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FIRST TL DATINGS OF VISTULIAN SEDIMENTS IN THE VISTULA VALLEY NEAR WŁOCIAWEK

Summary. TL dates are presented for three profiles of Pleistocene sediments situated in the Vistula valley between Dobrzyń and Włocławek. Two age complexes were distinguished within dated series of sediments. The preliminary results presented in this paper seriously contradict commonly accepted opinions on the chronostratigraphy of the last glaciation (Vistulian) in Central Poland.

1. INTRODUCTION

The aim of this paper is to present results of the thermoluminescence (TL) studies of Pleistocene sediments from three profiles situated on the right bank of the Vistula valley near Dobrzyń and Włocławek. TL data presented here will be further used as a starting point in a comprehensive paper dealing with the stratigraphy of Quaternary sediments of high Vistulian scarps in the Vistula valley between Modlin and Włocławek. This area, coinciding with the edge of the Vistula Pradolina (ice-marginal valley), is of primary importance for paleogeographical studies in the central part of the Polish Lowland because of occurrence of numerous and especially large outcrops with high variability of sediments in both vertical and horizontal directions. Though comprehensive background to the stratigraphy of Vistulian sediments in the Vistula valley between Płock and Gdańsk had been presented during the Symposium on Vistulian Stratigraphy, Poland 1979, in a number of field presentations (Guide-Book, 1979), this part of valley (between Dobrzyń and Włocławek) was not included in the field programme of the Symposium. However, sufficient data on stratigraphy, lithology and chronology of Vistulian deposits in the neighbouring parts of the Vistula valley are presented by several authors in the mentioned Guide-Book (1979).

The basets occurring in the discussed part of the Vistula valley have been described recently by M. Brykczynski (1982), who also attempted to correlate Pleistocene profiles (Brykczynski, 1983). Because of lack of

reliable methods of correlation this attempt was, however, limited to the best-baseted profiles in the discussed part of the Vistula valley. It seems that the difficulties arising in correlation of profiles of Quaternary sediments should be overcome with the application of the thermoluminescence (TL) method of dating.

2. STUDY AREA

Three bassets were chosen for detailed TL studies, namely: Kulin (52°50'12"N, 19°04'25"E), Bachorzewo (52°38'24"N, 19°17'55"E), and Dobrzyń-Wyszna (52°37'46"N, 19°19'42"E). Investigated profiles, described by Brykczynski (1983, profiles 1, 5 and 12 in Fig. 2) include three characteristic horizons of boulder clay separated with series of fluvioglacial sands. Thickness of deposits in natural outcrops range from 10 m (in Dobrzyń-Wyszna profile) to more than 20 m in Bachorzewo profile. TL studies were performed on 7 samples from the Kulin profile, 10 samples from the Bachorzewo profile and 9 samples from the Dobrzyń-Wyszna profile.

3. LABORATORY METHODS

All laboratory studies were performed at the TL Laboratory of the Department of Geomorphology and Quaternary Geology of Gdańsk University in Gdynia. Values of the dose rate d , defined as the sum of annual doses of d_a , d_b and d_γ was determined using three-channel γ -spectrometer AZAR82 and radiometer ZR16. The contribution of cosmic radiation (d_c) to the the annual dose was estimated from formulas given by Yokoyama et al (1982). The equivalent dose ED was determined by the regeneration method, taking into account the residual TL in dated samples (Wintle, 1982; Singhvi, Wagner, 1985; Fedorowicz, Olszak, 1985). All results of TL studies are presented in Table 1, which is constructed according to recommendations of the Third Specialist Seminar on TL and ESR Dating (Aitken, 1984) and shown in Fig. 1.

