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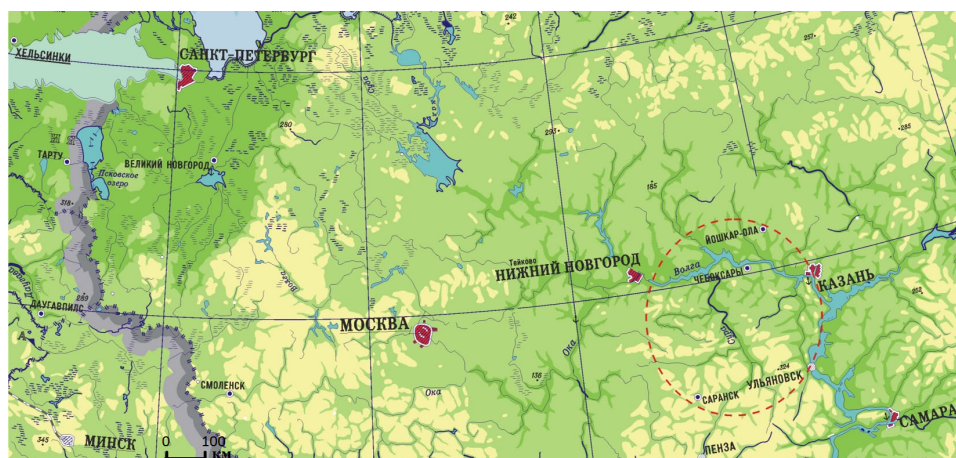
**CHRONOLOGY OF PIT-COMB WARE  
IN THE MIDDLE VOLGA REGION (RUSSIA):  
<sup>14</sup>C DATES OF ORGANIC SUBSTANCES  
WITHIN POTTERY MATRIX**

The Volga-Oka interfluvium (Central Russia) Neolithic sites with Pit-Comb Ware were dated to the 3rd millennium BC by the majority of archaeologists during the period of 1950–1970. With the appearance of radiocarbon dates for Lyalovo culture, characterized by pit-comb decorated pottery, in 1970, its chronology and periodization correcting was started. At the present time this culture is dated to the period from the end of the 5th till the middle of the 3rd millennium BC. At the beginning of the 21st century, the dating of organic matter in pottery began. The Middle Volga region (south-east area of European Russia) Pit-Comb Ware <sup>14</sup>C dates of organic substances within pottery matrix correspond with the dates, which were obtained by the samples from another material in Volga-Oka interfluvium. These dates permit to date the Middle Volga region sites with this type of pottery to the first half of the 5th millennium BC and show that Pit-Comb Ware spread to this region quite quickly, but ended earlier than in staging area.

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### **Introduction**

Neolithic antiquities with Pit-Comb Ware are known on the wide area in Eastern Europe, from Central Volga region in the east to the Baltic Sea in the west (including Estonia, e.g. Kriiska & Tvauri 2007, 63 f.). The Middle Volga region in south-east part of European Russia was in the distribution area of Pit-Comb Ware culture, located on its eastern edge (Fig. 1). The main territory for this culture was the Volga–Oka interfluvium area in central Russia. Here, the so-called Lyalovo culture and its local variants were singled out. Sites with the Middle



**Fig. 1.** The map of the sites with Pit-Comb Ware spreading in the forested Middle Volga region.

Volga region Pit-Comb Ware are spread in the River Volga basin and its left tributaries. The easternmost of them are observed at the upper course of the Ilet River (Nikitin 1996). In the forest-steppe zone a great number of sites are situated in the basins of the Moksha and Vad rivers (Tret'yakov & Vybornov 1988). At the present time there are active works in the Sura basin, where in the area of its middle course 7 new sites with Pit-Comb Ware have been discovered and explored since 2006 (Kondratyev 2008, 136 ff.).

The history of research of the Middle Volga region Pit-Comb Ware sites extends back over 60 years. However, there are a number of topical issues. Chronology is one of them. The only  $^{14}\text{C}$  date for the forested Middle Volga region materials by Pochinok site –  $4730 \pm 40$  BP (Ki-3150) ( $3730 \pm 40$  BC), raised doubts among archaeologists (Nikitin 1996). Therefore, the chronology of complexes with Pit-Comb Ware was given by analogy with materials of Lyalovo culture in the Volga–Oka interfluvium though the chronological framework of this culture was not always defined identically by researchers.

