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RADIOCARBON REVOLUTION AND 'HISTORICAL' COUNTERREVOLUTION

Chronology of Europe, Eurasia and China in the First Half of the 2nd Millennium BC

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A significant problem in archeology is the inconsistency between the radiocarbon chronology and the chronology built on the Near Eastern written sources. At the same time, the use of a more advanced AMS method gives younger dates that drift towards historical ones. Comparison of the Eurasian Sintashta and Seima-Turbino complexes with Near Eastern and Chinese materials, as well as with the dendrochronology of the Alpine zone, showed the closeness of these chronological systems. It follows from this that historical dates are more correct than radiocarbon dates.

Keywords: Eurasia, China, Early Bronze Age, chronology, radiocarbon dating, historical dates.

INTRODUCTION

This work was partly done during my visit at the Comenius University in Bratislava and Jozef helped me much in our discussions. Therefore, I am very grateful to the editors of this Volume for the opportunity to thank and congratulate him. I am also thankful to the Center of Chinese Studies (Taipei, Taiwan) for the possibilities to study Chinese materials.

The basis for archeological chronology is a typological method. Isolation of a complex of features and their comparison made it possible to connect it to historical chronology. However, the possibilities of this approach were limited to the periods of written sources and to the areas where chains of relations with the Near East could be constructed. However, with the introduction of the radiocarbon method, a universal mechanism for dating appeared, but this changed the dates. This was called 'radiocarbon revolution' (*Renfrew 1973*). With the appearance of calibration curves, the dates became older, and they were far removed from historical ones.

Ancient migrations allow us to compare complexes of different areas. An interesting situation is observed when comparing the complexes of the BA1c period, when some impulses from Transcaucasia penetrated into the Eastern and partly Central Europe and reached the Urals, and at the same time there are observed impulses from Central Europe towards the east, which led to the formation of the Abashevo and Babino cultures (*Grigoriev 2019*). Situation was similar in the BA2b period, when the Seima-Turbino tradition penetrated Europe; but afterwards, during BA2c phase, reverse impulses took place, which led to the spread of Mycenaean ornaments up to Kazakhstan. And, paradoxically, typologically older objects – marking a mixture of the Seima-Turbino tradition with the Ural traditions (the so-called 'Eurasian types') – appeared in the BA2b phase, and one classic Seima-Turbino spearhead of the type KD-20, typologically earlier, was found in the Borodino hoard along with Mycenaean ornaments, which belong to the Hajdúsámson-Apa horizon and, accordingly, to the later phase BA2c (*Grigoriev 2018a*). The second spearhead from this hoard is of type KD-34, and in the East its parallel is known in the Alakul burial of the Bliznetsy cemetery (*Chernykh/Kuz'minyh 1989*, 80). Thus, it belongs to the later 'Eurasian types', too.

This paradox shows that the strict application of the typological method is not always justified. Some stereotypes may persist in certain areas longer, or appear much earlier.

The Early Bronze Age (BA) in Southern Germany is dated from 2150–2100 BC until 1700 BC. At the same time, the dates of complexes with typical objects of the BA1 phase merge with the dates of complexes with objects of the BA2 phase, from which it is concluded that these complexes were not consecutive chronological phenomena, but reflect regional features (*Stockhammer et al. 2015*). This conclusion is exaggerated. The complexes of these phases reflect the chronology, but the preservation of old stereotypes in some areas and the earlier appearance of new ones in others took place. However, this effect is strengthened by the dispersion of radiocarbon dates.

Thus, the final Early Bronze Age dates are older than the historical dates of the Shaft Graves in

Greece, with which the final part of this period should be synchronized. This is a known problem. Historical dates of the Santorini eruption are the range between 1525–1500 BC, but radiocarbon dates are within the 17th century BC, which is explained by defects in historical chronology (*Friedrich et al. 2006*; *Manning et al. 2006*, 567, 569). The situation in Mesopotamia and Egypt is the same. For 1000 BC the error is 200 years, and for earlier periods it increases (*Michael 2004*, 18). This fact is not always taken into account. For example, when proving the earlier date of the Eurasian chariots (before 2000 BC) relative to the Near Eastern chariots (1800 BC) – the fact that the first date is radiocarbon and the second is historical is completely ignored (*Anthony 2007*, 402, 403). It is clear that these dates are not comparable and we must independently use two chronological scales: historical and radiocarbon.

