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CHRONOLOGY OF SOFIEVKA TYPE CEMETERIES: ARCHAEOLOGICAL AND ISOTOPIC ONE

Chronology is an important component of all historical - archaeological reconstructions. The age of any culture can be established, in many cases, from: the indirect features (ceramics, instruments, typological analogies, etc.) or isotope (here: ^{14}C) data.

Implementation of the radiocarbon method has not only extended the range of expedients and approaches in archaeology, but also has permitted researchers to obtain „independent", or using the previously adopted terminology, „absolute" data. The interest in the problems of radiocarbon dating has considerably increased in the past few years. This is explained by the latest achievements in this field connected with the transfer of radiocarbon data onto calendar temporal scale. At present, the calibration curves, the so-called ten-year and twenty-year period curves, up to 8000 BP have been worked out by different radiocarbon laboratories by radiocarbon measurements of dendrosamples containing 10-20 tree rings and generalized by Stuiver, Becker, Pearson and others [Stuiver and Becker 1986; Stuiver and Pearson 1993]. A computer program permitting the researcher to obtain plausible intervals of the calendar time with a various degree of probability was worked out based on the obtained curves [e.g. van der Plicht 1993]. Since the chronological reconstructions, as a rule, are made in the calendar temporal scale, application of the radiocarbon method for dating of archaeological sites has gained a new impulse. In this connection, the chronological dependence obtained earlier by the radiocarbon method is coming entering the stage of refinement, as illustrated in the present article.

1. RELATIVE CHRONOLOGY

Chronology of the Sofievka type cemeteries was based on the indirect data for a long period of time. According to some estimations, the Sofievka type belonged to an earlier time than the sites of Usatovo (Northern Black Sea littoral) type. T.G. Movsha considered them to belong to the earlier type because there are no ceramics with cord ornamentation in the Sofievka graves, though some types of ceramics are similar to those found in Zhvanets (Dniester area), and the dagger from Krasny Khutor is similar to the one found in Verteba cave, simultaneous to Zhvanets. The Dniester area monuments are considered to precede the Usatovo ones [Movsha 1985:254-255]. V.G. Zbenovich looked upon Sofievka and Usatovo cemeteries as simultaneous based on a correlation of the copper daggers [Zbenovich 1966:44; 1972:20- 21]. V.A. Kruts wrote in his article that the Sofievka type is simultaneous to the Tripolye culture from Volhynia (Troyanov type) dated earlier than the Usatovo type [Kruts 1977:148-149]. According to V.A. Dergachev, the Sofievka type is simultaneous to the Usatovo type (similar daggers) and Dniester area Tripolye types (ceramics, plastic arts) and also the Gorodsk type (ceramics, similar types of dishes) [Dergachev 1980:141]. Thus, all researchers dated the Sofievka cemeteries back to late Tripolye - C-II, though placing it in the end or in the beginning of this period, or in the middle of it.

2. RADIOCARBON CHRONOLOGY

According to isotope dating obtained in the end of the 1960s and in the beginning of the 1970s, Usatovo type monuments were dated back to 2600-2300 conv BC, Gorodsk type - to 2700-2600 conv BC. For a long time isotope chronology of Tripolye was based only upon non-calibrated ^{14}C data and C-II stage was dated between 2800/2750-2400/2350 conv BC [Arkheologiya 1985:254-255; Telegin 1985].

The calendar age of Tripolye C-II was dated 3580-3245 (3530-3175) BC by V.G. Petrenko [Patokova et al. 1989:4].

Tables 1 presents radiocarbon data for late Tripolye C-II cultures, obtained by different radiocarbon laboratories and may serve as the basis for relative chronology, confirming and adjusting the data obtained by other methods. Table 1 also shows the values of the calendar intervals, corresponding to the obtained dating (for probability 68,2% - 1 sigma and 95,4% - 2 sigma). As we can see, some calendar intervals, in the majority of cases, correspond to one datum. This may be explained by an ambiguous connection: radiocarbon data - calendar age, due to different concentrations of radiocarbon in the atmosphere of the past. Graphically the obtained