Aleksandr Brysov (1952, 46) and Maria Foss (1952, 154) dated the time of Lyalovo culture formation to the 3rd millennium BC. Vera Rauschenbach (1970, 46) specified the period of its existence to the end of the 4th – third quarter of the 2nd millennium BC. Viktor Tret'yakov (1972) supposed that Lyalovo culture sites were dated to the 4th – first half of the 3rd millennium BC. Sites with Pit-Comb Ware of neighbouring territories were dated to a slightly later date. In the Middle Oka basin, they were dated to the first half of the 3rd – middle of the 2nd millennium BC (Tsvetkova 1970, 99), and in the Lower Oka basin to the end of the 3rd – second half of the 2nd millennium BC (Tsvetkova 1963, 57 ff.). Such conception of dating the sites on the skirts of the Volga–Oka interfluvium to the later period was made on the hypothesis of common centre of Pit-Comb Ware culture formation and expansion.

### Materials and discussion

Since the 1970s the chronology of Lyalovo culture has been corrected on the basis of  $^{14}\text{C}$  dates. They were obtained for the occupation layers with Pit-Comb Ware of the following sites: Sakhtysh I –  $5150 \pm 40$  BP (LE-1023); Yazykovo I –  $5280 \pm 130$  BP (LE-1079); Ivanovskoe III –  $4800 \pm 60$  BP (GIN-241). Relying on these dates supplemented with palynological data Dmitriy A. Kraynov (1978, 60) dated the layers with Pit-Comb Ware to the end of the 4th – beginning of the 3rd millennium BC.

Furthermore, earlier dates were obtained by the Yazykovo I materials. Thus, there are two dates –  $5950 \pm 90$  BP (LE-1190) and  $5280 \pm 130$  BP (LE-1079) for the layer where ceramics of Upper Volga and Lyalovo cultures were jointly bedded. The dates for the layers with Lyalovo ware are  $5730 \pm 50$  BP (LE-1081) and  $5490 \pm 70$  BP (LE-1188). Dating was made on the basis of peat and worked wood samples (Khotinskiy et al. 1978, 63). On these data Vladimir Sidorov suggested a chronology of Lyalovo culture development different from the views of the 1950–1970s. The researcher defined the chronological framework of the culture from the end of the 5th till the middle of the 3rd millennium BC (Sidorov 1986).

Researches Sidorov and Asya Engovatova started a new stage in studying the chronology of Lyalovo culture. They distinguished four stages in the development of Lyalovo culture on the basis of the  $^{14}\text{C}$  dates of peat, wood and from different occupation layers of stratified Voymezhnoe I settlement and other sites (Ozerki V, Ivanovskoe III, IV, VII). Lyalovo culture was divided into four stages: 1) archaic stage: Voymezhnoe I –  $5990 \pm 50$  BP (GIN-6866),  $6000 \pm 40$  BP (GIN-6865),  $6100 \pm 50$  BP (GIN-6871); Ozerki V –  $5930 \pm 200$  BP (GIN-6663); Ivanovskoe VII –  $5920 \pm 60$  BP (GIN-7476), 2) early stage: Voymezhnoe I –  $5720 \pm 120$  BP (GIN-6870),  $5720 \pm 50$  BP (GIN-6871),  $5730 \pm 60$  BP (GIN-6863); Ivanovskoe IV –  $5610 \pm 40$  BP (GIN-5530), 3) middle stage: Voymezhnoe I –  $5340 \pm 50$  BP (GIN-6872),  $5370 \pm 50$  BP (GIN-6873),  $5300 \pm 100$  BP (GIN-6561), and 4) late stage: Voymezhnoe I –  $5100 \pm 70$  BP (GIN-6867); Ivanovskoe III –  $5100 \pm 60$  BP (LE-1976). Now the culture itself is dated to the period of the turn of the 5th–4th till the beginning of the 3rd millennium BC (The ancient hunters... 1997; Engovatova 1998, 243 ff.). These data proved Sidorov's assumptions.

The chronology of Lyalovo culture is still being improved. The crust from the Lyalovo culture ceramics is being dated at the laboratory of the Geological Institute of the Russian Academy of Sciences. This permits not only to add  $^{14}\text{C}$  dates for Lyalovo culture but to check them by using  $^{14}\text{C}$  dates of other materials.