4. DISCUSSION

The profiles of Pleistocene sediments in the Vistula valley between Dobrzyń and Włocławek consist of three horizons of boulder clay. The upper and middle horizons are separated with sands and gravels, and locally (Kulin) with thin layer of varved clays. The lower horizon is separated from the middle one with thick layer of varved clays, which is seen in most of bassets. The results of TL dating allow to distinguish two distinct age complexes in investigated profiles. The older complex consists of lower boulder clay horizon, dated to ca 130 ka BP, while the

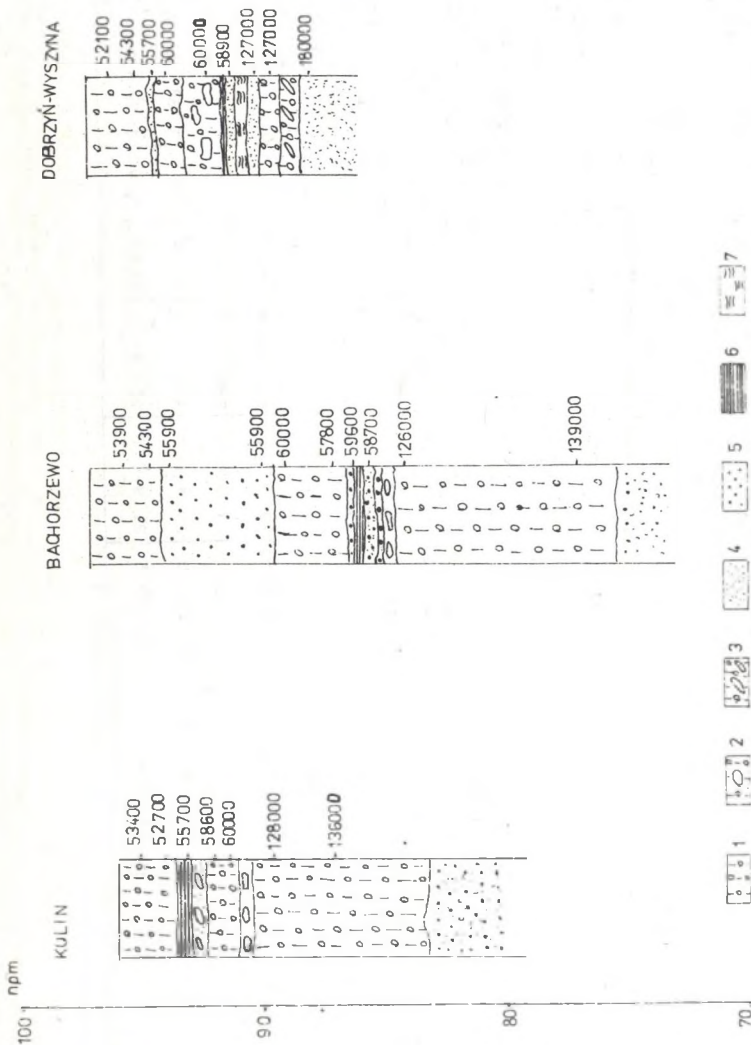


Fig. 1. Geological structure of investigated profiles with indicated TL dates. 1 - boulder clay, 2 - boulder clay with stones, 3 - boulder clay with lenticles of sand, 4 - sands, 5- gravels, 6- varved clays, 7 - gлина свазова z wkładkami piasku, 4 - piaski, 5 - świry, 6 - iły warwowe, 7 - mułki