SINTASHTA CHRONOLOGY

In the Ural region, there was an accepted sequence of cultures: Sintashta – Petrovka – Alakul. Sintashta culture within the radiocarbon chronology was dated to 2200–1650 BC (*Chernykh 2007*, 86). Later, after the use of AMS dates, the culture became younger. Molodin and coauthors solved this problem simply, calling the early dates 'odious', and the interval of 20th–18th centuries BC was adopted (*Molodin/Epimakhov/Marchenko 2014*, 140).

However, they did the same with the Alakul culture. Earlier dates within the last third of the 3rd millennium BC were obtained for Alakul in the Transural forest-steppe (*Matveev 1998*, 359–373). This corresponded to the early Sintashta dates, and since it was believed that the Alakul culture was later, these dates were excluded from further discussion (*Molodin/Epimakhov/Marchenko 2014*, 142, 143). However, we received Alakul dates on the settlement of Mochishche, which also fell into the Sintashta interval. And at that time 43 % of Alakul dates were early. Taken into account also other reasons, it has been concluded that the Alakul and Petrovka cultures began to form almost simultaneously with Sintashta (*Grigoriev et al. 2018*, 164, 165).

The Don-Volga Abashevo culture has much in common with Sintashta, but it was later and contemporary with the Early Srubnaja and Mycenaean periods. Four dates within the 24th–21st centuries BC come from the Lipetsk mound of this culture. All of them have been considered as false because they were older than Sintashta dates (*Mimokhod 2016*, 46–49).

Thus, the decision to abandon some dates is made, proceeding from ideas about the periodization. Old dates are indeed too early. But, in this case, we must refuse all of them and not those that fall out of the acceptable interval. Otherwise, arbitrary use of some dates appears. For example, R. A. Mimokhod, trying to prove an earlier chronological position of the Post-Catacomb block (Babino, Lola) and Abashevo culture, sets their dates within the 22nd–20th centuries BC, which is earlier than the Sintashta interval (*Mimokhod 2011*, 43, 48). However, there are many dates made in the same years and in the same laboratory as the rejected Sintashta dates. On the contrary, the analysis of artifacts shows the formation of Sintashta and Post-Catacomb complexes simultaneously (*Grigoriev 2018b*, 41–44; *2019*, 235, 236).

D. Anthony (*2007*, 374), trying to show an earlier position of Abashevo compared to Sintashta, explains the early dates of the Sintashta cemetery (graves 11 and 39) by the fact that they were obtained from the Poltavka burials and the Poltavka people began to explore this region earlier. But these are standard Sintashta burials with typical ware, metal complex and cheek-pieces (*Gening/Zdanovich/Gening 1992*, 155–161, 228–234).

Thus, we see that the old and new radiocarbon dates are poorly comparable. An example shown on Scottish material by *P. Ashmore* (*2004*, 126) is indicative: when using 129 dates with an error of less than 50 years, their peak occurs around 4000 BC, and when using 45 dates with an error of less than 10 years, this peak begins around 3800 BC.

Thus, we have a paradoxical situation. If we had to consider historical and radiocarbon chronology separately, now we are forced to compare radiocarbon dates only in the case of identical confidence intervals. Besides, dating of different material often gives different intervals (charcoal, bones etc.), and it adds some uncertainty in the comparison of large series.

There is also another problem. Even with a low 68.2 % probability, radiocarbon dates give too large intervals of 200–300 years. For example, dwellings at the settlement of Mochishche were built relatively simultaneously (*Grigoriev et al. 2018*, 158–167) and for the Seima-Turbino complex of Shaitanka, the date range was 550 years (see below). With a higher probability of 95.4 % we get such wide ranges that we lose the possibility of any intelligible discussion. Therefore, the radiocarbon dating does not give calendar dates. It allows us to rank the materials relative to each other in the case of comparable series.

And, taking into account the drift of radiocarbon dates towards historical ones, the final solution to this problem will come when the radiocarbon and historical dates coincide.

Previously, for the Eurasian complexes, there were two lines of connections with historical dates: the Balkan and the Chinese. They were based on a comparison of Sintashta cheek-pieces with Mycenaean ones, the Mycenaean ornaments on the artifacts in Borodino and the spearheads similar to the Seima-Turbino ones in China. As a result, the Balkan line of connections gave the 16th century BC and the Chinese line did the 14th century BC. However, the spearheads in China originated from a late context (*Chernykh 1970*, 101; *Chernykh/Kuz'minyh 1989*, 259; *Smirnov/Kuz'mina 1977*, 26–34). Subsequently, E. E. Kuzmina, on the basis of comparison of the Sintashta and Mycenaean cheek-pieces, was inclined to date the Sintashta culture to the period from the 17th to the 15th century BC (*Kuz'mina 2007*, 232). However, Sintashta is a Pre-Mycenaean complex.