After the analysis of the existing now  $^{14}\text{C}$  dates, Elena Kostyleva and Natalia Zaretskaya defined the chronological framework of Lyalovo culture stages more concretely. They defined the stages the following way: archaic stage – 6200–5900 BP (5200–4900 BC), early stage – 5900–5600 BP (4900–4600 BC), middle stage – 5600–5300 BP (4600–4300 BC), late stage – 5300–5000 BP (4300–4000 BC), and final stage – 5000–4600 BP (4000–3600 BC) (Zaretskaya & Kostilyova 2011, 175 ff.).

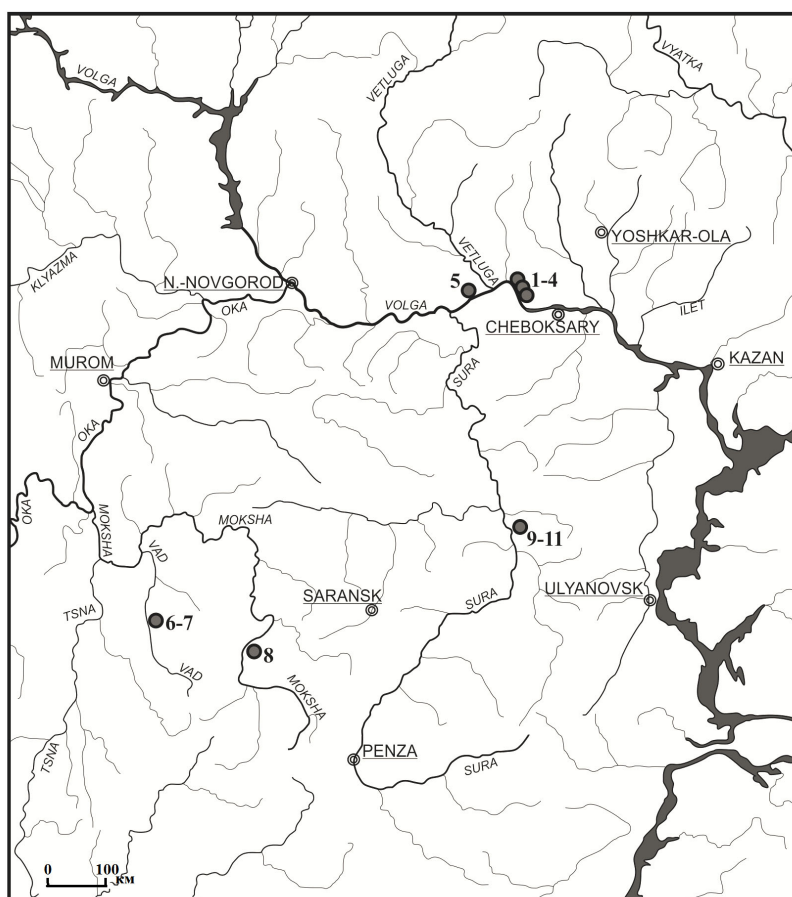
Thereby radiocarbon chronology of Lyalovo culture materials of the Volga–Oka interfluvium appears completely reliable. It permits to compare this chronology with the results of  $^{14}\text{C}$  dating of the Pit-Comb Ware samples from the Middle Volga region carried out at the laboratory of the Institute of Environmental Geochemistry under NAS of Ukraine in Kiev. The dates were obtained by the organic matter in ceramics (Zaitseva et al. 2008, 217 ff.; Zaitseva et al. 2009, 795 ff.; Vybornov et al. 2011, 110; Vybornov & Kulkova 2013, 21 f.; Vybornov 2014, 45 ff.). By now series of 18  $^{14}\text{C}$  dates by Pit-Comb Ware were obtained from different regions of the Middle Povolzhye (Vybornov & Kondratyev 2009, 282 ff.; Kondratiev & Shalapinin 2011, 259 ff.).

The specialists in radiocarbon analysis have proved the presence of organic substances in the Neolithic pottery, which are anthropogenic (Zaitseva et al. 2011, 383 ff.). According to the technological analysis of the ceramics of Pit-Comb type from the forested Middle Volga region, it is made of silty clay with organic solution admixture (Tolpygina 2016, 178 ff.). This particular solution could be the basis for dating. According to the specialists, another source for dating on the ware can be the carbon obtained at the moment of burning the ceramics (Kul'kova 2014, 115 ff.).