Table 1

Results of dose and TL age determinations

Sample	No. lab.	Depth m	U	Th	K	d _c	d _a	d _b	d _y	D _r	ED	TL age
Kullin 1	UG-278	1.2	11.7±0.4	19.1±0.6	520.5±16	0.14	0.05	1.54	0.74	2.48	132±14	53.4±8.0
Kullin 2	UG-279	2.5	10.4±0.3	24.0±0.7	603.3±18	0.13	0.06	1.76	0.86	2.82	149±15	52.7±8.0
Kullin 3	UG-280	2.8	0.3	9.7±0.3	327.1±10	0.13	0.02	0.88	0.38	1.41	78±10	55.7±8.5
Kullin 4	UG-281	3.5	12.0±0.4	17.6±0.5	442.5±13	0.12	0.05	1.34	0.67	2.18	128±13	58.6±9.0
Kullin 5	UG-282	4.0	11.9±0.3	20.0±0.6	522.0±16	0.12	0.06	1.55	0.76	2.50	150±12	60.0±9.0
Kullin 6	UG-283	5.0	14.9±0.5	21.5±0.6	555.5±16	0.10	0.06	1.67	0.83	2.68	343±40	128.0±19.0
Kullin 7	UG-284	6.0	15.6±0.5	24.6±0.7	553.7±16	0.07	0.07	1.69	0.87	2.72	369±40	136.0±20.5
Bachorzewo 1	UG-285	1.5	9.9±0.3	18.9±0.5	497.9±10	0.14	0.05	1.46	0.72	2.37	128±15	53.9±8.0
Bachorzewo 2	UG-286	2.5	6.8±0.2	18.9±0.5	499.5±10	0.13	0.05	1.44	0.68	2.30	125±15	54.3±8.5
Bachorzewo 3	UG-287	3.1	1.2±0.3	6.4±0.2	248.4±8	0.12	0.01	0.67	0.28	1.09	60±9	55.9±8.5
Bachorzewo 4	UG-288	7.0	0	7.3±0.4	287.2±8	0.07	0.01	0.76	0.31	1.16	65±10	55.9±8.5
Bachorzewo 5	UG-289	7.5	10.7±0.3	23.4±0.7	450.2±13	0.07	0.06	1.38	0.74	2.25	135±15	60.0±9.0
Bachorzewo 6	UG-290	10.0	15.4±0.5	21.9±0.7	569.6±17	0.04	0.06	1.72	0.65	2.68	155±16	57.8±9.0

Bachorzewo 7	UG-291	10.5	4.6±0.1	12.4±0.4	381.0±11	0.04	0.03	1.06	0.49	1.64	97±10	59.6± 9.0
Bachorzewo 8	UG-292	11.1	8.3±0.2	19.0±0.6	455.2±14	0.04	0.05	1.34	0.66	2.10	123±16	58.7± 9.0
Bachorzewo 9	UG-293	12.5	13.1±0.4	22.9±0.7	526.1±15	0.03	0.06	1.59	0.81	2.50	315±32	126.0±18.9
Bachorzewo 10	UG-294	20.0	14.2±0.4	21.3±0.6	529.8±15	0.03	0.06	1.08	0.80	2.78	386±40	139.0±20.8
Dobrzyń - Wyszyna 1	UG-295	1.5	10.8±0.3	21.6±0.6	560.1±16	0.14	0.06	1.65	0.80	2.65	138±14	52.1± 7.8
Dobrzyń - Wyszyna 2	UG-296	2.5	7.3±0.2	21.3±0.6	522.0±16	0.13	0.05	1.51	0.73	2.43	131±14	54.3± 8.5
Dobrzyń - Wyszyna 3	UG-297	3.0	0	5.2±0.1	286.0± 9	0.12	0.01	0.75	0.28	1.17	65±10	55.7± 8.5
Dobrzyń - Wyszyna 4	UG-298	3.5	8.7±0.3	20.3±0.6	528.3±16	0.12	0.05	1.42	0.77	2.37	142±15	60.0± 9.0
Dobrzyń - Wyszyna 5	UG-299	5.5	10.9±0.3	20.3±0.6	516.8±15	0.10	0.05	1.53	0.75	2.44	146±15	60.0± 9.0
Dobrzyń - Wyszyna 6	UG-300	6.2	3.6±0.1	8.5±0.2	318.6±10	0.08	0.02	0.89	0.38	1.37	80± 8	58.9± 9.0
Dobrzyń - Wyszyna 7	UG-301	6.6	12.8±0.4	22.0±0.7	528.1±16	0.08	0.06	1.59	0.80	2.53	321±30	127.0±19.0
Dobrzyń - Wyszyna 8	UG-302	7.8	14.0±0.4	21.4±0.6	531.4±16	0.06	0.06	1.60	0.80	2.54	322±30	127.0±19.0
Dobrzyń - Wyszyna 9	UG-303	9.0	15.9±0.9	18.1±0.5	370.4±11	0.05	0.06	0.26	0.65	1.03	>185	>180.0

