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ORIGINAL ARTICLE

Plant food subsistence in the human diet of the Bronze Age Caspian and Low Don steppe pastoralists: archaeobotanical, isotope and ^{14}C data

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Abstract
The paper presents the result of analysis of charred food on the interior part of the vessels from the graves of the East Manych and West Manych Catacomb archaeological cultures (2500–2350 cal BC). The phytolith and pollen analyses identified pollen of wild steppe plants and phytoliths of domesticated gramineous plants determined as barley phytoliths. Direct ^{14}C dating of one of the samples demonstrates that barley spikelets and stems were used in funeral rites by local steppe communities. However, there are no data suggesting that steppe inhabitants of the Lower Don Region were engaged in agriculture in the mid-3000 BC. Supposedly, barley could have reached the steppes through seasonal migrations of mobile pastoralists to the south, use of North Caucasus grasslands in the economic system of seasonal moves and exchange with local people. Nevertheless, presence of carbonized barley seeds in the occupation layers at North Caucasus settlements of 4000–3000 BC requires confirmation by direct ^{14}C dating of such samples.

Keywords Eurasian steppe · Bronze Age · Catacomb culture · Crusts and pot residue · Barley

Introduction

Background

The economic cycle and form of production developed by the Bronze Age populations of the Caspian and the Low Don steppes were based on the exploitation of raw materials, food resources and the organization of an exchange system, as well as short and long-distance movements across the steppe and foothill region of the North Caucasus and the Volga and Don river valleys. Animal husbandry was a core economy of the Catacomb culture population (2500–2350 cal BC) during the third millennium BC. Pastoral economic strategy was stipulated by specific features of pasture use in the desert areas such as low forage yield and the seasonal nature of the vegetation. The economy also included gathering of plants and molluscs, fishing and hunting (Shishlina 2008), but crop growing was not practiced on the steppes until the end of the Bronze Age (Lebedeva 2005).

Despite thousands of excavated kurgans, which are the main funeral sites of the steppe cultures in prehistory, there is almost a complete absence of settlements. The main sources for studying the life style and life ways of the steppe

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population that lived in the Bronze Age Caspian and Low Don steppes are kurgans and burials.

Burials and the deposits from the Bronze Age steppe settlements yielded numerous bones of sheep/goats, horses, saiga, koulan and, rarely, other wild animals; also bones of pike (*Esox lucius*), carp (*Cyprinus carpio*), pike-perch (*Stizostedion lucioperca*) and catfish (*Silurus glanis*), Caspian kutum (*Rutilus frisii*) and edible shells of *Unia* and *Poludina* (Shishlina 2008; Shishlina et al. 2015). Cultural layers from the bottom of the graves and occupation layers of the camps revealed charred seeds and fruits only of wild plants such as *Amaranthus, Lithospermum officinale*, etc. (Novikova et al. 2002; Shishlina et al. 2007; Rühl et al. 2015). However, in order to assign seeds and fruits to a specific archaeological culture, direct ^{14}C-dating is needed to exclude intrusive species.

Additional evidence of food consumed is remains of charred food on the interior surface of the pots and sometimes on their exterior surface, because when food was cooked in a pot, it could be burnt. Residues of burned plants were found in ritual incense burners and braziers as well. Hence, carbonized remains and charred food residue from such vessels are an indication of the components of food remains including plants.

The aim of this study was to examine the crusts and carbonized remains from Catacomb culture clay pots using phytolith and pollen analyses in order to determine what wild or domesticated plants were consumed as food or used for ritual purposes. In addition, radiocarbon dating of crusts, carbonized remains and human bones was performed.

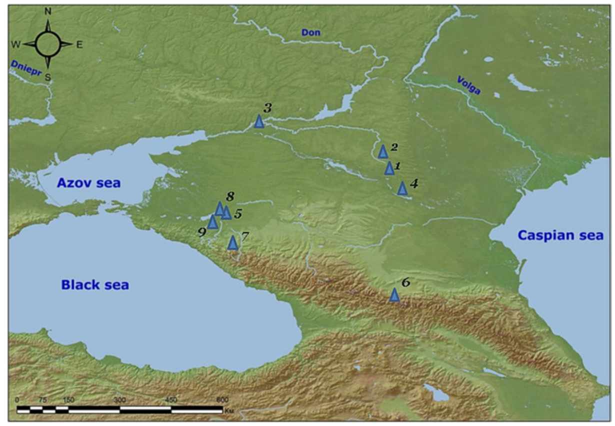

Fig. 1 Location of sites. 1: Ulan IV; 2: Peschany IV and V; 3: Shakhaevskaya 1; 4: Zunda-Tolga 2; 5: Lesnoye; 6: Chidgom; 7: Meshoko; 8: Chishkho; 9: Svobodnoye