We did not aim in this article to address methodological issues of radiocarbon dating of ceramics or crust. It is a topic for a particular study and a special article. This article presented the chronology of the monuments with Pit-Comb Ceramics of the forested Middle Volga region. It is based not only on radiocarbon dates, but also on other data (typology of ceramics and stone tools, comparison with other cultures, etc.). It is important to note that researchers had suggested a periodization of the sites with Pit-Comb Pottery in the region of interest before the radiocarbon dates were obtained. This periodization was confirmed by them. It is all the data that enable to achieve the target objective of this article. The validity of a significant part of the dates for the Pit-Comb Ceramics of the forested Middle Volga region is confirmed by examples of several Neolithic cultures in several regions. Here are just a few of the many examples: at the Baybek site in the north Caspian Sea region, three dates for the pottery  $6920 \pm 120$  BP (SPb-1053);  $6925 \pm 120$  BP (SPb-1716);  $7050 \pm 120$  BP (SPb-1719) coincide with the three dates for coal  $6986 \pm 44$  BP (Ua-50260);  $6948 \pm 120$  BP (SPb-1713);  $7041 \pm 120$  BP (SPb-1715) and three dates for the bones of animals  $6955 \pm 80$  BP (SPb-973);  $6940 \pm 80$  BP (SPb-1710);  $7015 \pm 100$  BP (SPb-1707) (Andreyev et al. 2016, 57, 58, 61). At the Oroshaemoe site in the Lower Volga region, the date for pottery  $5890 \pm 120$  BP (SPb-1729) is similar to the date on the bones of animals –  $5806 \pm 26$  BP (UGAMS-23059) (Vybornov et al. 2017, 132). At the Chekalino IV site in the Middle Volga region, the date for pottery  $7127 \pm 150$  BP (SPb-1731) coincides with the date for coal in ceramics –  $7250 \pm 60$  BP (Poz-42051) (Vybornov et al. 2016). At the Koksharovskiy Holm site in Trans-Urals, the date for ceramics  $7010 \pm 80$  BP (Ki-15915) coincides with the date for coal –  $7050 \pm 180$  BP (LE-7883) (Shorin & Shorina 2011). At the Zamostye II site in the Upper Volga region, the

dates for ceramics  $6830 \pm 80$  BP (Ki-15533) and  $6680 \pm 80$  BP (Ki-15434) are similar to the dates for the crust –  $6834 \pm 63$  BP (Ua-48463) and  $6650 \pm 45$  BP (Ua-37101) (Lozovskaya & Lozovsky 2016). In Prikamye, the date for the ceramics of the Ziarat site is  $6110 \pm 80$  BP (Ki-15087), and for the crust –  $6323 \pm 43$  (Hela-2991) (Vybornov et al. 2016).

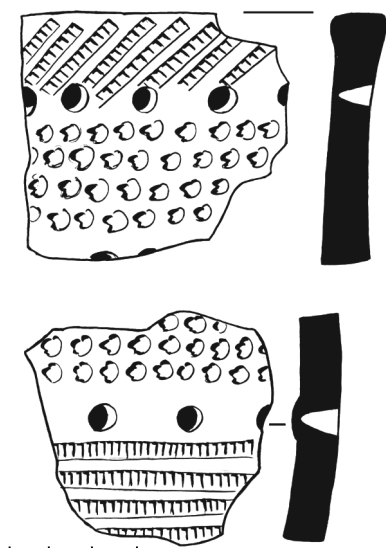
There are 8 dates from 5 sites for the Middle Volga region (the territory of Mari El) (Fig. 2). The date  $5930 \pm 80$  BP (Table 1: 7) was obtained by ceramics from Dubovskoe III settlement ornamented with horizontal rows of stroke prints made by comb tool and separated by pits. This date corresponds with the dates by ware from Otarskoe VI settlement, which has similar ornament and is dated to  $5810 \pm 80$  BP and  $5930 \pm 80$  BP (Table 1: 15, 8). Ceramics from Dubovskoe VIII



**Fig. 2.** The sites with Pit-Comb Ware of the Middle Volga region which have radiocarbon dates from organic substances within pottery matrix. 1 Dubovskoe III, 2 Dubovskoe VIII, 3 Dubovskoe XII, 4 Otarskoe VI, 5 Galankina Gora II, 6 Imerka IV, 7 Imerka VIII, 8 Ozimenky II, 9 Utyuzh I, 10 Vyunovo Ozero II, 11 Chyornenkov Ozero.

