

WORKING WITH SETS OF RADIOCARBON DATINGS. THE 3RD MILLENNIUM BC IN KUJAWY IN LIGHT OF 14C DATES

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At present we have 113 14C dates referring to Kujawy (Central Poland) which are presented in Table 1 in the order of a value of calibration age. The datings were made in laboratories in Berlin (Bln), Gliwice (Gd), Groningen (GrN), Kiev (Ki) and Köln (KN), Figure 1.

The Table 1 gives the basic data like the name of locality and site and feature number. Next, the table provides information about the relation of each 14C dating to a specific archaeological culture and its phase. In addition, there is information on the feature character (economic, grave, ritual) and the dated source material. Finally, the lab number and conventional BP value are included. Classes of standard deviations are established (Fig. 2). From this point of view almost a half of them have standard deviations between 30 and 45 years and 35% are in class 50–65

years. The calibrated value of each dating, obtained using Weninger's and Joris' program (Weniger/Joris 1998), is given as well.

The table also includes information about the category of each dating. This is an elaboration on the proposal presented in 1998 (Czebreszuk/Szmyt 1998, 213; cf. another proposal concerning the same matter: Waterbolk 1983; Müller 2000). The division into classes is based on two major criteria. The first of them is the type of source material sent to be dated (I – short-lived materials such as bones, single tree rings, carbon layer on vessels, seeds, reeds or grass; II – long-lived materials such as charcoal or soil samples; III – transformed short-lived materials, e.g. burnt bones). The other criterion is the character of the feature from which the sample comes tied to the degree of certainty of the relation of a given material to a specific cul-

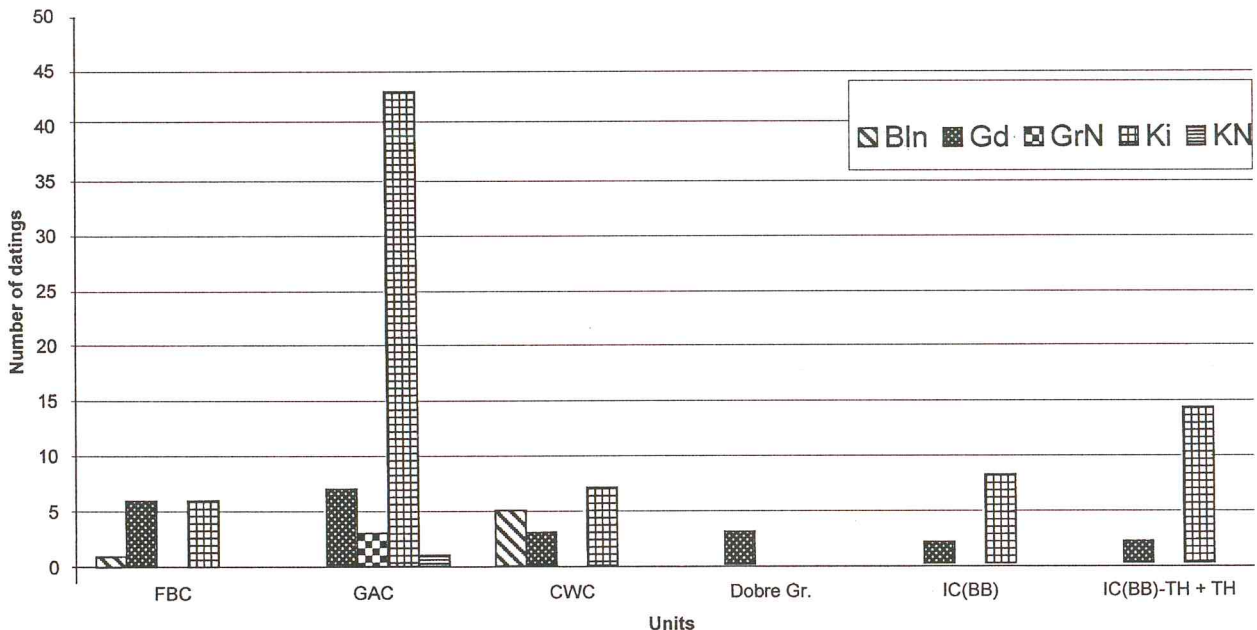


Fig. 1. Number of radiocarbon dates from different laboratories for each cultural units in Kujawy.

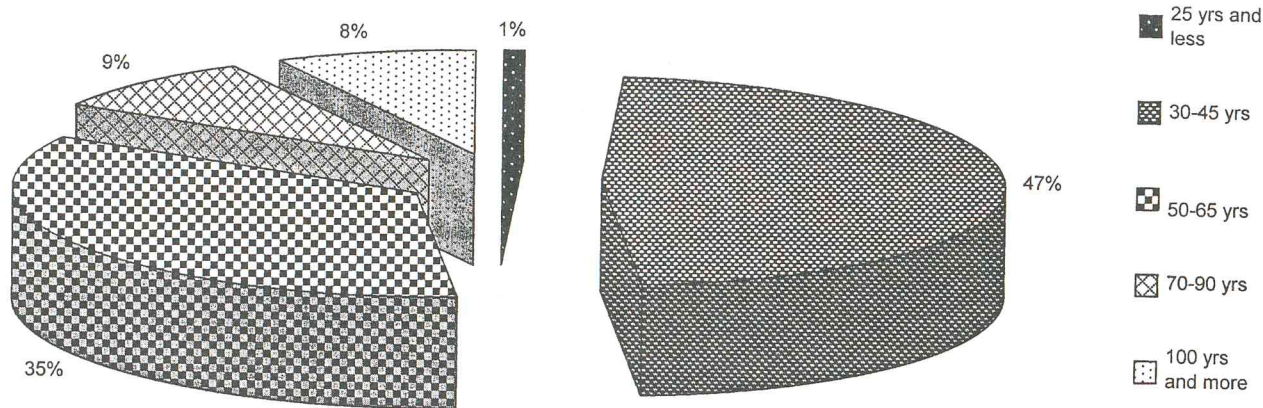


Fig. 2. Classes of standard deviations 14C dates using in the paper.

tural tradition (A – the sample comes from a grave or a ritual feature that is unequivocally related to a specific cultural tradition; B – the sample comes from a settlement feature that has a clear cultural identity; C – the sample comes from any feature of unclear cultural affiliation). The distribution of categories for each archaeological culture is given in Figure 3.

Series of 14C dates may serve the purpose of dating individual chronological and cultural units on two levels of generality: (1) setting general time brackets for individual archaeological cultures and (2) determining the chronology of specific stylistic phases within each of them.

1. ABSOLUTE CHRONOLOGY OF ARCHAEOLOGICAL CULTURES

Determining chronological brackets of taxonomic units of the highest rank, namely archaeological cultures, specifically of the Funnel Beaker Culture (FBC; Czerniak et al. 1990; Koško 1991a, Fig. 1; Czebreszuk/Szmyt 1998), Globular Amphora Culture (GAC; Szmyt 1996; Czebreszuk/Szmyt 1998), Corded Ware Culture (CWC; Czebreszuk 1996; 2000a; 2000b), Iwano Culture (IC – a local variety of Bell Beakers; Czebreszuk 1996; Czebreszuk/Szmyt 1998; Makarowicz 1998), Unetice Culture (UC; Koško 1991b) and Nemunas Culture (NC; Czebreszuk/Szmyt 1999), has strong foundations at the current stage of research based on 113 14C datings (Table 1).