Fig. 2 Peschany V, kurgan 18, grave 4

Geography and archaeological context

The area under investigation, i.e., the western Yergueni slopes, which gradually turn into the Salsk Steppes, is a dry steppe over dark- and bright-chestnut coloured soils (Fig. 1). In some places the soils are grasslands-chestnut and alkali. The area descends gradually towards the Don and the Manych steppes. The ground water level is 10–25 m deep. The area is characterized by a moderate continental climate. The vegetation cover is rather diversified. Grass steppes with chamomile and *Artemisia* (wormwood) over bright-chestnut alkali soils cover the Yergueni Hills. Associations with *A. herba-alba* (white wormwood), *Festuca* (fescue) and *Stipa* (feather-grass) dominate. *Festuca* and *Stipa* associations prevail also on the upper Salsk basin, to the west of the Yergueni Hills, with mixed grasses occurring, and with various *Artemisia* spp. on alkali soils (Narodetskaya 1974; Lavrenko et al. 1991). Whereas the vegetation on the higher ground is poor, *limans*, which are narrow lagoons near the mouth of a river, and flat-bottom depressions enjoy a higher diversity of vegetation cover (Demkin et al. 2002).

Since 2500 cal BC this area was actively exploited by East Manych and West Manych Catacomb population groups, which left behind thousands of kurgans (burial mounds). Their burials are characterized by a distinct funeral rite that included numerous funeral offerings such as clay pots, stone weapons and implements, animal bones and in rare cases, bird and fish bones. The special arid conditions enabled the preservation of macro-archaeobotanical remains, e.g., plant mats, grass, seeds and fruits (Novikova et al. 2002) in the burial context. Settlement sites are represented by seasonal summer and winter short-term camps (Shishlina et al. 2007, 2015) characterized by occupation layers that have yielded domestic items.

The pots retrieved from the Catacomb culture graves (usually 2–4) were placed at the feet or near the head of the deceased (Fig. 2). In some graves the number of pots was even higher (Table 52-4 in Sinitsyn 1978)—not only new kitchen pots, but also pots that had been used many times. They contained residues of burnt food used as funeral offerings. We do not know how often Catacomb herders washed their pots. We assume that when an individual was buried, regular food or some special ritual food or beverages associated with the funeral traditions of a specific community was placed or poured into the pots. Incense burners and braziers were used by the steppe Catacomb population during funeral rites to burn fragrant plants. The pots were then placed inside the graves, and many still have burnt residue of plants and charred matter (Shishlina et al. 2009).

Materials and methods

Materials

Organic residues, found in clay pots in the form of crusts of burned food, are preserved on the inside as well as outside surface of the pots. The colour of the crusts can be almost black, dark or light brown; they can be up to several mm thick and cover an area from 1 to 5–6 cm^2. The food products used to cook meals may also settle down on the bottom of pots and therefore get preserved either as macro-residue (fish and animal bones, burnt seeds or fruits) or micro-residue (pollen and phytoliths, collagen strands, chitinous microplates of fish scales, parasites or insects). The colour of food residue accumulated on the bottom is usually dark brown or light brown. The food crust and residue samples from vessels were first subjected to micro-remains analyses, i.e., pollen and phytolith analyses.

Depending on the ingredients of cooked but slightly burned meals, the signals of stable nitrogen and carbon isotopes of the crusts may also demonstrate what products were used for cooking meals. Terrestrial wild or domesticated C_3 or C_4 plants, meat/milk of domesticated animals, freshwater fish from rivers and lakes or sea fish and molluscs have different isotopic signals (Fischer et al. 2007; Philippsen 2010). Following the micro-remains analyses, the charred plant samples and crust were subjected to isotope analyses.