**Table 1.** Radiocarbon dates for Neolithic sites with Pit-Combed Ceramics in the Middle Volga region

No.	Date BP	Date (cal BC, 2σ)	Laboratory index and number	Site	Material
1	6085 ± 90	5289-4785	Ki-15626	Vyunovo Ozero II	Organic in pottery
2	6080 ± 90	5286-4780	Ki-15640	Utyuzh I	Organic in pottery
3	6040 ± 90	5210-4729	Ki-15200	Chyormenkoe Ozero III	Organic in pottery
4	5970 ± 90	5205-4614	Ki-15737	Dubovskoe XII	Organic in pottery
5	5965 ± 90	5202-4612	Ki-15620	Vyunovo Ozero II	Organic in pottery
6	5940 ± 90	5054-4582	Ki-15641	Utyuzh I	Organic in pottery
7	5930 ± 80	5016-4604	Ki-14535	Dubovskoe III	Organic in pottery
8	5930 ± 80	5016-4604	Ki-14449	Otarskoe VI	Organic in pottery
9	5890 ± 90	4989-4544	Ki-16036	Imerka VIII	Organic in pottery
10	5880 ± 90	4984-4537	Ki-16167	Imerka IV	Organic in pottery
11	5880 ± 90	4984-4537	Ki-15735	Dubovskoe VIII	Organic in pottery
12	5840 ± 90	4932-4494	Ki-14571	Ozimenki II	Organic in pottery
13	5840 ± 80	4901-4499	Ki-15195	Chyormenkoe Ozero III	Organic in pottery
14	5820 ± 70	4837-4505	Ki-16850	Chyormenkoe Ozero	Organic in pottery
15	5810 ± 90	4896-4458	Ki-14425	Otarskoe VI	Organic in pottery
16	5720 ± 80	4727-4368	Ki-15736	Dubovskoe VIII	Organic in pottery
17	5610 ± 80	4678-4330	Ki-15733	Galankina Gora II	Organic in pottery
18	5430 ± 90	4451-4047	Ki-15734	Galankina Gora II	Organic in pottery

**Fig. 3.** Potsherds from Dubovskoe VIII site (Table 1: 11, 16).

settlement (Fig. 3) was dated, which ornament presents single rows of cone-shaped pits that separate the zones ornamented with horizontal bands of prints made by comb tool and prints in four rows made by a bird bone. Ware ornamented with prints made by a metatarsal bone was spread at the archaic stage of Lyalovo culture. Such ornament can also be found on the ware of early stage of Lyalovo culture. Dates  $5880 \pm 90$  BP and  $5720 \pm 80$  BP were obtained by the ware from Dubovskoe VIII (Table 1: 11, 16). Dubovskoe XII ceramics (Fig. 4) have a date  $5970 \pm 90$  BP. The sherds are ornamented with horizontal bands of prints made by comb tool and separated by single rows of pits. By their typological characteristics all the listed samples correspond with pottery of the early stage

of Lyalovo culture. A moderate mixture of gravel and sand is typical for them; single rows of pits that separate the ornamental zones; simple ornamental patterns of stroke or horizontal prints made by comb tool, prints made by a metatarsal bone. Dates obtained by these samples correspond with chronological framework of early stage of Lyalovo culture (Nikitin 2014).

Of all Middle Volga sites the latest dates were obtained by ceramics from Galankina Gora II site. The fragments had an ornament of vertical and stroke prints made by a comb tool and separated by pits in one row. This is also typical of vessels of the early stage. The received dates are  $5610 \pm 80$  BP and  $5430 \pm 90$  BP (Table 1: 17–18). The first date quite corresponds to the chronology of Lyalovo culture, but the latter is a bit younger. This fact can be explained by uneven development of ceramics traditions and preservation of early signs in separate regions at a later time. The date of this fragment needs to be rechecked.

There were dates about the absolute chronology of the sites with Primokshanye Pit-Comb Ware. There is a  $^{14}\text{C}$  date by charcoal –  $5660 \pm 100$  BP (LE-2313) for the bedding of cultural layer of Imerka III site, where Comb-Prick and Pit-Comb ceramics were bedded together (Timofeev et al. 2004, 79).