In the grave IV of circle A in Mycenae, cheek-pieces of type IA were found, which are common in cultures of the Sintashta and post-Sintashta periods in Eurasia (*Kuz'mina 2007*, 117). This is regarded as a sign of eastern impulses at the beginning of the emergence of these tombs. In addition, up to Kazakhstan, Mycenaean ornaments are known on bone objects at this time, which already indicates a subsequent opposite impulse. These ornaments are not typical for Sintashta, except for one burial in the Kamenny Ambar cemetery (*Epimakhov 2002*, fig. 6: 4), but they are present on objects of the Don-Volga Abashevo, Petrovka and Alakul cultures, and of the Potapovo type (*Bochkarjov/Kuznetsov 2013*). This allows us to connect this horizon with the time of distribution of these ornaments outside of Greece, i. e. with the beginning of the LH period in Greece, Hajdúsámson-Apa horizon, or BA2c phase. *S. Marinatos* (*1976*, 66) dated the beginning of the LH I around 1550 BC, but the most accepted date is 1600 BC (*Tartaron 2008*, 84). It is the end date for Sintashta and the culture is correlated with the MH III, but we cannot synchronize the lower boundaries of these complexes.

The beginning of Sintashta was synchronous with the 2nd stage of the Middle Don Catacomb culture, the beginnings of the Abashevo, Lola and Babino cultures and the BA1c phase in Central Europe (*Grigoriev 2019*). The BA period in the historical chronology is dated to 1900–1700 BC (*Coles/Harding 1973*, 67), while neck rings from this period have parallels in Ugarit in 1900–1850 BC (*Krause 2003*, 168). Since synchronization of this period with Sintashta is possible only in the subphase BA1c, the beginning of this culture should be within the 18th century BC. Near Eastern parallels of Sintashta are within the 19th–17th centuries BC, but the greatest number of these parallels is dated since the 18th century BC. If we assume that the Sintashta migration was stimulated by the penetration of the Kassites, the possible date is 1742–1740 BC (*Grigoriev 2002*, 136, 137). However, there were other similar events, so the probable interval is 1800–1740 BC. R. A. Mimokhod, basing on K. Kh. Kushnareva (*Kushnareva 2007*) and R. A. Lytvynenko (*Litvinenko 2010*) writes about the synchronization of the Caucasian Karmirberd culture with the chariot cultures and proposes a date within the Old Babylonian period, i. e. also the 19th–18th centuries BC (*Mimokhod 2013*, 263, 264). Accordingly, the period BA1c should begin within the 18th century BC. Thus, in the radiocarbon chronology Sintashta is dated to the 20th–18th centuries BC, in the historical chronology to the 18th–17th centuries BC.

SEIMA-TURBINO CHRONOLOGY

The Seima-Turbino bronze artifacts are widespread from Moldova to Siberia (*Chernykh/Kuz'minyh 1989*). Their radiocarbon chronology is badly proved. The dates of the Shaitanka site in the Ural region range between 2150–1600 BC (*Chernykh/Korochkova/Orlovskaja 2017*, 50–53). Seima-Turbino complexes of Baraba in Siberia are dated to 2300–2000 BC and the dates of Elunino culture associated with the Seima-Turbino bronze artifacts are dated to 2200–1800 BC (*Molodin/Epimakhov/Marchenko 2014*). But the Elunino culture in Eastern Kazakhstan is dated to the mid-25th–18th centuries BC (*Merts/Svyatko 2016*, 133). In general, the Seima-Turbino complexes of Western Siberia fall into the interval of 27th–21st centuries BC and without extreme dates in the interval of 25th–22nd centuries BC; and the dates of the Rostovka cemetery fall into 23rd–21st centuries BC. In this case, the values of $\delta^{13}C$ and $\delta^{15}N$ of bone collagen indicate a reservoir effect, which in Western Siberia increases the age of the samples up to 200–300 years (*Kovtun/Marochkin/German 2017*, 272, 273). But even if we subtract 300 years from dates without extreme values, we get an interval of 23rd–19th centuries BC, which precedes the synchronous Sintashta complexes. Therefore, today we cannot rely on the Seima-Turbino dates.