To do this pilot study, we selected clay pots from kurgan burial grounds Ulan 4, Peschany IV and V and Shakhaevskaya 1, attributed to the East and West Manych Catacomb cultures and located in the Rostov Oblast in the Lower Don Region, as well as Zunda-Tolga 2 in the Kalmyk steppes (Fig. 1). The residue from eight pots was subjected to archaeobotanical examination (phytolith and pollen analyses). Crusts were selected from six pots (Fig. 3). Two samples of the carbonized remains, one sample of the crust and three samples of the human bone collagen were ^{14}C dated.

The crusts were scraped mechanically from the interior surface by a spoon or a knife. The residue was selected only from the bottom of the pot or the incense burner. Charred macro-residue was carefully collected. The samples, weighing 2–10 g were then divided into two parts. To identify the components of the samples, phytolith and pollen analyses were conducted, and the nitrogen and carbon stable isotopic composition of these samples was determined. The results obtained were compared with the collection of phytoliths, which includes wild and domesticated plants growing in the steppe areas of Kalmykia and the Lower Don Region (Novikova et al. 2002; Bobrov 2002; botanical collections of the Steppe Archaeological Expedition of the State Historical Museum made in 2000–2015 are used as reference data). The published micro-archaeobotanical data obtained from pot residues found in other Catacomb pots in the studied region (Shishlina et al. 2007, 2009) were also used as a baseline.

To exclude potentially intrusive species in the samples analysed, such as seeds and fruits of subsequent periods not relating to the Catacomb culture, additional direct ^{14}C dating of the crusts of burned food and carbonized remains was conducted. Bones of the individuals from three analysed burials were also ^{14}C dated. A potentially older age of the crusts caused by a reservoir effect was taken into account if the crust contained food of aquatic origin (Fischer et al. 2007; Philippsen 2010).

Fig. 3 Clay pots: 1: Peschany V, kurgan 18, grave 4, incense burner; 2: Peschany V, kurgan 13, grave 3, incense burner; 3: Peschany V, kurgan 18, grave 6, brazier

Method

The standard protocol for the phytolith analyses was used (Rosen 1999). Samples were dried at 50 °C for 24 h. The sediment was sieved through a 0.5 mm mesh, and placed in tubes. The samples were treated with 15 ml 10% HCL to remove any carbonates, washed in distilled water and placed into ceramic crucibles where they were left to dry; then they were burnt for 2–4 h at 500 °C. The suspension containing the phytoliths was removed and washed twice with distilled water at 2,000 rpm for 5 min. The phytoliths were removed from the tubes, dried and weighed. The samples were analysed at Moscow State University using an optical microscope (400× magnification). Identification of archaeological phytoliths was made using modern comparative reference collections from Moscow State University.

Pollen analysis was done at the Institute of Geology and Institute of Archaeology, Russian Academy of Sciences, Moscow and in Kolomna Archaeology Centre. The samples were treated using caustic soda (10%), hydrochloric acid (10%), and a liquid with a specific gravity of 2.35. Microscopic analysis was carried out using an optical microscope (400× magnification) (Grichuk and Zaklinskaya 1948). Stable isotope ratio measurements were made at the Institute of Geochemistry and Analytical Chemistry, Moscow, using a DELTA Plus XP isotope mass-spectrometer (ThermoFinnigan) linked to a Flash EA elemental analyser. The food crust was treated following the procedure of Philippsen (2010) including the standard chemical treatment for isotope analysis to remove contamination (Mook and Streurman 1983). The isotope ratios are reported in permil deviation relative to the international standards VPDB and AIR for $\delta^{13}C$ and $\delta\ ^{15}N$, respectively. Each sample was measured in triplicate and the standard deviation of repeated measurements was 0.2 and 0.2 to 0.3‰ for $\delta^{13}C$ and $\delta\ ^{15}N$, respectively. For bones, the collagen integrity was assessed by the C/N atomic ratio.

Radiocarbon dating was performed at the Centre for Isotope Research, Groningen University. The radiocarbon dates are reported by convention as BP, which includes correction for isotopic fractionation and using the conventional half-life (Mook and van der Plicht 1999). The conventional dates are calibrated as calendar year intervals using the calibration curve Oxcal 4.2 (Reimer et al. 2013).