A commonly used methodological solution to achieve the goal of dating a taxonomic unit is a joint calibration of all 14C dates relating to it. However, in the case of the 3rd millennium BC, this may present certain complications. A closer look at the calibration curve shows that throughout the 3rd millennium it

takes a very complicated course made up of alternating “flat” sections (*plateaux*) and abrupt peaks. Only after 1500 BC does its course become regular. The peak sections of the curve are the most useful as far as dating accuracy is concerned. In fact, with a reasonably accurate measurement, it is possible to determine the age of a sample in a peak section with point accuracy. Unfortunately, these abrupt peaks represent only a very low percentage of the whole curve. The greatest problem is the “flattenings”. In the case of a series of dates obtained from one feature or site, for which a sequence can be established with archaeological methods (e.g. stratigraphy), a way out is the wiggle matching analysis (e.g. Jansma/van der Plicht/Kars 1997; Weninger 1997; Weninger/Joris 1998) consisting in the “fitting” of a series of dates of known sequence into the complex course of the curve. It is quite different when we work with single datings of medium accuracy which, for instance, date a specific taxonomic unit in a given region. We face such a situation in Kujawy. A clear majority of dates is made up of single datings for a given feature or site. Moreover, even if we have more than one date for a feature, then, as a rule, we do not have any other data (e.g. stratigraphic ones) that would allow us to establish the temporal relationships between them. Such single dates, if their calibrated age falls on one of those “flattenings” of the curve, become “wandering datings”. As such they can refer practically to any moment within the “flat” section. The brief comments on the consequences of the complicated course of the calibration curve in the stage of prehistory of interest to us here, clearly restrict the use of this method. However, there are certain beneficial aspects of this state of affairs. For instance, if we had two separate datings whose calibrated values fitted entirely into different, for instance, neighboring “flattenings” of

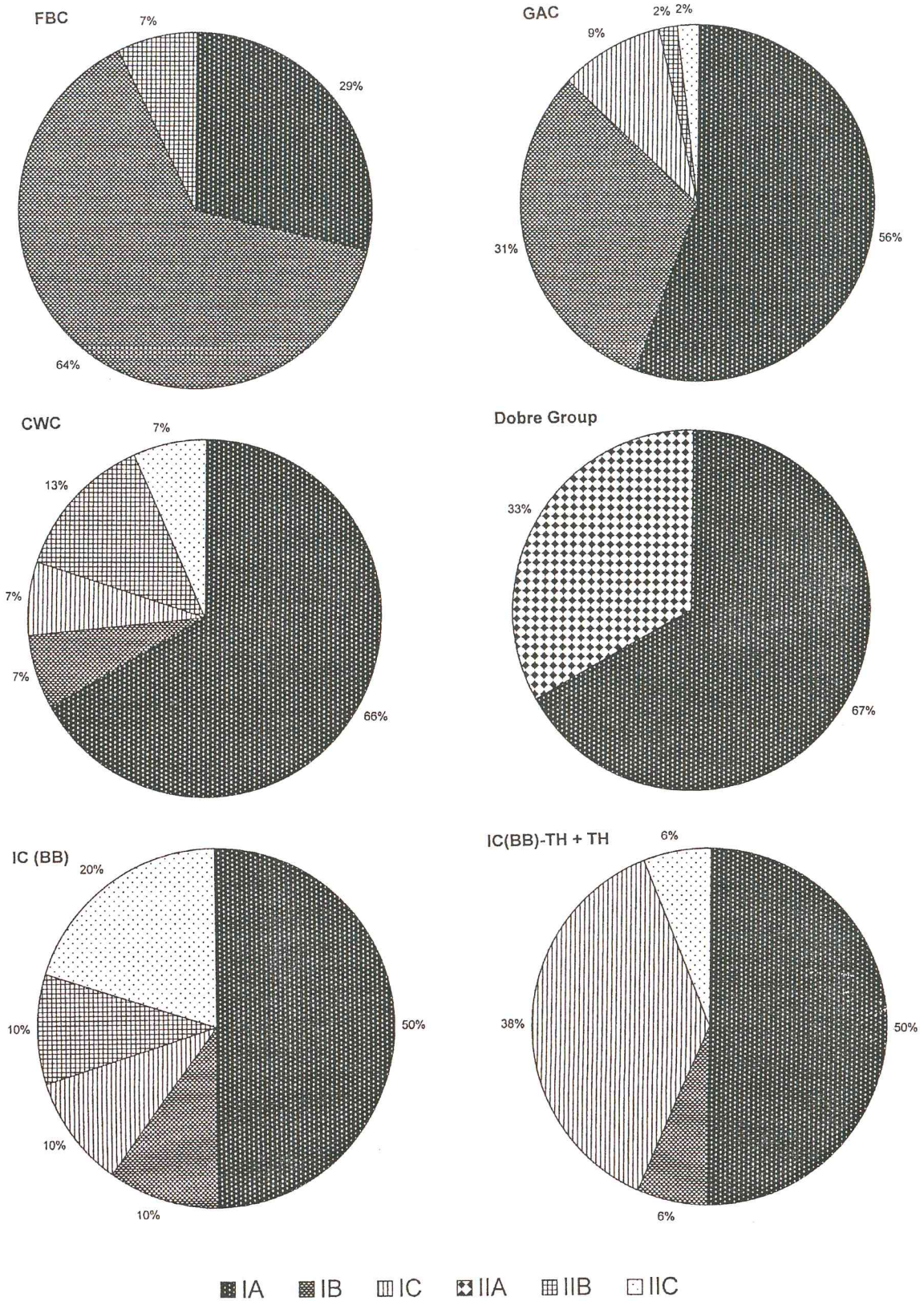


Fig. 3. The distribution of 14C dates' categories for cultural units.

Table 1. 14C dates from 3 rd millennium BC referring to Kujawy.