In Europe, the 'Eurasian' spearheads, arising as a result of interaction of the Seima-Turbino and Sintashta-Alakul traditions, spread in the BA2b period and the Borodino hoard with the Seima-Turbino spearheads belongs to the period BA2c. Accordingly, in the Mycenaean chronology, their late phase is dated from the end of MH III till the beginning of LH I, i. e. around 1600 BC. However, since the Seima-Turbino artifacts partly coexisted with the Early Srubnaja ones, in the east they could be preserved for longer time. In Switzerland, the

Table 1. Historical chronology of the second quarter of the 2nd millennium BC.

Historical dates	Central Europe	Greece	Eurasia	China	Chinese dynasties
1550/1500 (?)	BB1	LH	Alakul, Fyodorovka	Erligang Erlitou IV	Shang
–	BA2c	LH 1	Alakul, Fyodorovka	Erlitou III	Shang ?
1600/1550	–	–	–	–	Xia ?
–	BA2b	MH III	Sintashta, Seima--Turbino, Early Alakul, Petrovka	–	–
1650	–	–	–	–	–
1650	–	–	–	Erlitou II	–
–	BA2a	MH	Sintashta, Seima--Turbino, Early Alakul, Petrovka	Erlitou I	Xia
ca. 1700 (?)	–	–	–	–	–
–	BA1c	MH	Sintashta, Early Alakul, Petrovka	Longshan	–
ca. 1740 (?)	–	–	–	–	–

dendrochronological dates of the BA2b period range between 1650–1600 BC and from 1600 BC onwards artifacts of the first phase of the Věteřov and Maďarovce cultures appeared, i.e. during the BA2c period (see details in *Grigoriev 2018a*). Accordingly, in the framework of dendrochronology, 1600 BC is the starting date for the Borodino hoard and the spread of Mycenaean ornaments. This date is near the end of Sintashta and Seima-Turbino.

In China, the Seima-Turbino objects are presented from the east of Gansu to the Bohai Gulf. An early date is accepted for them (*Lin 2014*, 664), but there is no reason to date their appearance before the Erlitou III layer, because a knife of the Seima-Turbino type is connected with it. Other finds can be attributed to the Erlitou period in general. However, it is possible to assume their earlier appearance at the end of Erlitou II (*Grigoriev 2020, in print*).

This layer demonstrates significant changes: palatial architecture, a lot of metal, tin bronzes and so on. Therefore, most likely, it marks the beginning of the Shang Dynasty. However, the reliable time of Shang is the subsequent Erligang period and the Erlitou IV layer contains Erligang ceramics. Accordingly, both options are valid. We can assume that the Seima-Turbino tradition first penetrated the Yellow River basin and later the Shang people came.

In radiocarbon chronology, layer II is dated to 1740–1590 BC, layer III to 1610–1555 BC and layer IV to 1560–1520 BC (*Zhang et al. 2008*, 197–210). In historical chronology, the beginning of the Shang is dated to 1576 (before the conquest), 1558 or 1554 BC (*Nivison 1999*, 14; *Pankenier 1981–82*, 21). If we choose the layer III for the identification of the Shang beginning, then the radiocarbon dates are older, but only for 35–60 years. It coincides with the beginning of the LH I period in Greece. But the penetration of the Seima-Turbino tradition into Europe occurs earlier than into China. However, we assumed above that this tradition could appear in China in the late phase of the Erlitou II, and its appearance in Europe and China is almost contemporary.

If we choose the layer IV, the Chinese radiocarbon dates and historical chronology are close. In this case, the Seima-Turbino penetration into China was before the Shang period. It occurs within the historical chronology around the late 17th century BC, i. e. 40–50 years after the penetration of this tradition into Central Europe. And the beginning of the phase BA2c and LH I for the same time span precedes the beginning of the Shang.

If we use the Seima-Turbino spread to the west and east as a basis for synchronization of distant complexes, then we can synchronize this late phase of Erlitou II with the BA2b phase in Europe and date it after 1650 BC, and the beginning of the period earlier. In this case the beginning of Erlitou III will be the most reasonable border for the beginning of the Shang. But two questions arise: 1. may we date phase II of Erlitou until 1558/1554 BC (i. e. its interval was 100 years, and not 150 as the radiocarbon method shows); 2. may we suppose that these Seima movements to the east and west were synchronous?