At the present time  $^{14}\text{C}$  dates were obtained by the samples from Imerka IV and VIII sites in the basin of the River Vad and Ozimenki II in the Upper Moksha (Kondratiev 2009, 162 ff.).

For dating fragments of a vessel ornamented with metatarsal made prints were taken from the materials of Imerka IV site (Fig. 5). Similar prints are on the ware of archaic and early stages. However, rare cases are known when this element of ornamentation exists till the late stage (Sidorov & Stavitsky 2003, 118). Doubts about the early dating of the chosen sample could also be provoked by the fact that the ornament on this vessel was made not strictly horizontally but wavyly here and there forming a kind of rhomb in conjunction with pits. Still, the received date  $5880 \pm 90$  BP (Table 1: 10) corresponds to early Lyalovo pottery dating. This can be the evidence of similar ornament appearance in the basin of the River Vad already at the first quarter of the 4th millennium BP. Pit-Comb Ware of Imerka VIII settlement is chronologically nonhomogeneous. Arcady Korolev and Vladimir Stavitsky singled out two complexes here – the early one

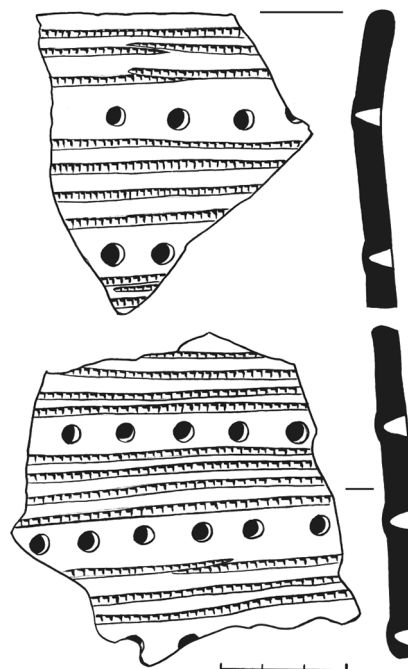


Fig. 4. Potsherds from Dubovskoe XII site (Table 1: 4).

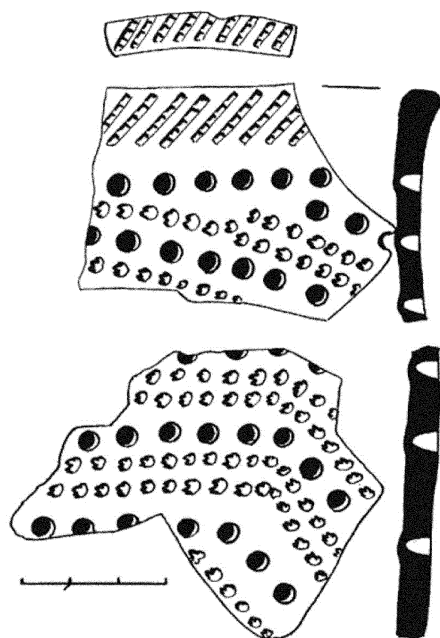


Fig. 5. Potsherds from Imerka IV (Table 1: 10).

that has analogies in materials of the early stage of Lyalovo culture, and the later one, which is synchronous to the advanced stage. In the researchers' opinion the ceramics that have a running ornament of pits on the surface are generally connected with the late complex. In the ware ornamentation of the middle stage of Lyalovo culture pits play a more prominent role, they are larger and are more closely located (Korolev & Stavitsky 2000, 30 ff.). The fragments of the vessel with only pits ornamentation were chosen for dating. The received date  $5890 \pm 90$  BP (Table 1: 9) is earlier than the chronological framework of the middle stage. Apparently it is necessary to compare this date to the early complex with Pit-Comb Ware of this settlement.

Pit-Comb Ware from Ozimenki II site has analogies among the ware of the early stage of Lyalovo culture. And this was also noted by the researcher (Vybornov et al. 2007, 79). By analogy with early Lyalovo layer of Voymeznoe I settlement the materials of Ozimenki II were dated to the second quarter of the 4th millennium BP (Vybornov et al. 2007, 79). Radiocarbon dating by ceramics –  $5840 \pm 90$  BP is very close to this date (Table 1: 12).