No	Locality	Site	Feature	Culture	Phase	Type of feature	Material	Lab. no	Conv.bp	Cal.BC	Category
1	Kuczkowo	1	A136	GAC	IIb	ritual	bones	Ki-6927	4420+55	3115+145	IA
2	Dębrowa Biskupia	21	89/90	TRB	IIIC	pit	charcoal	Gd-2289	4400+140	3105+195	IIB
3	Kuczkowo	1	A136	GAC	IIb	ritual	bones	Ki-6917	4415+45	3105+145	IA
4	Krusza Zamkowa	3	427	CWC	1	grave	bones	BlN-1812	4395+70	3100+150	IA
5	Kuczkowo	1	A136	GAC	IIb	ritual	bones	Ki-6929	4400+50	3085+135	IA
6	Opatowice	36	123	GAC	IIla	ritual	bones	Gd-6522	4350+120	3050+190	IA
7	Opatowice	3	19	TRB	VB	pit	bones	Gd-2642	4330+90	3020+140	IB
8	Kuczkowo	1	A136	GAC	IIb	ritual	bones	Ki-6928	4385+45	3015+75	IA
9	Kuczkowo	1	A136	GAC	IIb	ritual	bones	Ki-6926	4370+50	3005+75	IA
10	Kuczkowo	1	A15	GAC	IIb	pit	bones	Ki-6918	4380+40	3005+65	IB
11	Opatowice	12		TRB	VB?	pit	corn	Lod-20	4340+180	2995+275	IB
12	Siniarzewo	1	I48	GAC	IIb	ritual	bones	Ki-5910	4350+45	2980+60	IA
13	Boyejewice	22	F44	GAC	IIb	pit	bones	Ki-6913	4335+40	2965+55	IB
14	Krusza Zamkowa	13		GAC	IIb-IIIa	ritual	bones	GrN-14022	4330+35	2960+50	IA
15	Boyejewice	28	B40	GAC	IIb	pit	bones	Ki-6916	4315+40	2950+50	IB
16	Boyejewice	22	A2	GAC	IIb	ritual	bones	Ki-6914	4305+45	2945+55	IA
17	Siniarzewo	1	I127	GAC	IIb	pit?	bones	Ki-5909	4290+40	2925+45	IB
18	Opatowice	3	35	GAC	IIb-IIIa	pit	charcoal	KN-3765	4290+120	2920+200	IIB
19	Boyejewice	28	A14	GAC	IIb	pit	bones	Ki-6915	4280+45	2910+50	IB
20	Piecki	8	16	GAC	IIIa	pit	bones	Ki-5681	4270+30	2895+25	IB
21	Kierzkowo	1		GAC	IIIa	grave	bones	GrN-15412	4270+40	2885+45	IA
22	Boyejewice	22	A3	GAC	IIb	pit	bones	Ki-6912	4275+45	2880+60	IB
23	Inowrocław	58		TRB	V	ritual	bones	Gd-7118	4270+50	2865+85	IA
24	Opatowice	34	2	GAC?	IIb-IIIa	pit	bones	Ki-5138	4250+45	2830+80	IC
25	Piecki	8	13	GAC	IIIa	pit	bones	Ki-5680	4230+25	2830+60	IB
26	Krusza Podłotowa	2		TRB-CWC	VB-1	ritual	bones	Gd-1983	4250+70	2820+110	IA
27	Piecki	1	90	GAC	IIb-IIIa	pit	bones	Ki-6232	4230+40	2810+80	IB
28	Opatowice	3	64	GAC	IIb-IIIa	ritual	bones	Gd-4117	4230+110	2810+160	IA
29	Skoczka	1		GAC	IIb-IIIa	grave	bones	Ki-6329	4220+40	2800+80	IA
30	Siniarzewo	1	H152	CWC	4	pit	bones	Ki-5915	4180+40	2770+80	IB

No	Locality	Site	Feature	Culture	Phase	Type of feature	Material	Lab. no	Conv.bp	Cal.BC	Category
31	Opatowice	1	37	TRB	VC	pit	bones	Gd-8034	4190+60	2765+95	IB
32	Opatowice	34	34	GAC?	IIb-IIIa	pit	charcoal	Gd-8033	4200+70	2765+105	IIC
33	Yerniki	27		CWC	2	grave	bones	Ki-6331	4170+40	2760+80	IA
34	Opatowice	36	123	GAC	IIIa	ritual	bones	Ki-5136	4180+70	2750+100	IA
35	Rzadkwin	21	7	GAC	IIb-IIIa	grave	bones	Ki-6233	4150+40	2745+95	IA
36	Yegotki	2	A68	GAC	IIIa	pit	bones	Ki-6220	4150+45	2745+95	IB
37	Kierzkowo	1		GAC	IIIa	grave	bones?	GrN-15411	4135+40	2735+95	IA
38	Opatowice	32	51B	GAC?	IIb-IIIa	pit	bones	Ki-5597	4160+70	2735+105	IC
39	Yerniki	27		CWC	2	grave	bones	Ki-6330	4120+45	2725+105	IA
40	Nakonowo	1		GAC	IIIa	grave	bones	Ki-7019	4120+50	2720+110	IA
41	Opatowice	35	82	GAC	IIIa	pit	bones	Ki-5594	4130+65	2720+110	IB
42	Piecki	8	18	GAC	IIIa	grave	bones	Ki-6513	4105+40	2710+110	IA
43	Boyejewice	8	32B	CWC	1	grave	charcoal	Gd-888	4140+120	2705+155	IIA
44	Nakonowo	1		GAC	IIIa	grave	bones	Ki-7015	4090+40	2700+120	IA
45	Opatowice	35	83	NC		pit	bones	Ki-5129	4070+40	2650+120	IB
46	Opatowice	34	34B	GAC?	IIb-IIIa	pit	bones	Ki-5131	4060+55	2645+125	IC
47	Nakonowo	1		GAC	IIIa	grave	bones	Ki-7014	4050+50	2615+105	IA
48	Nakonowo	1		GAC	IIIa	grave	bones	Ki-7013	4130+45	2615+105	IA
49	Opatowice	1	7	TRB	VC	pit	bones	Ki-5596	4040+50	2590+90	IB
50	Yegotki	2	A113	GAC	IIIa	ritual	bones	Ki-6221	4030+60	2590+100	IA
51	Kuczkowo	5	C114	GAC	IIIa	pit	bones	Ki-6508	4040+35	2560+60	IB
52	Opatowice	36	67	GAC	IIIa	ritual	bones	Gd-6438	4010+100	2560+170	IA
53	Murzynno	1		TRB-CWC	V-1	ritual	bones	Ki-6332	4020+50	2555+65	IA
54	Kuczkowo	1	E2	GAC	IIIb	pit	bones	Ki-6510	3990+35	2515+45	IB
55	Opatowice	1	36	TRB	VC	pit	bones	Ki-5133	3990+65	2505+95	IB
56	Siniarzewo	1	O9	GAC	IIIb	pit	bones	Ki-6511	3980+45	2500+60	IB
57	Opatowice	1	6	TRB	VC	pit	charcoal	Gd-4686	3980+80	2495+125	IIB
58	Opatowice	1	39	TRB	VC	pit	bones	Ki-5139	3960+45	2470+80	IB
59	Smarglin	22		BB	1	pit	charcoal	Ki-6885	3950+45	2450+80	IIC
60	Opatowice	35	34	GAC	IIIa	ritual	bones	Ki-5595	3950+60	2445+95	IA