younger complex (dated to ca 60 ka BP) include whole upper part of sediments. TL age of the lower boulder clay horizon indicate that it is connected with the Warta glaciation (Wartanian).

5. CONCLUSIONS

The results presented in this paper should be treated as preliminary. They form a part of a research project on Pleistocene sediments in the Vistula valley between Modlin and Włocławek. Further studies will include other bassets of the Vistula valley and also sediments of the Vistula Pradolina, deposits forming upper terraces of the Vistula valley, and the flow tills at base of the valley. In certain localities these sediments show distinct glacitectonic deformations. These studies should lead to reconstruction of a geological processes in Polish Lowland during significant part of Pleistocene.

TL dates which form the "upper age complex" require carefull and critical approach. In future studies particular attention should be paid to the problem of validation of these data. They seriously contradict commonly accepted opinions on the chronostratigraphy of Vistulian sediments. Beacause this paper was prepared as a preliminary laboratory repbrt, we will not discuss here sophisticated chronostratigraphical details and confront our data with published papers on this subject. The readers are kindly asked to consult general review papers dealing with stratigraphy of Vistulian sediments in the Polish Lowlands (Drozdowski, 1980; Kozarski, 1980; Makowska, 1980; Mojski, 1980; Galon, 1982), published in proceedings volumes of the mentioned Symposium on Vistulian Stratigraphy. If our data are correct and will be confirmed in further studies, they will lead to the conclusion that the maximum extent of the last glaciation has occured in the older Vistulian, i.e. during phase GIV-1-2 according to the scheme of S. Z. Różycki (1978, 1980). In consequence essential changes of opinions concerning the course of the last glaciation in Central Poland will be necessary.

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PIERWSZE WYNIKI DATOWAŃ METODĄ TL OSADÓW VISTULIANU W DOLINIE WISŁY KOŁO WŁOCŁAWKA

Streszczenie

W artykule przedstawiono wyniki datowań metodą TL osadów plejstoceny z trzech stanowisk zlokalizowanych w dolinie Wisły między Dobrzyniem i Włocławkiem. Uzyskane wyniki pozwalają wyróżnić dwa zasadniczo różne kompleksy wiekowe osadów i prowadzą do wyraźnej sprzeczności z

powszechnie akceptowanymi poglądami dotyczącymi chronostratygrafii ostatniego zlodowacenia (Vistulianu) na terenie Polski Środkowej.

ПЕРВЫЕ РЕЗУЛЬТАТЫ ТЕРМОЛЮМИНЕСЦЕНТНОГО ДАТИРОВАНИЯ ОСАДКОВ ПОСЛЕДНЕГО ОЛЕДЕНЕНИЯ В ДОЛИНЕ ВИСЛЫ ВБЛИЗИ ВЛОЦЛАВКА

Резюме

В докладе приведены результаты датирования термолюминесцентным методом плейстоценовых осадков из трех разрезов в долине реки Вислы между Добжином и Влоцлавком. Все датировки проведены в термолюминесцентной лаборатории Гданского Университета в Гдыне регенерационным методом. Авторы приводят детальные результаты измерений всех величин необходимых для определения термолюминесцентного возраста и дают краткое описание применяемой экспериментальной методики. Полученные результаты указывают присутствие во всех исследованных разрезах двух существенно отличающихся возрастных комплексов, несовместимых с вообще распространенными воззрениями на хроностратиграфию последнего оледенения (вистулиана) в Центральной Польши.