Results

Results of the macro- and micro-archaeobotanical analyses

Pollen and phytoliths of wild plants, including C_3 gramineous plants, were identified in practically all samples. The crusts on the interior surface of the pots revealed Cichoriaceae, Chenopodiaceae, *Artemisia, Ephedra*, Asteraceae and other plants common in the steppe areas (Fig. 4). A large quantity of chitinous microplates of fish scales was found in a pot from Zunda-Tolga 2. Two vessels, i.e., a clay pot and an incense burner, contained phytoliths of cultivated cereals. After an additional study with reference samples of modern millet, wheat and barley obtained from the Rostov Region and from the collection of the State Historical Museum, the phytoliths obtained from the archaeological samples were attributed to *Hordeum* sp. (barley) (Table 1; Fig. 5). The results of the analyses correlate with the phytoliths available from other archaeological contexts (Ball et al. 2016; Fig. 2.7 in; Rosen 1999).

Results of stable isotope $\delta^{13}C$ and $\delta^{15}N$ measurements

For seven crust samples we performed stable isotope analysis. The results are shown in Table 1 and Fig. 6.

The isotopic signature of the crust samples taken from the interior and exterior surfaces of four pots is consistent with the isotopic signature of contemporaneous wild C_3 plants of the same species from the studied area (database of the steppe archaeological expedition, State Historical Museum). Two samples, i.e., the burned organic substance from the bottom of the pot and the carbonized remains from the bottom of the incense burner (some components of which have been attributed to *Hordeum* sp., show a more negative value of $\delta^{13}C$). Worth noting is that *Hordeum* has been observed to have lower $\delta^{13}C$ values than other C_3 species such as *Triticum* sp. However, our values are lower than those usually reported for *Hordeum*. We do

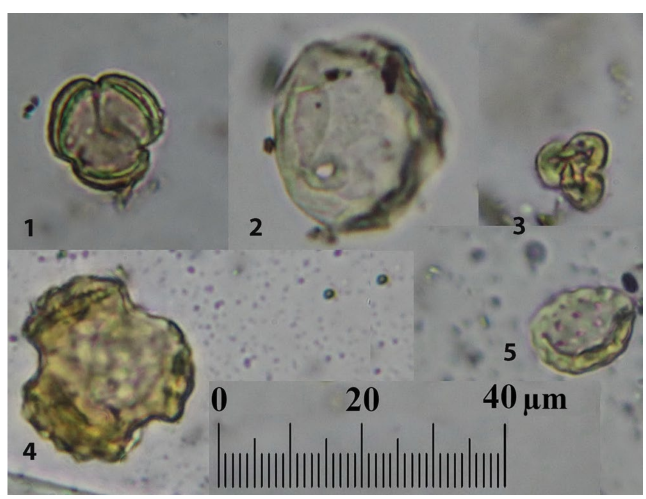

Fig. 4 Pollen: 1: *Artemisia*; 2: Poaceae; 3: Rosaceae; 4: Asteraceae; 5: Chenopodiaceae, Peschany V, kurgan 18, grave 6 (2, 5); Peschany V, kurgan 18, grave 4 (1, 3); Peschany V, kurgan 16, grave 5 (4)

Table 1 Results of phytolith and pollen analyses and the $\delta^{13}C$ and $\delta^{15}N$ values for the pot crusts and food residues