Radiocarbon dates are obtained for 4 of 7 explored sites in the Middle Sura with Pit-Comb Ware. By a number of features the ware of these sites is very similar to each other and for dating, samples were selected which have motives typical of this group of sites: Utyuzh I (horizontal comb prints separated by rows of cone-shaped pits) –  $5940 \pm 90$  BP and  $6080 \pm 90$  BP (Table 1: 2, 6); Chyornenkoe Ozero (2010) (stroke and vertical prints made by comb tool separated by one row of cone-shaped pits) (Fig. 8) –  $5820 \pm 70$  BP (Table 1: 14); Chyornenkoe Ozero III (rows of stroke prints made by comb tool separated by one row of cone shaped prints) (Fig. 7) –  $5840 \pm 80$  BP and  $6040 \pm 90$  BP (Table 1: 13, 3); Vyunovo Ozero II (rows of stroke prints made by comb tool and stroke oval shaped pit stamping separated by one row of pits) (Fig. 9) –  $5965 \pm 90$  BP and  $6085 \pm 90$  BP (Table 1: 5, 1). It was the first time that archeologists got dates on food residue on pottery of Utyuzh I site (Fig. 6) –  $5640 \pm 120$  BP (SPb-942) (Tolpygina 2013, 32 ff.; 2014, 71 ff.; Berezina et al. 2014, 208 ff.; Table 1). This ware has its analogy in the materials of Lyalovo culture early stage. However,



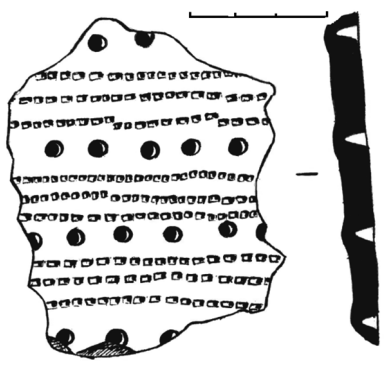


Fig. 6. Potsherd from Utyuzh I site (Table 1: 2, 6).

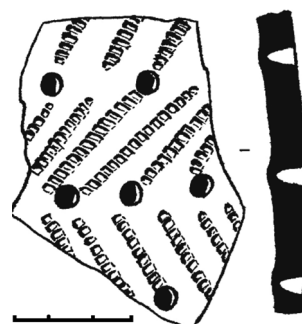


Fig. 7. Potsherd from Chernenkoe Ozero III site (Table 1: 3, 13).

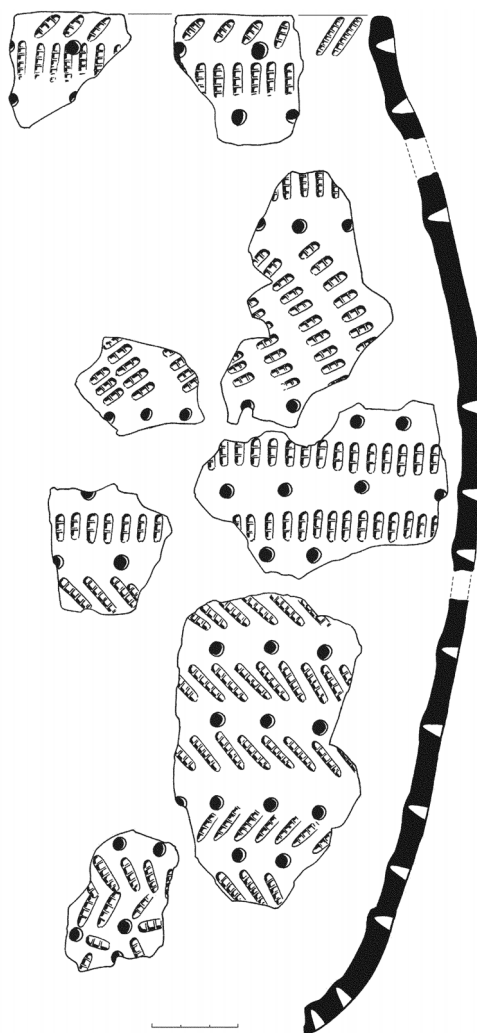
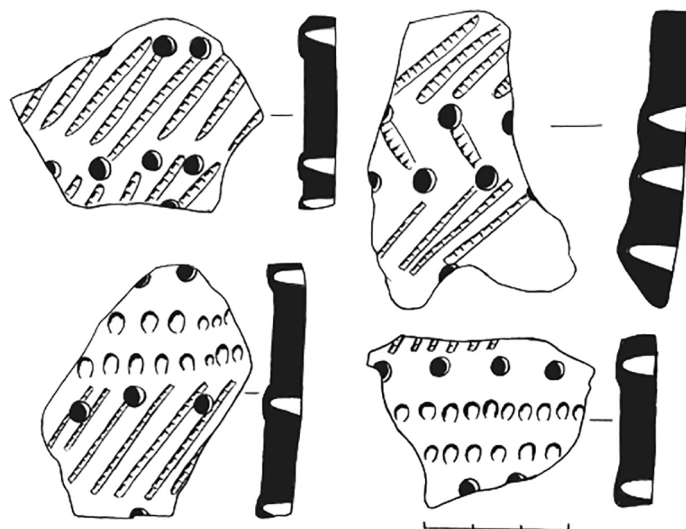