No	Locality	Site	Feature	Culture	Phase	Type of feature	Material	Lab. no	Conv.bp	Cal.BC	Category
61	Opatowice	1	9	TRB	VC	pit	bones	Ki-5598	3930+60	2420+90	IB
62	Narkowo	16	23	BB	1	pit	charcoal	Ki-5604	3930+70	2415+105	IIB
63	Opatowice	36	101A	GAC	Illa	ritual	bones	Ki-5137	3920+60	2400+90	IA
64	Krusza Zamkowa	13		TRB-CWC	VB-1	ritual	bones	Bln-2187	3920+60	2400+90	IA
65	Siniarzewo	1	H126	GAC	Illa	pit	bones	Ki-6512	3915+40	2400+60	IB
66	Ujowo	4	37	BB	2-3	grave	bones	Gd-5117	3910+50	2390+70	IA
67	Kuczkowo	1	A132	GAC	Illa	ritual	bones	Ki-6509	3910+40	2390+60	IB
68	Ciechrz	25	A60	CWC	4	grave	bones	Ki-6228	3900+35	2390+60	IA
69	Nakonowo	1		GAC	Illa	grave	bones	Ki-7016	3905+45	2385+65	IA
70	Kuczkowo	1	D6	GAC	Illa	pit	bones	Ki-6507	3895+45	2380+70	IB
71	Opatowice	1	38	GAC	Illa	ritual	bones	Gd-8035	3900+60	2375+85	IA
72	Opatowice	35	78	GAC	Illa	pit	bones	Ki-5922	3890+50	2365+75	IC
73	Opatowice	1	6	TRB	VC	pit	bones	Ki-5600	3890+60	2360+90	IB
74	Nakonowo	1		GAC	Illa	grave	bones	Ki-7017	3880+50	2360+80	IA
75	Nakonowo	1		GAC	Illa	grave	bones	Ki-7018	3870+45	2350+80	IA
76	Dfbrowa Biskupia	21	214	CWC	4	grave	bones	Ki-6881	3865+45	2345+85	IA
77	Kuczkowo	5	B73	CWC	2	grave	bones	Ki-6243	3860+40	2340+80	IA
78	Opatowice	35	78	GAC?	Illa	pit	bones	Ki-5593	3870+60	2335+95	IC
79	Opatowice	36	101A	GAC	Illa	ritual	bones	Gd-8037	3850+50	2320+90	IA
80	Podgaj	6A	3	CWC	4	grave	bones	Gd-1684	3840+50	2310+90	IA
81	Siniarzewo	1	H21	BB	2	grave	bones	Ki-6239	3820+50	2285+95	IA
82	Opatowice	1	38	GAC	Illa	ritual	bones	Gd-8036	3820+60	2285+105	IA
83	Podgaj	32	9	CWC	2	pit	charcoal	Bln-2299	3800+60	2255+105	IIB
84	Bojejewice	8	2	UC		grave	charcoal	Gd-1349	3800+50	2250+90	Ila
85	Biskupin	2a		BB-TH		ritual	bones	Ki-6313	3800+40	2240+70	IA
86	Biskupin	2a		BB-TH		ritual	bones	Ki-6311	3790+50	2235+85	IA
87	Bojejewice	28		CWC?		grave	bones	Ki-6219	3790+30	2225+55	IC
88	Biskupin	2a		BB-TH		ritual	bones	Ki-6314	3780+45	2215+75	IA
89	Bojejewice	8	24	UC		grave	bones	Gd-3025	3770+50	2190+90	IA
90	Bojejewice	8	24	UC		grave	bones	Gd-2499	3760+120	2190+180	IA

No	Locality	Site	Feature	Culture	Phase	Type of feature	Material	Lab. no	Conv.bp	Cal.BC	Category
91	Podgaj	34		CWC?		ritual	charcoal	BIn-2598	3760+60	2175+105	IIC
92	Biskupin	2a		BB-TH		ritual	bones	Ki-6310	3740+40	2140+80	IA
93	Parchanki	25		BB	1	grave	bones	Ki-6335	3730+40	2130+70	IC
94	Dóby	29A	89	CWC-BB		pit	charcoal	Gd-7040	3710+50	2110+80	IIC
95	Biskupin	2a		BB-TH		ritual	bones	Ki-6306	3710+55	2105+85	IA
96	Biskupin	2a		BB-TH		ritual	bones	Ki-6305	3680+45	2065+75	IA
97	Siniarzewo	1	H21	BB	2	grave	bones	Ki-5908	3680+50	2065+75	IA
98	Zarbowo	21	1	CWC	2	pit	charcoal	BIn-1512	3670+45	2055+75	IIB
99	Mycielewo	1		BB	2	grave	bones	Ki-6334	3670+40	2050+70	IA
100	Biskupin	2a		BB-TH		ritual	bones	Ki-6312	3660+50	2040+80	IA
101	Biskupin	2a		BB-TH		ritual	bones	Ki-6305	3680+45	2041+76	IC
102	Grabie	4	27	TH		grave	bones	Gd-2644	3650+90	2035+125	IC
103	Biskupin	2a		BB-TH		ritual	bones	Ki-6315	3650+50	2030+80	IA
104	Biskupin	2a		BB-TH		ritual	bones	Gd-6664	3630+100	2005+145	IIC
105	Biskupin	2a		BB-TH	1	ritual	bones	Ki-6308	3620+45	1990+70	IC
106	Brzeź	4	738	CWC-BB		?	?	Lod-160	3590+250	1990+330	IC
107	Mycielewo	1		BB	2	grave	bones	Ki-6333	3610+45	1975+65	IA
108	Biskupin	2a		BB-TH		ritual	bones	Ki-6309	3610+45	1975+65	IC
109	Yegotki	3	A112	BB-TH	3-1	pit	bones	Ki-6896	3605+50	1970+70	IB
110	Toruń	243		BB	3	pit	charcoal	Gd-7228	3600+50	1960+70	IIC
111	Biskupin	2a		BB-TH		ritual	bones	Ki-6307	3600+40	1960+60	IC
112	Radojewice	29	A110	TH		grave	bones	Ki-6883	3590+40	1950+60	IC
113	Siniarzewo	1	H201	BB	3	pit	bones	Ki-5916	3590+50	1945+75	IB

1,3,5,6,8-10,12-22,24,25,27-29,32,34-38,40-42,44,46-48,50-52,54,56,60,63,65,67,69-72,74,75,78,79,82 - Szmyt 2000; 2 - Koško 1989a, Fig.1.; 4 - Koško 1992; 7 - Koško 1991a, Fig.1; 11 - Grygtel 1979; 23 - Koško 1996; 26 - Koško 1997; 30,68,77,87 - Czebreszuk 2000a; 31 - Czebreszuk/Szmyt 1998, Abb.8A; 33,39 - Czebreszuk/Łoś 1999; 43 - Koško/Kločko 1991; 45 - Czebreszuk/Szmyt 1999; 49,55,58,61 - excavation of Prof. A. Koško Ph.D. We would like to express our gratitude to him for the opportunity to using unpublished dates; 53 - Koško 1997; 57 - Czebreszuk/Szmyt 1998, Abb.8B; 59,62,66,81,84-88,90,92,93,95-97,99-113 - J. Czebreszuk/P. Makarowicz 2000; 64 - Koško 1989b, 46-58; 73 - Czebreszuk/Szmyt 1998, Abb.8B; 76 - excavation of P. Chachlikowski Ph.D. We would like to express our gratitude to him for the opportunity to using unpublished dates; 80 - Klunder 1988; 83 - Czebreszuk 1996, Ryc.17; 91- Czebreszuk 1996, Ryc.26; 94 - Czebreszuk/Szmyt 1998, Abb.22; 98 - Czebreszuk 1996, Ryc.18.