The existence of this choice for the beginning of Shang and the Seima-Turbino penetration forces us to leave this question open. We must understand that the Seima-Turbino tribes could move west and east with different speeds. After the first wave, the Seima-Turbino materials are present in the Borodino

hoard corresponding to the BA2c phase. Therefore, we have a wide range of possibilities in the range of 1610–1550 BC. And this date means the end of the Seima-Turbino bronzes as well as the beginning of Mycenae and the Shang. Judging from the European materials, this process was started around the mid-17th century BC. But we have no guarantee that this process was simple and one-act and that these processes in Europe and China were synchronous.

In general, it is close to the time of significant cultural transformations in Eurasia, when the Sintashta culture ceased to exist, the bearers of the Early Alakul tradition were forced out of the forest--steppe into the steppe, where the classical Alakul culture was formed – eroding the old Sintashta and Petrovka stereotypes – and Andronovo (Fyodorovka) tribes appeared in the forest-steppe. At the first stage, eastern impulses reached Europe, but, almost immediately, reverse impulses took place when Mycenaean ornaments penetrated eastwards. Therefore, it is likely that the coming of Fyodorovka people led to these significant cultural shifts and to the displacement of some bearers of the Seima-Turbino tradition. All this allows us to create a table 1 of the chronology of the European, Eurasian and Chinese complexes in the system of historical dates (see Table 1). Certainly, in some areas some cultures could persist longer, but this possibility is not taken into account here.

CONCLUSION

Presented data show that radiocarbon chronology provides everywhere earlier dates than historical chronology and dendrochronology which are both close to one another. It is very likely that the historical dates of China and Mycenae are also close. Perhaps a comparison of the astronomical events described in Chinese and Near Eastern sources will help to relate these events with sufficiently high accuracy. The radiocarbon dates of the complexes, which were relatively contemporary, form too wide intervals that do not correspond to a possible duration of these sites. The recent shift of radiocarbon dates in comparison to the historical ones indicates that only when the radiocarbon dates stably coincide with the historical dates in the Near East and the Alpine dendrochronology, this method will be quite adequate.

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Rádiouhlíková revolúcia a „historická" kontrarevolúcia
Chronológia Európy, Eurázie a Číny v prvej polovici 2. tisícročia pred n. l.

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SÚHRN

V súčasnosti je základom archeologickej chronológie rádiouhlíkové datovanie. Po zavedení kalibrácie konvenčných dát sa takto získané údaje stali „staršími" než historické údaje založené na blízkovýchodných písomných prameňoch. S ďalším rozvojom tejto metódy vzniká tendencia posúvať tieto údaje opačným smerom. Kultúra Sintašta na Pouralí, ktorej počiatky sú súčasné so začiatkom stupňa BA1c v strednej Európe, bola pôvodne datovaná na základe rádiouhlíkového datovania do obdobia 2200–1650 pred n. l. Po datovaní pomocou AMS bol tento interval posunutý na obdobie po 20. stor. pred n. l., zatiaľ čo „historické" údaje počítajú s dolnou hranicou tohto intervalu okolo polovice 18. stor. pred n. l. S veľkou pravdepodobnosťou patrí do tohto obdobia aj výskyt bronzových predmetov typu Seima-Turbino v oblasti Uralu a Sibíri. Finálny horizont výskytu predmetov kultúry Sintašta ako i typu Seima-Turbino je v rámci rádiouhlíkovej chronológie stotožnený s 18. stor. pred n. l., no v rámci historickej chronológie až s obdobím okolo 1600 pred n. l. Navyše, historické dáta z Číny a mykénskeho Grécka sú navzájom veľmi blízke, čo vynikne pri analýze výskytu bronzových predmetov typu Seima-Turbino v Európe a Číne. V prvom zo zmienených regiónov boli rozšírené počas stupňa BA2b-c, v druhom regióne ich výskyt bezprostredne predchádzal počiatku dynastie Šang. Tieto údaje sú veľmi blízko k alpskej dendrochronológii. Na záver možno konštatovať, že historické údaje sú presnejšie. V súčasnosti sa rádiouhlíkové a historické údaje častokrát používajú v rovnakom kontexte, čo nie je metodologicky akceptovateľné. Údaje získané rádiouhlíkovým datovaním s rôznymi intervalmi spoľahlivosti by preto mali byť posudzované separátne.