Site/kurgan/grave/vessel	Sample	Pollen	Phytoliths	$\delta^{13}C$	$\delta^{15}N$
Ulan 4 kurgan 4, grave 10	Residue from the bottom of a vessel	Large quantity of carbonized remains, no pollen	Poaceae	–	–
Peschany V kurgan 16, grave 5, vessel 1	Crust from the interior surface	Isolated pollen of Cichoriaceae and Chenopodiaceae, including two concentrations of Chenopodiaceae and a spore of *Glomus* (soil fungus)	Poaceae	−21.8	+9.6
Peschany V kurgan 16, grave 5, vessel 1	Crust from the exterior surface	–	–	−22.9	+9.7
Peschany V, kurgan 16, grave 5, incense burner	Crust from the bottom of a bowl	Isolated pollen of Asteraceae, Chenopodiaceae, Poaceae; spores of Adiantaceae were observed	–	–	–
Peschany V, kurgan 16, grave 5, vessel 2	Crust from the interior surface	–	–	−23.1	−0.5
Peschany V kurgan 18, grave 6, incense burner	Dust from the bottom of a bowl	Caryophylaceae, Poaceae, Chenopodiaceae; abundance of phytoliths of barley (*Hordeum* sp.)	*Hordeum* sp.	−31.7	+9.0
Peschany V kurgan 18, grave 4, incense burner	Dust from the bowl	Poaceae (1), Chenopodiaceae (5), *Artemisia* (2), *Pinus* (2), Polygonaceae (1), Rosaceae (2), *Betula* (1), *Carduus* (1), indet. (2); 'silica dust', phytoliths of grassland plants, a small quantity of barley phytoliths	Gramineous cuticles; a stem of gramineous plant, with trichomes—*Hordeum* sp., presumably, forest reed	−31.8	+9.4
Peschany IV kurgan 13, grave 3, incense burner	Charcoal and crust from the bowl	–	Cloth fragments of unknown origin; gramineous plants	−28.5	+9.6
Shakhaevskaya 1, kurgan 4, grave 35, incense burner	Plants from the bowl	–	Mesophilic plants (gramineous plants?) and silicified tissues of gramineous plants of steppe areas (with typical short phytoliths)	−27.7	+5.7
Zunda-Tolga 2 kurgan 1, grave 5, vessel 2	Crust from the interior surface	Small quantities of Varia, Chenopodiaceae, *Artemisia, Ephedra*, Asteraceae, Poaceae; a lot of chitinous remains of microplates of fish scales	–	−23.7	+19.5