Table 2. Distribution of Kujawy's 14C dates depending on intervals BC and archaeological unites.

<i>Interval BC</i>	<i>Wiggle-Interval BC</i>	<i>FBC</i>	<i>GAC</i>	<i>CWC</i>	<i>IC</i>	<i>TH</i>	<i>Other</i>
to 2920	3350 – 3100	Gd-2289	Ki-6927 Ki-6917	Bln-1812			
	3100 – 2920	Gd-2642 Lod-20	Ki-6929 Ki-6928 Ki-6918 Ki-6926 Gd-6522 Ki-5910 Ki-6913 GrN-14022 Ki-6916 Ki-6914 Ki-5909				
2920 - 2880			KN-3765 Ki-6915 Ki-6912 GrN-15412 Ki-5681				
2880 – 2480	2880 – 2600	Gd-7118 Gd-1983 Gd-8034	Ki-5138 Ki-5597 Ki-6233 GrN-15411 Gd-4117 Ki-5680 Ki-6232 Ki-6329 Gd-8033 Ki-5136 Ki-6220 Ki-5594 Ki-6513 Ki-7013 Ki-7019 Ki-7613 Ki-7015 Ki-5131 Ki-7014	Gd-888 Ki-5915 Gd-1983 Ki-6331 Ki-6330			Ki-5129 NC
	2620 – 2480	Ki-5596 Ki-5133 Ki-6332 Gd-4686	Ki-6221 Ki-6510 Ki-6508 Gd-6438 Ki-6511	Ki-6332			Ki-5129
2480 – 2300		Ki-5139 Ki-5598 Bln-2187 Ki-5600	Ki-5595 Ki-5137 Ki-6512 Ki-6509 Ki-7016 Gd-8035 Ki-6507 Ki-5922 Ki-7017 Ki-5593 Ki-7018 Gd-8037	Gd-1684 Ki-6228 Ki-6881 Ki-6243 Bln-2187	Ki-6885 Ki-5604 Gd-5117		

<i>Interval BC</i>	<i>Wiggle-Interval BC</i>	<i>FBC</i>	<i>GAC</i>	<i>CWC</i>	<i>IC</i>	<i>TH</i>	<i>Other</i>
2300 – 2140	2300 – 2200		Gd-8036	Bln-2299 Ki-6219	Ki-6239 Ki-6313 Ki-6311 Ki-6314	Ki-6313 Ki-6311 Ki-6314	Gd-1349 UC
	2200 – 2140			Bln-2598	Ki-6310	Ki-6310	Gd-3025 UC Gd-2499 UC
2140 – 1950	2140 – 2030			Gd-7040 Bln-1512	Ki-6335 Ki-6306 Gd-7040 Ki-5908 Ki-6305 Ki-6334 Ki-6312 Ki-6315	Ki-6306 Ki-6305 Ki-6312 Gd-2644 Ki-6315	
	2030 – 1950			Lod-160	Ki-6308 Ki-6309 Ki-6333 Ki-6896 Ki-6307 Lod-160	Ki-6308 Ki-6309 Ki-6896 Ki-6307 Ki-6883	

the curve, then we could say with certainty that they refer to two episodes of a clearly defined sequence. Owing to the “flattening analysis”, it is, therefore, possible to assign series of “wandering dates” to reasonably separate sets for which, in turn, clear time brackets can be set.

Recently, D. Raetzl-Fabian (1986) and J. Müller (2000) have brought some order to the problem of irregularity of the calibration curve. D. Raetzl-Fabian distinguished 16 sections in the interval between 4200 and 2200 cal BC and designated them A – O. Most of them are the “flat sections” which present difficulties. J. Müller, on his part, continued the division of the calibration curve into more “flat” and “peak” sections until the year 1700 BC (Müller 2000, Abb. 3). After this date, there comes a long stage when the course of the curve is regular (in J. Müller’s terminology it is medium steep as in section D, cf. Müller 2000, Abb. 3). J. Müller has further suggested to combine neighboring “wiggle-areas” of the calibration curve into clearly distinctive time intervals (Müller 2000, Abb. 3). Taking the findings of both researchers as a point of departure, it is possible to order the series of Kujawy dates within the time interval (Table 2). Some small differences on our paper (Fig.4) are connected with using a new version of the calibration curve (Weninger/Joris 1998).

The results of the “flattening analysis” for Kujawy can be presented as follows.

1. It is possible to precisely draw the end limits of the FBC (between 2480 and 2300 BC) and the decline of the classical phase of the GAC (between 2300 and 2200 BC).

2. Less clear is the issue of dating the beginnings and end of the CWC. It follows from the analysis of the distribution of 14C dates that intervals dated with the series of dates of relatively the highest legitimacy (category IA) fall between 2880 and 2300 BC. Outside this interval, down the time scale, only one dating falls (Bln-1812) while four fall up the time scale (Bln-2299, Bln-2598, Bln-1512, Ki-6219) and other two with uncertain connection with CWC: Gd-7040 and Lod-160, see Table 1). We shall discuss more this question.

Only one of the above-mentioned dates (lab no. Bln-1812) falls straight on the border between section (“flattening”) 3350–3100 BC and 3100–2920. A group of five CWC dates falls only on section 2880–2600 BC. The “flattening analysis” reveals a peculiar isolation of date Bln-1812, the oldest of all known dates in Kujawy. Despite a progress in research consisting in dating other assemblages containing the oldest CWC materials in Kujawy, all the newly obtained values fit, however, into section 2880–2600 BC. For this reason we should particularly carefully interpret dating Bln-1812 (the moment of prehistory to which this date refers most probably falls on the youngest section of the time bracket set by it) and date the be-