Table 1

^{14}C Chronology of the late Tripolye types

Sites	Etape	Lab. No.	^{14}C age, BP	Intervals of calibrated ages, cal BC	
				1 δ	2 δ
Evminka	C-I	Ucla–1466B	4790±100	3690–3680 3660–3500, 3450–3440, 3430–3380	3780–3350
Evminka	C-II	Ucla–1671B	4890±60	3764–3736, 3716–3634	3894–3888 3796–3620, 3590–3526
Mayaki	C-II	KIGN–280	4475±30	3340–3030, 2980–2930	3610–3600, 3520–2870, 2800–2790
Mayaki	C-II	KIGN–282	4580±120	3500–3420, 3380–3090	3630–3570, 3540–3020, 3000–2920
Mayaki	C-II	Bln–609	4340±65	3032–2942, 2936–2886	3296–3272, 3270–3238 3172–3170, 3106–2870, 2806–2772, 2720–2702
Mayaki	C-II	Le–645	4340±65	3032–2942, 2936–2886	3296–3272, 3270–3238 3172–3170, 3106–2870, 2806–2772, 2720–2702
Mayaki	C-II	Ki–870	4670±110	3630–3340 3150–3140	3660–3090, 3060–3040
Mayaki	C-II	Ucla–1642B	4375±110	3300–3230, 3180–3170, 3110–2880	3360–2860, 2820–2690
Usatovo	C-II	Ucla–1642	4333±60	3032–2964, 2958–2950, 2932–2884	3260–3244, 3100–2872, 2804–2776, 2716–2706
Gorodsk	C-II	Grn–5099	4651±35	3500–3452 3440–3426, 3380–3364	3510–3404 3388–3350
Danku	C-II	Le–1054	4600±80	3500–3456, 3378–3306, 3230–3186, 3160–3116	3608–3604, 3512–3402, 3388–3256, 3246–3098

Sites	Etape	Lab. No.	^{14}C age, BP	Intervals of calibrated ages, cal BC	
				1 δ	2 δ
Krasny Khutor (c) grave 2	C-II	Ki–5038	4280±110	3040–2860, 2820–2670	3310–3230, 3190–3160, 3120–2570, 2520–2500
Krasny Khutor (b) grave 6	C-II	Ki–5016	4140±110	2876–2794, 2784–2582	3014–3000 2926–2450, 2438–2402, 2372–2368
Krasny Khutor (c) grave 98	C-II	Ki-5039	4160±90	2876–2842, 2832–2796, 2784–2616	2912–2550, 2542–2490
Sofievka (c) grave 1	C-II	Ki–5012	4320±70	3032–2946, 2936–2874, 2798–2782	3262–3244, 3100-2860, 2816–2690, 2680–2664, 2634–2628
Sofievka 1963 (c) sq.m. 11	C-II	Ki–5013	4270±90	3028–2980, 2928–2860, 2816–2692, 2680–2666, 2632–2630	3254–3248, 3096–2580
Sofievka (a) from the cemetery	C-II	Ki–5029	4300±45	3016–2998, 2926–2876, 2790–2788	3034–2870 2804–2772, 2716–2704
Zavalovka (c) grave 6	C-II	Ki–5015	4290±90	3034–2866, 2810–2748, 2726–2698	3296–3276, 3268–3238, 3104–2608, 2600–2588
Zavalovka (c) grave 10	C-II	Ki–5014	4230±80	2914–2860, 2816–2690, 2680–2664, 2634–2628	3030–2972, 2932–2574, 2512–2510

Material for datings from Sofievka type cemetaries: a - charcoal, b - organic material from the inside of the pot, c - burnt bones.

results are shown in Fig.1. The most ancient of the studied monuments is Evminka, which dates back to the beginning of the fourth century BC. The next two groups of simultaneous monuments - Mayaki, Danku, Gorodsk and, to an extent, Usatovo may be noted. The earlier phase of existence of Mayaki settlement is simultaneous to the late phase of Evminka. The next group of later simultaneous cemeteries includes Krasny Khutor, Sofievka and Zavalovka.

It may be concluded that these cemeteries existed somewhat longer than the Usatovo ones. The only datum of Gorodsk settlement is not quite correct and does not correlate with the Sofievka ones. All materials from the cemeteries show that