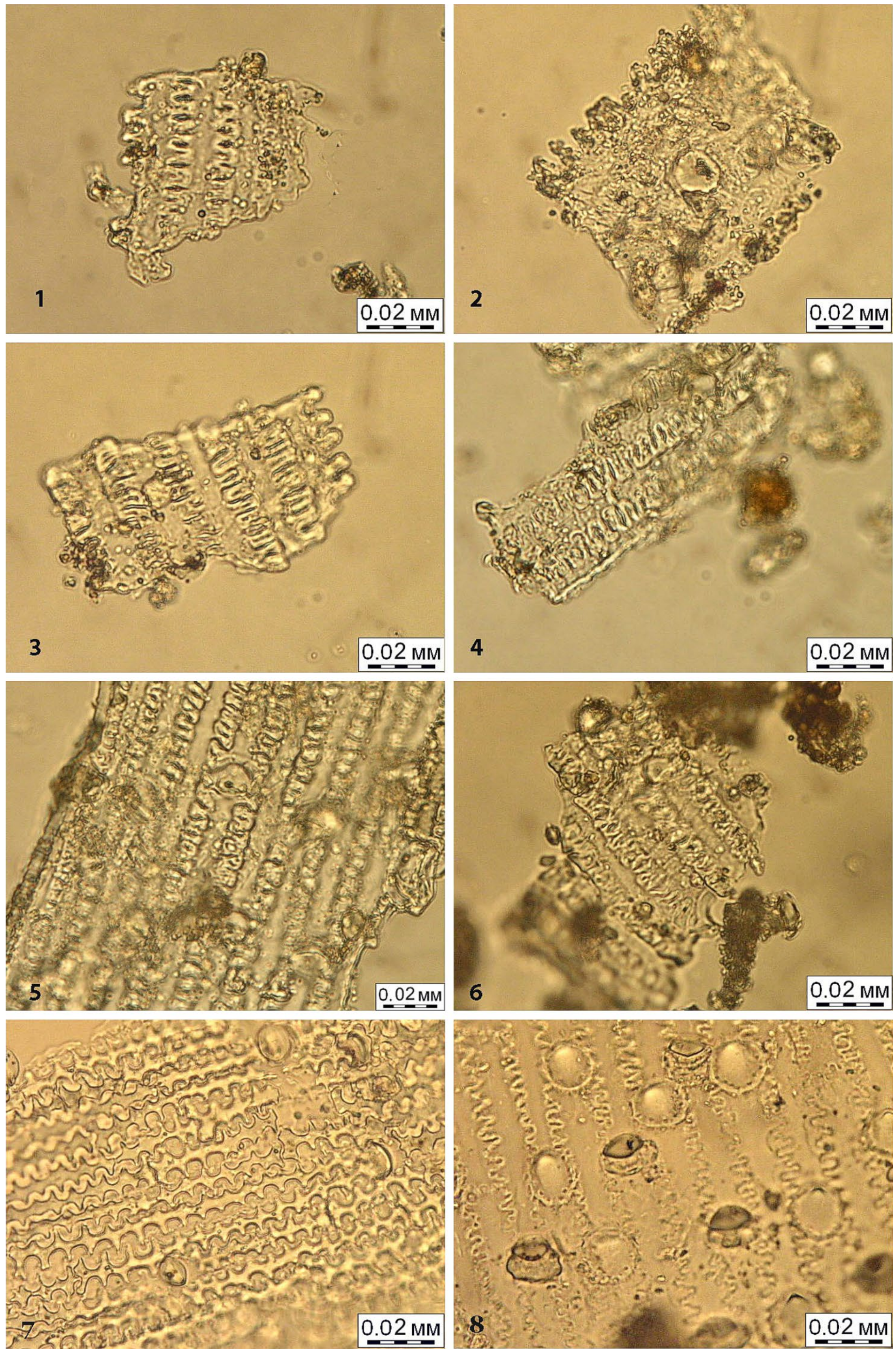

Fig. 5 Phytoliths of *Hordeum* sp. (barley): 1–3: Peschany V, kurgan 18, grave 4, incense burner; 4–6: Peschany V, kurgan 18, grave 6, brazier; 7–8: contemporary *Hordeum* sp.

not have an explanation for this effect. The highest value of ^{15}N is observed in the crust which has as main components chitinous microplates of fish scales (Shishlina et al. 2007). These values are close to the isotopic values of the bones from archaeological fish in the Don region (unpublished data).

Results of radiocarbon dating

The ^{14}C age of the crust sample from one pot and two samples of the carbonized plant remains from the cups of incense burners were compared with the radiocarbon age of the human bones coming from the same grave (Table 2; Fig. 7). The correlation of the data from grave Peschany V,

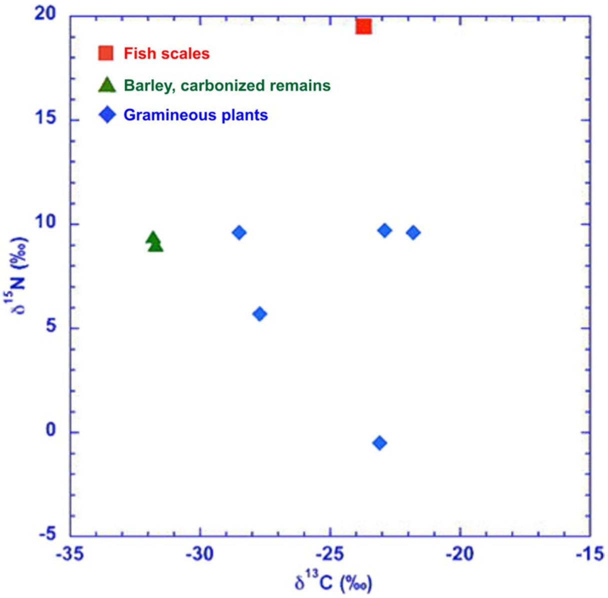

Fig. 6 Isotope values of organic residues from Catacomb culture pots

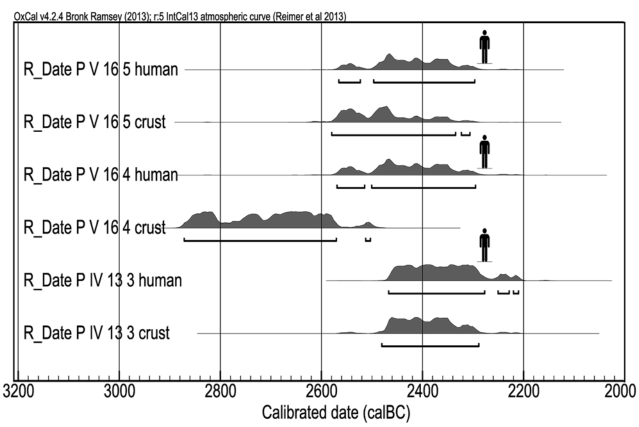

Fig. 7 ^{14}C dates of food crust and human bones; East and West Manych Catacomb cultures