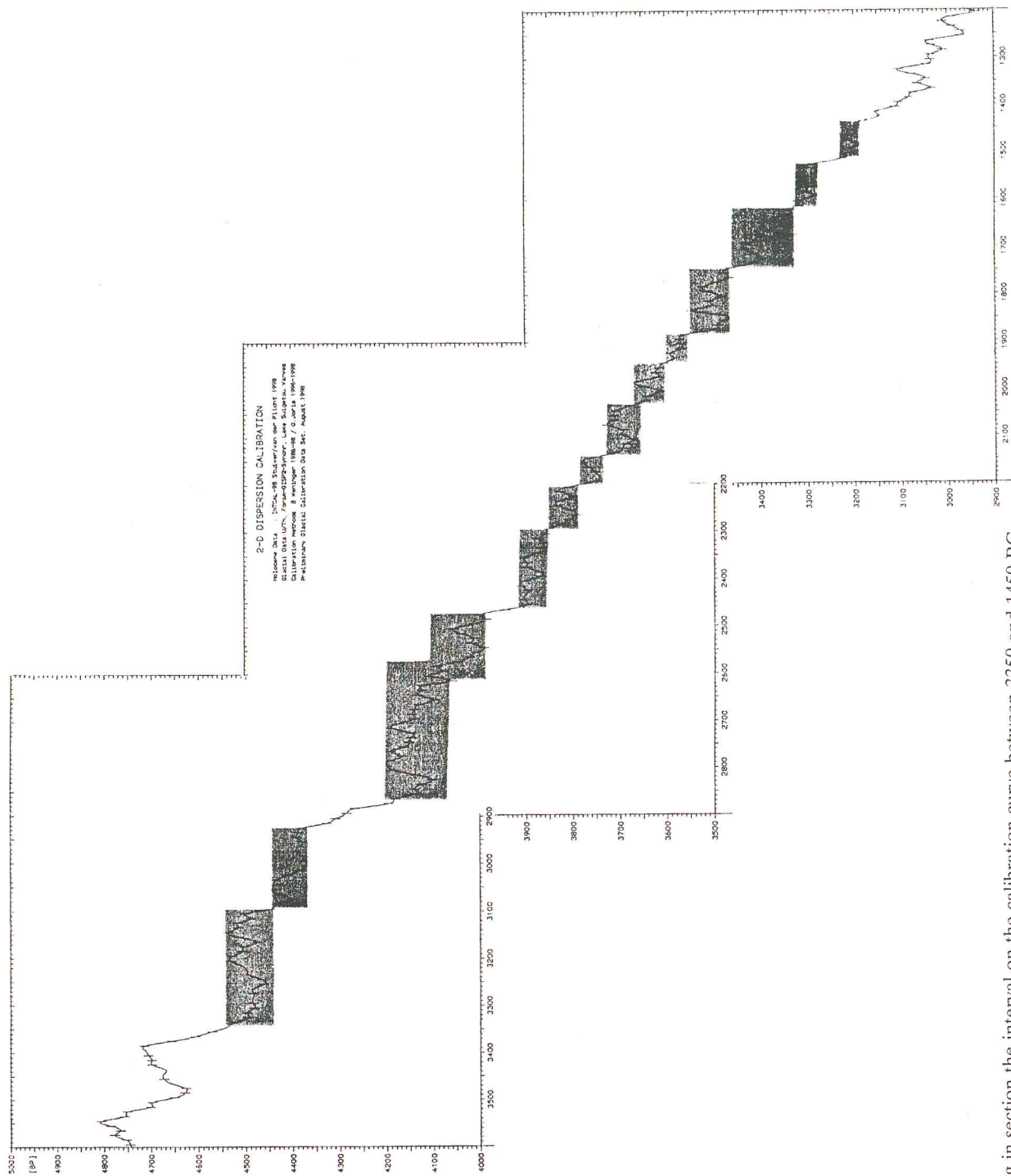


Fig. 4. Dividing in section the interval on the calibration curve between 3350 and 1450 BC.

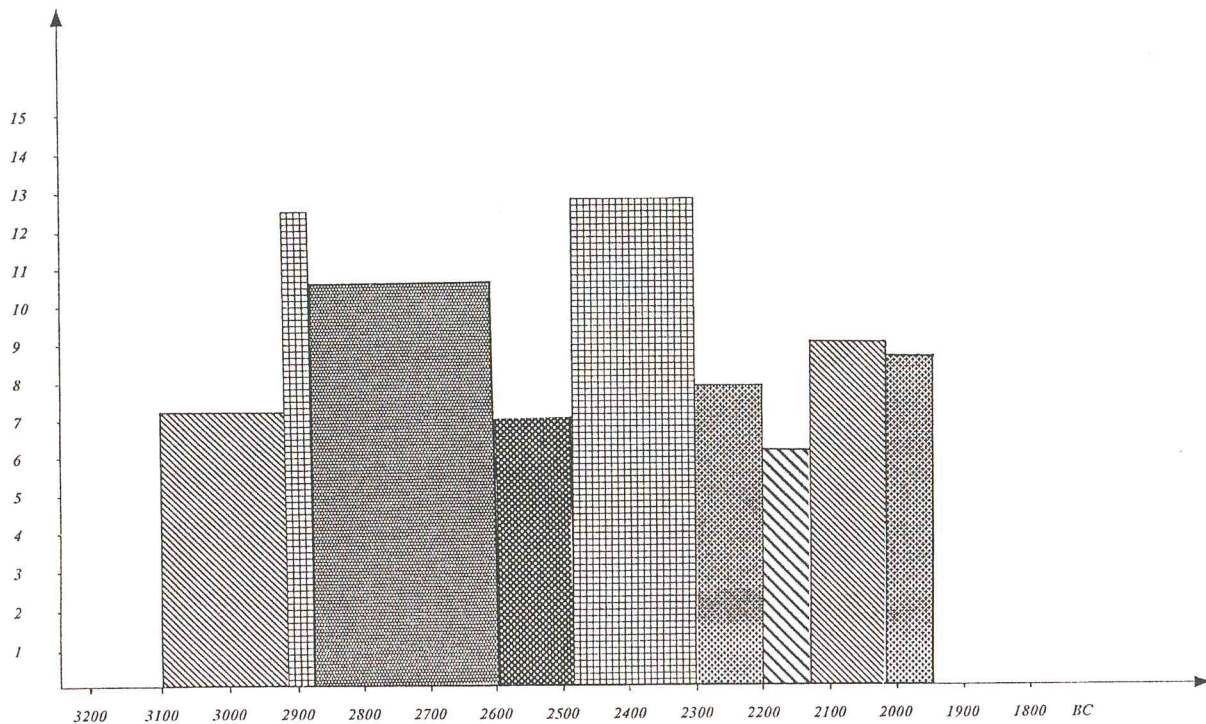


Fig. 5. The frequency index of datings made within individual time intervals.

ginnings of the CWC to the years ca. 2900 BC. This is the effect of the “flattening analysis”, whereas jointly calibrating all the datings for the CWC, we receive a distribution curve whose initial section can be differently interpreted by dating the beginnings of the CWC to the period clearly prior to 3000 BC. This issue calls for further research.

The issue of the decline of the CWC in Kujawy, in the light of 14C dating, is a complex one, too. From the area under investigation we know of as many as four dates which fall after 2300 BC (Bln-2299, Bln-2598, Bln-1512, Ki-6219); there are two others: Gd-7040 and Lod-160 which connection with CWC are not clear. All of them belong to a low category (see Table 1), which considerably lowers their documentary value. In the light of the above findings the decline of the CWC in Kujawy can be dated to ca. 2200 BC.

3. The beginning of the IC(BB) occurs in the “wobble” stage of 2480–2300 BC.

4. The situation is difficult in the case of the dating of the rise of “Trzciniec” in this region. It seems to start in the stage 2300–2200 BC. This conclusion bases only on dates from Biskupin: ceremonial (ritual?) site with the pottery joining the feature of IC(BB) and „Trzciniec” (Grossman 1998; more precisely about the process of origin of „Trzciniec” see: Czebreszuk 1998).