Fig. 8. Potsherds from Chernenkoe Ozero site (Table 1: 14).



**Fig. 9.** Potsherds from Vyunovo ozero II site (Table 1: 5).

some of the received dates are slightly older than the chronological framework of this period and partly correspond with its archaic type.

### **Conclusion**

Thereby the main part of the received dates from the Middle Volga region Pit-Comb Ware correspond with the chronology of similar ware in the Volga–Oka interfluvium which is founded on dating the samples of charcoal, peat, sapropel, snuff, wood and bones. In other words, the method of dating by organic matter in ware works. Due to the received data there are rather strong reasons to claim that expansion of culture with Pit-Comb Ware from the Volga–Oka interfluvium to Middle Volga region went on rapidly in the first half of the 5th millennium BC. These dates permit to date the Middle Volga region Pit-Comb Ware to the first half of the 5th millennium BC. It seems that Pit-Comb Ware spread to the Middle Volga region quite quickly, but ended earlier than in the staging area.

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**KESK-VOLGA PIIRKONNA (VENEMAA) LOHK-KAMMKERAAMIKA KRONOLOOGIA: <sup>14</sup>C DATEERINGUD SAVINÕUDE KOOSTISES OLEVAST ORGAANILISEST AINESEST**

*Resümee*

Lohk-kammornamendiga keraamika levis neoliitikumis ulatuslikul alal Ida-Euroopas alates Kesk-Volga piirkonnast idas kuni Läänemereni läänes (sh Eesti alal). Selline tohutu ulatus eeldab fenomeni eriaegsust ja ühtlasi vajadust selgitada niisuguse keraamika teket ning arengut. 1950.–1970. aastatel dateeriti lohk-kammkeraamika muistised Volga ja Okaa jõe vahelisel alal enamasti 3. aastatuhandega eKr. 1970. aastatel saadi esimesed dateeringud radiosüsinikumeetodil, mis andis võimaluse asuda korrigeerima Ljalovo kultuuri kronoloogiat ja perioodiseeringut. Praegu dateeritakse see periood kalibreerimata radiosüsiniku vanusena 5. aastatuhande lõpust kuni 3. aastatuhande lõpuni eKr. Kesk-Volga piirkonna kohta olid pikka aega olemas vaid üksikud dateeringud, mis ei võimaldanud määrata isegi lohk-kammkeraamika kasutusaja kronoloogilisi raame sellel alal. 2000. aastate algul algas savinõude koostises oleva orgaanika dateerimine radiosüsinikumeetodil. Kesk-Volga lohk-kammkeraamika vanused vastavad Volga ja Okaa jõe vaheliselt alalt tehtud teiste orgaaniliste materjalide radiosüsinikudateeringutele, võimaldades dateerida lohk-kammkeraamika muistised selles piirkonnas kalibreerimata radiosüsiniku vanusena 4. aastatuhandega eKr.

Kahe piirkonna erinevatest materjalidest tehtud radiosüsinikudateeringute võrdlus osutab, et keraamikas oleva orgaanika dateerimine on toimiv meetod. Tänu saadud vanusemäärangutele on piisav alus väita, et lohk-kammkeraamika kultuur levis Volga ja Okaa jõe vaheliselt alalt Kesk-Volga piirkonda kiiresti, kuid see lõppes siin kiiremini kui lähtealal.