kurgan 16, grave 5 and Peschany IV, kurgan 13, grave 3, demonstrates that the remains of the burned food and the carbonized remains in the incense burners date to the period when the grave was made by the Catacomb people. Thus, the samples are not contaminated with some later or earlier species. The ^{14}C date of the carbonized remains from the incense burner from Peschany V, kurgan 16, grave 4, is older than the date obtained for the human bone from the same grave. This situation could be caused for several reasons, for example, thermic heating during the burning of the plants. It is also possible that the crust on the inner wall of the large pot was formed during the cooking of fish. When the pot was broken (by accident or for a special funerary purpose) its bottom was used for burning plants including barley. The crust could have been formed long before, and could contain remains of fish cooking. This could explain the offset of 170 year identified in human and crust ^{14}C ages in this case.

Interpretation and conclusion

The correlation of archaeobotanical and isotopic data provides new insights into the dietary system of the steppe Catacomb population of the Bronze Age (2500–2350 cal BC). Wild plants of C_3-type formed the basis of the plant component of the diet. It can be concluded that the Catacomb population gathered a lot of wild C_3 plants, including gramineous plants. A similar situation is observed in other steppe regions (Rühl et al. 2015).

The presence of chitinous fish scales in one of the pots from Zunda-Tolga 2 implies that fish was also included in the diet. Also teeth of *Rutilus frisii*, a freshwater fish of the Cyprinidae, were found in grave 4, kurgan 18, at Peschany V.

The most interesting finds, though, are phytoliths of *Hordeum* sp. in two vessels, a clay pot and an incense burner. The database of residues from the vessels of the Don river and Caspian steppe cultures does not contain any data on phytoliths, pollen or grains of domesticated barley or other domesticated cereals (Shishlina 2008). Such archaeobotanical data are not available for other Catacomb culture sites of the steppe region. Crop growing and active consumption of domesticated crops were not practiced in the region in question until the late Bronze Age (Lebedeva 2005).

Hordeum domestication occurred in various geographical regions around 6500 cal BC. It was grown in South-Western Asia (Zohary 1971) and appeared in the North Caucasus at the end of 5000–early 4000 BC (Ostashinsky et al. 2016); this crop reached Europe through the Caucasus and the Mediterranean in 4000–3000 BC (Spengler 2015). Carbonized fragments of *Hordeum* spikelets were found along with *Triticum* at the Eneolithic Meshoko settlement and the Meshoko rock shelter, and at the Svobodnoye settlement (Ostashinsky et al. 2016). The Chishkho Early, Middle and Late Bronze Age settlement layers also included carbonized *Hordeum* grains (Lebedeva 2011). *Hordeum* was also identified among domesticated crops (with *Triticum*) at Chidgom, which is a small mountainous settlement in Ossetia, North Caucasus (Lebedeva 2015, p 73, Fig. 4). Radiocarbon dates for sheep bones from the occupation layers suggest that this settlement was occupied during several periods, one of which is the middle to second half of the third millennium BC (Albegova and Tsvetkova 2015, p 11), i.e., the period of the steppe Catacomb culture. However, no grain samples from these sites were directly ^{14}C dated.

The ^{14}C date of the carbonized remains from the incense burner (Peschany V, kurgan 16, grave 4), which contains *Hordeum* phytoliths, demonstrates that this gramineous plant

Table 2 Results of ^{14}C dating of the crust, carbonized remains from pots and incense burners and human bones (calibrated with OxCal 3.10)

Lab. code	Sample	^{14}C age (BP)	Calibrated range (BC)	$\delta^{13}C$, ‰
Peschany, kurgan 16, grave 5				
GrA-59133	Human bone	3,935 ± 40	2487 (48.0%) 2396 2386 (20.2%) 2346	− 15.6
GrA-59135	Crust on the interior surface of a pot (Asteraceae, Chenopodiaceae, Poaceae)	3,965 ± 45	2570 (31.5%) 2514 2502 (30.0%) 2454 2418 (3.4%) 2408 2374 (1.8%) 2368 2361 (1.5%) 2356	− 23.1
Peschany V, kurgan 16, grave 4				
GrA-61707	Human bone	3,940 ± 45	2556 (5.5%) 2536 2490 (45.1%) 2395 2386 (17.6%) 2346	− 15,3
GrA-61257	Carbonized remains from the incense burner (Poaceae, *Hordeum* sp., grassland plants)	4,110 ± 45	2856 (17.4%) 2811 2747 (7.9%) 2724 2698 (32.2%) 2616 2611 (10.6%) 2581	− 12.0
Peschany IV, kurgan 13, grave 3				
GrA-64620	Human bone	3,875 ± 35	2454 (17.6%) 2418 2408 (16.5%) 2374 2368 (34.1%) 2297	− 17.5
GrA-64555	Carbonized remains from the incense burner (Poaceae, indet. plants)	3,910 ± 35	2468 (43.8%) 2391 2386 (24.4%) 2346	− 14.0