5. Another effect is a more precise placement in time of the fundamental cultural watershed that took place in Kujawy in the 3rd millennium BC. To make the problem clearer, we shall cite a simple calculation (Fig. 5) consisting in indexing the frequency of datings made within individual time intervals following J. Müller. The index is clearly the lowest for the period from 2200 to 2140 BC. This is a period when two cultural traditions, forming the core of the local Neolithic, namely the FBC, GAC (the classical horizon) and CWC disappear from Kujawy. During this period only the IC(BB), “Trzciniec” (early-Trzciniec phase) and Dobre group exist in the area in question. Thus, it can be said that it was then that the Neolithic actually ended in Kujawy and the oldest period of the Metal Age began. In the literature, this watershed, determined with the use of parademographic methods and less precise absolute chronology data, has been predominantly dated to the second half of the 3rd millennium BC (Czebreszuk 1996:234–235 and Fig. 81).

2. ABSOLUTE CHRONOLOGY OF PHASES

The dating of individual stylistic phases is more accurate at the same being more methodologically complex. In the last 30 years of studies in Kujawy, se-

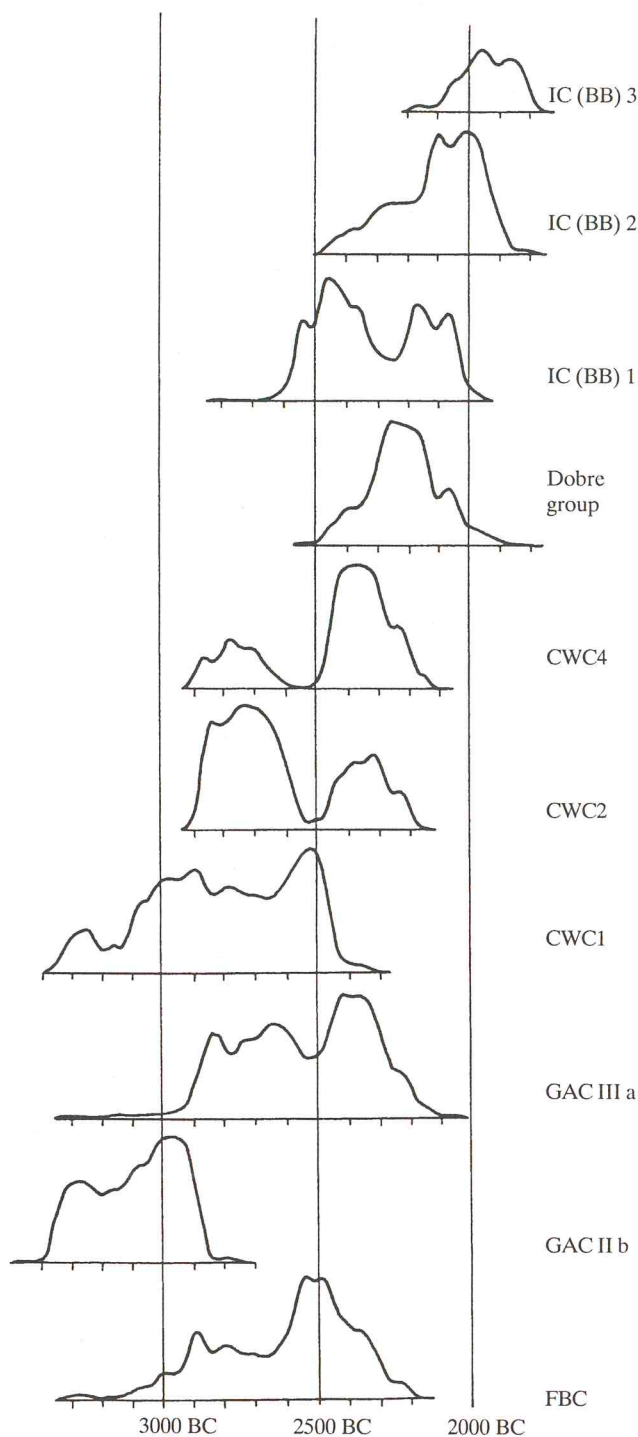


Fig. 6. The cumulative calibration of 14C dates for each culture unite.

veral such units have been developed within each of the archaeological cultures, which is fully shown by the literature cited above. The rudiments of these divisions were laid using the classic methods of com-

parative archaeology (Koško 1979; 1981, Fig. 9). This could not be changed even by a small series of 14C dates concerning Kujawy that was available already in the early 1980's (Jankowska et al. 1979; Koško 1991, Fig. 1). Only stationary excavations of site complexes, such as Wzgórze Prokopiaka in Opatowice (Koško/Szmyt 1993) or Piaski Krzywosądzkie (Czebreszuk/Szmyt 1992) and, in the first place, the archaeological studies along the transit gas pipeline (Czebreszuk 2000a; Koško 2000; Makarowicz 2000; Szmyt 2000), have brought about a radical change in the situation. Now, it is possible to verify, on the basis of independent information, the time length of stylistic phase sequences for individual cultures.

In the case of dating individual phases we relied on a joint calibration of a series of 14C dates. However, not all datings were treated by us identically. They were graded according to date categories proposed in the beginning. The most useful for further analysis are the datings of the samples of bones or cereal grains coming from graves, settlement and ritual features of clear cultural identity (categories IA and IB) and samples of wood or wood charcoals from clearly culturally classified graves (category IIA). The dates of the above three categories will serve as a basis for a further analysis.

Fig. 6 demonstrates results of this part of our research.

CONCLUSION

Radiocarbon dating revealed a complicated picture of time interrelationships in Kujawy during the 3rd millennium BC. This applies both to individual archaeological cultures and to their contents, i.e. to individual stylistic phases. In terms of radiocarbon chronology one can speak of a co-existence of different stylistic phenomena in the region. The long existence of all post-Neolithic traditions cannot be questioned. The FBC must have ended ca. 2300 BC. For the classic GAC horizon (i.e. phases IIb and IIIa) we can expect the time ca. 2200 BC as the ending period. For late GAC horizon (i.e. phases IIIb and IIIc) still we have only two 14C datings which fits to ca. 2600–2400 BC. The CWC continued throughout the whole millennium until about 2200 BC too.

Basing on radiocarbon dates is possible to recognize more precise the cultural border between Neolithic nad Early Bronze Age in Kujawy. It took place in period from 2200 to 2140 BC.

In the beginning of the latter half of the millennium in question, IC(BB) emerged in Kujawy. Dur-

ing their lifetime, specifically between 2340 and 2130 BC, the proto-Snetice episode took place.

When one adds the fact, confirmed by 14C dates, of temporal overlapping of individual stylistic phases within the GAC, CWC and IC(BB), it can be justifiably claimed that the 3rd millennium BC was a stage

of prehistory which fully deserves to be called the age of a “cultural mosaic”.