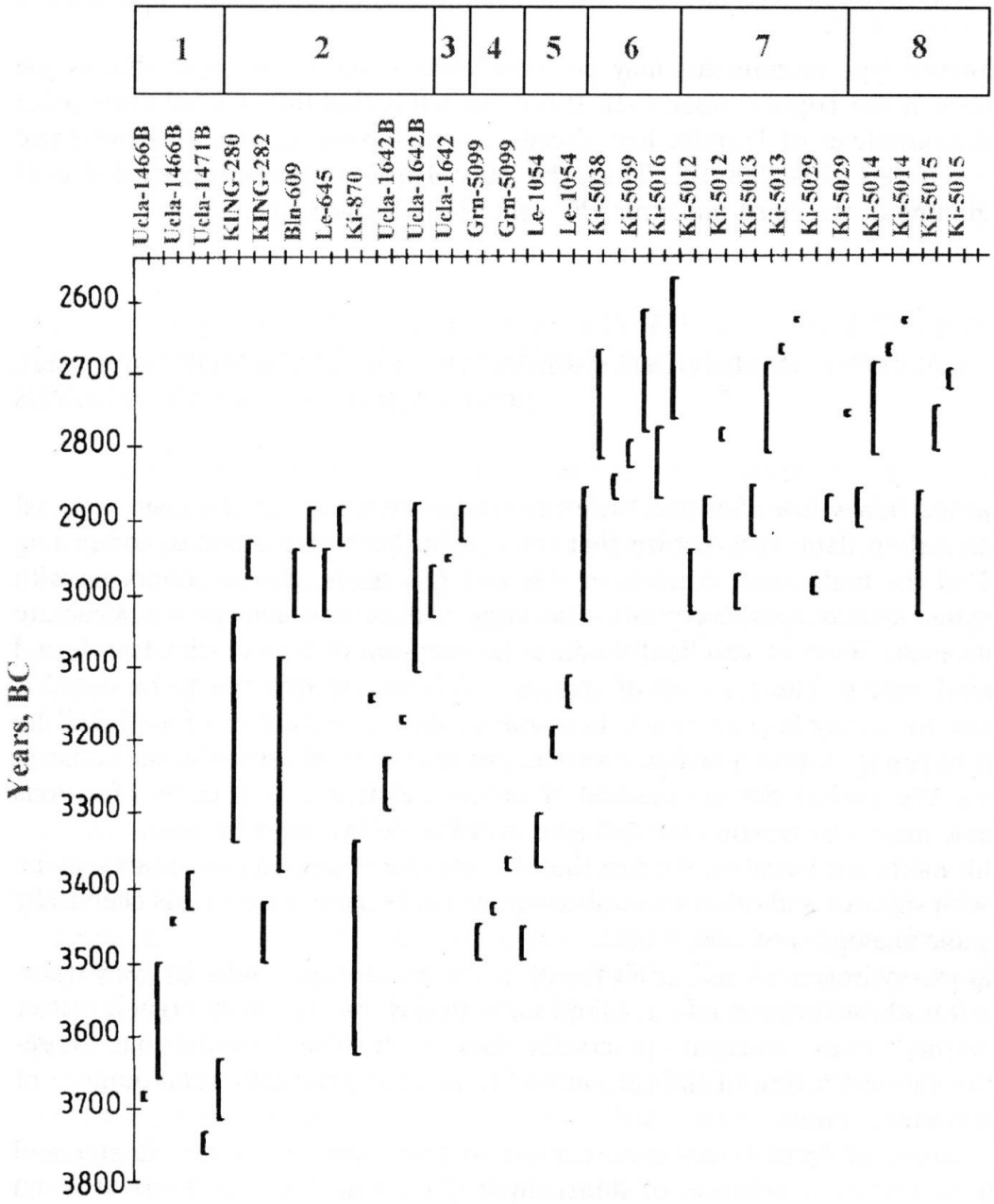

Fig. 1. Radiocarbon chronology of the late Tripolye culture (1σ). 1 - Evminka, 2 - Mayaki, 3 - Usatovo, 4 - Gorodsk, 5 - Danku, 6 - Krasny Khutor, 7 - Sofievka, 8 - Zavalovka.

they existed for a relatively short period, as indicated by isotope data, within 200-250 years.

Sofievka type monuments may be considered, based on isotope data, as the latest ones of the Tripolye stage C-II. It is conceivable that they existed when other cultural alternatives of Tripolye had already stopped existence. Their calendar age may be between 3300-2900 BC. Thus, the latest Tripolye monuments existed until the beginning of the third millennia BC - the Early Bronze Age.

3. COMMENT ON METHODS USED IN THE PREPARATION OF THE FOSSIL BONES FOR RADIOCARBON ANALYSIS

Burned bones from Sofievka type cemeteries were used as the main material for radiocarbon data. It is known that the organic part of the bones, comprising 10-20% of the body mass, consists of thin collagen fibers, closely connected with non-organic hydroxyapatite crystals. The large surface area and porous structure of bones make them an excellent medium for sorption of humic acids transferred by ground waters. The removal of strange ^{14}C from the material to be dated is important for dating burned bones. In results of the research, it was found that the content of young carbon may reach several per cent of total carbon in the collagen of bones. We worked out the method of selective distribution of carbon fractions of organic matter by treating the collagen with fluoric-hydrogenous acid.

This method is based on the fact that the introduced carbon precipitates on the bones with silicates and other mineral components, because humic acids chemically are organic analogues of silicon acid.

Fluoric-hydrogenous acid easily dissolves the silicate basis and selectively transfers the introduced organic into a colloid state. In this case, the main organic matter of the burned bones - collagen - practically does not dissolve. It permits one to preserve the dating fraction of the carbon and to achieve practically total removal of organic contamination.

A sample of fossil bones was reduced to fragments of 3-5 mm in size and treated with 0,5-1 N solution of fluoric-hydrogenous acid for 24 hours at room temperature. The collagen was washed with water and treated with 2 N solution of fluoric-hydrogenous acid at room temperature for 24 hours. After washing, when Ph+7, the collagen was dried and used for receiving a counting form of radiocarbon.

Translated by authors