogeographical analysis of Lake Jasień.

The findings on the stratigraphic position of peats occuring in Lake Jasień channel are conformable to the results of the recent researches on lakes of the glacial area of Poland. This particularly refers to the recently published works by Nowaczyk (1994 a, b) about the lakes in Brda outwash plain, Niewiarowski (1995) describing the changes of lakes of the Żnin-Biskupin subglacial channel, and Błaszkiewicz (1998) about the development of poligenetic valley of River Wierzyca.

Table. 3. *Dating results of samples from delta and alluvial fan.*

Site	Lab. No.	Altitude [m a.s.l.]	^{14}C Ages [BP]	Remarks
Jasień	Gd-6089	114.50-114.0	980±60	Fossil soil
Jasień	Gd-9615	108.54-108.59	3010±350	Delta
Jasień	Gd-10473	110.73-110.78	300±80	Delta
Jasień	Gd-11260	111.03-111.08	850±60	Delta
Jasień	Gd-10458	111.18-111.23	Modern	Delta

Table. 4. *Dating results of calcareous gyttja.*

Site	Lab. No.	Altitude [m a.s.l.]	^{14}C Ages [BP]	Remarks
Jasień (Łupawsko)	Gd-5325	110.21-110.29	8580±70	Bottom of the lower layer
Jasień (Łupawsko)	Gd-4144	111.50-111.63	8090±120	Bottom of the upper layer

Common to those authors is a thesis about existing pre-Allerød stage of the lakes development and close connection of genesis of bottom peat layer with an to existence of buried dead-ice blocks, preserving the deepest parts of lake channels. The authors mentioned above link the gradual melting of the dead-ice and flooding of peats by water with the Eo-Holocene stage of lake development on young glacial area. Similar succession of events with regard to Lake Jasień subglacial channel has earlier been indicated by Florek (1991, 1992). Results of the latest investigations confirm the cogency of such interpretation of geological materials and radiocarbon datings.

What is worth emphasising is the procurement of the series of dates defining the age of top peat layers, which will be used for the revision of the curve of the lake water level changes in Subatlantic period. These materials will be published in separate work.

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