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DIRBANT SU RADIOKARBONINĖMIS DATOMIS. 3 TŪKSTANTMETIS PR. KR. KUJAVIJOJE PAGAL C14 DATAS

Janusz Czerbreszuk, Marzena Szmyt

Santrauka

Šiuo metu iš Kujavijos (Centrinė Lenkija) yra gauta 113 C14 datų, kurios pateiktos lentelėje Nr. 1. Lentelėje, be pagrindinių duomenų, kaip paminklo pavadinimas, laboratorijos Nr., konvencionali data taip pat nurodoma kultūra ir jos fazė, su kuria siejamas konkretus pavyzdys, bandiniui paimta medžiaga ir kalibruota data. Visos datos suskirstytos į kategorijas pagal du pagrindinius kriterijus: (1) pagal bandinio pobūdį (I – trumpai gyvavusi medžiaga – kaulai, atskiri medienos gabalai, sėklos, prikepęs sluoksnis puoduose ir pan., II – ilgai gyvavusi medžiaga – anglis, dirvožemio pavyzdžiai, III – pakitusi trumpai gyvavusi medžiaga – deginti kaulai). (2) pagal objekto, iš kurio buvo paimtas bandinys, pobūdį (A – iš kapo ar ritualinio objekto, kurio kultūrinė priklausomybė nekelia abejonių, B – iš gyvenvietės kultūrinio sluoksnio, kurio kultūrine priklausomybe neabejojama, C – bet koks bandinys, kurio kultūrinė priklausomybė nėra aiški).

C14 datų serijos panaudotos datuoti (1) atskiras archeologines kultūras ir (2) atskiras stilistines fazes kiekvienos kultūros viduje.

Tyrimo rezultatai pateikti 5 paveikslė. Radiokarboninis datavimas rodo, kad 3 tūkstantmetyje pr. Kr. Kujavijoje vienu metu egzistavo įvairios kultūros ir jų stilistinės fazės. Piltuvėlinių taurių kultūra sunyko maždaug apie 2300 pr. Kr. Klasikiniam ritualinių amforų horizontui kol kas turimos tik dvi datos, priklausančios periodui tarp 2600–2400 m. pr. Kr. Virvelinės keramikos kultūra tęsiasi per visą tūkstantmetį iki maždaug 2200 m. pr. Kr. Remiantis radiokarboniniu datavimu įmanoma tiksliau pasekti ribą tarp neolito ir žalvario amžiaus, kuri yra laikotarpyje 2200–2140 m. pr. Kr. Antroje 3 tūkstantmečio pr. Kr. pusės pradžioje Kujavijoje pasirodo Ivno kultūra (Varpinių taurių kultūros variantas). Jai egzistuojant, ypač laikotarpyje tarp 2340–2130 m. pr. Kr., pastebimas protounetičių pasirodymas.

Priduriant tai, kad Rutulinių amforų, Virvelinės keramikos ir Ivno kultūrų atskiros stilistinės fazės gyvavo tuo pat metu, 3 tūkstantmetį pr. Kr. Kujavijoje galima apibūdinti kaip „kultūrinę mozaiką“.

LENTELIŲ SĄRAŠAS

1 lentelė. C14 datos 3 tūkstantmečiui pr. Kr., susijusios su Kujavija.

2 lentelė. C14 datų, susijusių su Kujavija, pasiskirstymas, priklausomai nuo intervalų pr. Kr. ir

archeloginių pavyzdžių. Raidžių dydis, priklausomai nuo datos kategorijos: didelė – IA ir IB, vidutinė – IIA ir IIB, maža – IC, IIC ir IIIA-C.

ILIUSTRACIJŲ SĄRAŠAS

1 pav. Radioaktyviosios anglies datų skaičius kiekvienam kultūros pavyzdžiui Kujavijoje iš įvairių laboratorijų.

2 pav. Standartinių C14 datų nykrypių klasės, naudojant popierių.

3 pav. C14 datų kategorijų paskirstymas tarp kultūros pavyzdžių.

4 pav. Kalibravimo kreivės intervalo nuo 3350 iki 1450 m. pr. Kr. padalijimas į sekcijas.

5 pav. Datavimo dažnio indeksas atskiruose laiko intervaluose.

6 pav. Bendras C14 datų kalibravimas kiekvienam kultūros pavyzdžiui.

РАБОТА С СЕРИЯМИ РАДИОУГЛЕРОДНЫХ ДАТ. РАДИОУГЛЕРОДНЫЕ ДАТЫ III ТЫС. ДО Н. ЭРЫ В КУЯВАХ

Януш Чебрешук, Мажена Шмыт

Резюме

По работе с радиоугольными датами, 3 тысячелетие до н.э., в Куявах, по датам C14.

В настоящее время из Куяв (Центральная Польша) получено 113 дат C14, которые приведены в таблице № 1. Наряду с основными данными, как наименование памятника, номер лаборатории, конвенциональная дата, в таблице также указана культура и её фаза, с которой связан конкретный образец, взятый для пробы материал и калиброванная дата. Все даты разделены на категории по двум основным критериям: (1) по характеру пробы (I – материалы, существовавшие в течение непродолжительного времени, – кости, отдельные куски древесины, семена, прилипший слой в горшках и т.п.; II – материалы, существовавшие в течение продолжительного времени, – уголь, образцы почвы; III – изменившиеся материалы, существовавшие в течение непродолжительного времени, – жжёные кости); (2) по характеру объекта, с которого взята проба (А – из могилы или ритуального объекта, чья культурная принадлежность не вызывает сомнений, В – из культурного слоя поселений, культурная принадлежность которого сомнительна, С – любая проба, культурная принадлежность которой неясна).

Даты серии C14 использовались для датирования

(1) отдельных археологических культур и (2) отдельных стилистических фаз внутри каждой культуры.

Результаты исследования приведены на рис. 5. Радиоугольное датирование показывает, что в 3 тысячелетии до н.э. в Куявах одновременно существовало несколько культур и их стилистических фаз. Культура воронкообразных чаш исчезла около 2300 г. до н.э. Для установления классического горизонта ритуальных амфор пока что есть лишь две даты, принадлежащие периоду между 2600 и 2400 гг. до н.э. Культура шнуровой керамики продолжалась целое тысячелетие, приблизительно до 2200 г. до н.э. На основании радиоугольного датирования можно более точно проследить границу между неолитом и бронзовым веком, которая находится между 2200–2140 гг. до н.э. В начале второй половины 3 тысячелетия до н.э. в Куявах появляется Ивнинская культура (вариант культуры куполообразных чаш). Во время её существования, в особенности между 2340 и 2130 гг. до н.э., наблюдается появление протовнетичей.

Напомним, что в то же время существовали отдельные стилистические фазы культур шаровых амфор, шнуровой керамики и ивнинской культуры, 3 тысячелетие до н.э. в Куявах можно определить как “мозаику культур”.

СПИСОК ТАБЛИЦ

Таблица 1. Даты C14 по 3 тысячелетию до н.э., касающиеся Куяв.

Таблица 2. Распределение дат C14 по Куявам в зависимости от интервалов до н.э. и археологических

образцов. Величина букв в зависимости от категории дат: большая – IA и IB, средняя – IIA и IIB, малая – IC, IIC и IIIA-C.

СПИСОК ИЛЛЮСТРАЦИЙ

Рис. 1. Число радиоугольных дат из разных лабораторий для каждого образца культуры в Куявах.

Рис. 2. Классы стандартных отклонений дат C14 при использовании бумаги.

Рис. 3. Распределение категорий дат C14 между образцами культуры.

Рис. 4. Разделение интервала калибрационной кривой от 3350 до 1450 гг. до н.э. на секции.

Рис. 5. Частотный индекс датирования в отдельных интервалах времени.

Рис. 6. Общая калибровка дат C14 для каждого образца культуры.

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