in some way appeared in the steppe environment around 2500 cal BC.

The main research task is to link the finds of *Hordeum* phytoliths from the two Catacomb vessels discovered in the Don Steppe areas to a specific cultural context. The Eastern Europe database has sparse data on *Hordeum* finds at Bronze Age steppe sites.

Still, there are a number of questions to be answered:

- Could the steppe population somehow obtain access to the North Caucasus crops?
- How could *Hordeum* appear in the steppe Catacomb cultural context?
- What is the role of *Hordeum* in funeral rites?

Like Lebedeva (2005), we believe that presently there is no evidence suggesting that the steppe population of the Caspian maritime steppes, the Don river region and the Volga river region practiced crop growing in the Early and Middle Bronze Age. A bag containing *Triticum* from a Catacomb grave near the village of Bolotnoye (Korpusova and Lyashko 1990) is probably just booty from war (Lebedeva 2005), whereas the preserved seeds of domesticated crops probably were grown elsewhere and were subsequently imported (Ryabogina and Ivanov 2011, p 98).

The mobility of the Catacomb population was rather high. It was predetermined by the economic pattern based on pastoralism. Population groups made seasonal moves within the exploited ecological areas. The boundaries of such areas shifted depending on the climatic situation, overgrazing of the pastures and for many other economic and social reasons (Shishlina 2008; Shishlina et al. 2017). The variation of the $^{87}Sr/^{86}Sr$ ratio in human tooth enamel from Catacomb individuals (Shishlina and Larionova 2013), the carbon ($\delta^{13}C$) and the nitrogen ($\delta^{15}N$) isotopic composition of the collagen from humans (Shishlina et al. 2009), pasture-fed animals with low tolerance of water restrictions as well as archaeological pasture plants (Shishlina et al. 2017) and seasonality of archaeological sites (Kirillova et al. 2000; Klevezal et al. 2007) confirm this hypothesis. Therefore, most likely, North Caucasus pastures systems containing foothills and highland pastures were included into the seasonal grassland system exploited by the East Manych and the Catacomb populations.

It means that the Catacomb population probably obtained access to the food produced in the North Caucasus through exchange. It has already been suggested that honey came to the steppes from the Caucasus (Shishlina 2008). Can we include domesticated crops in the list of exchange goods? At present, relevant data on both the North Caucasus and the steppes are so scarce that until we get precisely dated archaeobotanical data linked to archaeological sites (Stevens and Fuller 2012; Pelling et al. 2015), this suggestion will remain just a hypothesis.

Our second conclusion is related to the cult context of the find. The brazier from the bottom of the large pot and the incense burner from Peschany V graves are attributes to the rituals conducted during a funeral ceremony. They contain preserved carbonized plant micro-residues, including *Hordeum* phytoliths.

The analyses of the crusts and the pot residue provide the basis for discussing issues such as how the plants were used, why they were found in the archaeological context, and how these finds can be linked to the funeral assemblage (Antipina and Lebedeva 2015). The results obtained confirm a diversity of wild edible plant species and demonstrate that the steppe population cooked them for food. The samples of carbonized remains with *Hordeum* phytoliths from the ritual pots, including braziers and incense burners were analysed for the first time. Direct ^{14}C dating of one of the samples suggests that *Hordeum* spikelets and stems were used in funeral rites. It is possible to assume that in rare cases cultivated *Hordeum* was the part of the steppe population diet. However, from where this plant was imported into the steppe region around 2500 cal BC is still a pending issue until uncontaminated archaeobotanical residue is obtained (Lebedeva 2005) and is accurately dated by ^{14}C.

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