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RAPID CLIMATIC EVENT 8200 CAL BP AND SOCIAL DYNAMICS IN NORTH-WESTERN PONTIC REGION

The article treats the archaeological record of North-Western Pontic region in search of traces of 8200 calBP event. The two different approaches are applied: summation of 14C dates and a site-oriented approach. In the framework of the latter we refer to materials of Melnychna Krucha site, which contains a sequence covering 7500-1200 y. BCE. Twelve AMS dates highlight the probable gap in the sequence of human habitation on the site around 6250-6000 y. BCE, around the expected timing of the paleoclimatic oscillation. It seems that the event was accompanied by drastic changes in the watering of major rivers of Northern Pontic area like Southern Buh or Dnieper.

Keywords: abrupt climate change, radiocarbon dating, subsistence patterns, soil sequence

INTRODUCTION

Rapid climatic event around 8200 calBP was the major abrupt climatic reversal of the Holocene (Alley et al., 1997; Alley, 2000). It was probably caused by the catastrophic release of glacial lake Agassiz-Ojibwa. The cool water released from the lake interrupted North-Atlantic warm currents, thus, leading to general climate cooling. The latter was recorded in a variety of proxies from all over the Northern Hemisphere (Haas et al., 1998; Alley, 2000; Mayewski et al., 2004; Ravazzi, Aceti, 2004; Wurth et al., 2004; Renssen et al., 2007; Ruth et al., 2007; Feurdean et al., 2008).

As the largest cooling of Holocene, 8200 calBP event attracted attention of archaeologists and paleoclimatologists interested in deducing the patterns of prehistoric societal response to climate change. Several episodes of Neolithization were related to the aftermath of the event. It was suspected in the delay of agricultural colonization of Balkans or in facilitating the maritime spread of Anatolian farmers along the shores of the Aegean Sea (Weninger et al., 2006; Weninger et al., 2009; Krauss, 2016).

In 2010-2012 two of the authors of this contribution (D.K. and S.I., jointly with O. Vinogradova) presented an overview of the data available at that moment on the issue of climate-driven change in North-Western Pontic region around the turn of the VII/VI[th] mill.BC. Our joint effort of that time treated the issue of radiocarbon dates calibration both for palaeoecological proxies and archaeological sites. This helped us to meet the issue of correlation of rapid climatic events, Black Sea level changes and revolutionary alterations of the local population subsistence patterns on the calendar chronological scale in the North-Western Pontic Area (Vinogradova, Kiosak, 2010; Ivanova et al., 2011). Both approaches and results can be revisited today, almost ten years later. The proxy for human habitation intensity (sum of radiocarbon dates for archaeological sites of the region), which we had applied then, seems too simplistic and inappropriate now (Contreras, Meadows, 2014). So, in this paper we re-examine our previous observation, applying a refined set of 14C dates and suggest some new directions of research, namely a site-oriented approach.

SUMMING THE 14C DATES

A sum of 14C dates for a given region in a given timeslot has been applied as an indicator of human activities on many occasions. This proxy is obviously not perfect (Contreras, Meadows, 2014; Carleton, Groucutt, 2019). Radiocarbon dating is often uneven and depends on funding

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and approved projects. In search of the origin of studied phenomena archaeologists tend to date the earliest events and the lowest strata. In such a way a bulk of 14C dates reflects rather modern reality than past behaviors. On the other hand, it has important advantages, when compared to traditional "chrono-typological" thinking. The latter equals the stages of relative chronology (pottery phases, lithic styles etc.) with chronozones of climatic change (usually Blytt-Sernander scheme) and then, tries to explain by climatic change (already induced in the model as a tentative dating of the relative chronology stages) a change in the pottery decoration styles or lithic technologies. A sum of 14C dates reflects the actual presence of activity at the site of interest without a need to refer to disputable attributions of sites to some larger classificatory units. So, while sum of radiocarbon dates is obviously not the best proxy, it can be used as the first approximation for the intensity of human settlement in the region.

In 2010 we summed the available radiocarbon dates of the Mesolithic and Neolithic of the North-Western Pontic Area. The probability distribution picked at 6400-6000 calBC in the very time when the climate deterioration had to occur. However, at the moment we used indiscriminantly every available date (Vinogradova, Kiosak, 2010). While, as early as 2007, Dmytro Haskevych demonstrated that there are two equally probable chronologies for VII-V mill.BC in the region under study. The "old" chronology was built on the conventional dates obtained mostly from charcoal till 1998. The "new" chronology applied numerically more solid base of 14C conventional analyses carried out in Kyiv radiocarbon facility between 1998 and 2008. They were consistent systems that correctly reflected the relative chronology (typological seriations, stratigraphies of the sites etc.). The difference between two data-sets was systematic and reached as much as four hundred years for some sites in question. Thus, D. Haskevych concluded that two chronologies cannot be used for the same analysis (Gaskevych, 2007). And that was exactly what we did in our text of 2011.

Since then, the Kyiv laboratory produced certain amount of conventional dates that are in a good correspondence with "old" chronology (Kotova, Tuboltsev, 2013; Tovkailo, 2014; Kotova, 2015). Some series of AMS dates were obtained for sites from the region under study (Kiosak, Salavert, 2018; Haskevych et al., 2019; Kiosak et al., 2020; Saile, 2020). Thus, the radiocarbon database became diversified. So, sums of the dates selected by different criteria can be calculated and cross-checked in order to validate the results.

First of all, the Kyiv dates should be compared to non-Kyiv dates (Fig. 2). In order to meet this issue we will study separately two sets of dates: Kyiv 1998-2009 (41 dates) and non-Kyiv – recent Kyiv determinations (20 dates). The results indicate that the 8200 calBP event had triggered different response according to different chronologies. While a large group of Kyiv dates fell into the range 6200-5900 calBC (a supposed duration of event locally), non-Kyiv radiocarbon dates seems to avoid this time span and their rapid increase in intensity starts immediately after this climatic event was over.

Since 2008 several new series of AMS dates have shed new light on the prehistory of the region under study. AMS dates usually have smaller standard deviations than conventional radiocarbon dates and, thus, they can be calibrated to a more precise time slots. When compared with both conventional data-sets, both Kyiv and non-Kyiv, it is east to see, that sum of AMS dates has a clear "gap" (significant lowering of probability distribution) at the expected time of 8200 calBP climatic event. The similar minimum on probability graph is absent while treating Kyiv dates and is less pronounced in case of non-Kyiv conventional dates.

So, it seems that the certain depopulation of the North-West Pontic region becomes better visible with growing precision of radiocarbon dating. However, in order to understand the character and the scale of this event we need a more refined methodological approach than simple comparisons of sums of radiocarbon dates. For example, we can take a look at the sequences of the sites that existed prior to and after the 8200 calBP event.

THE SITE-ORIENTED APPROACH

Several long sequences covered the 8200 calBP event in the North-Pontic region (Lillie et al., 2009; Biagi et al., 2014). Thus, their local chronologies are, to some extent, indicators of local climatic change and human response. A sequence of this type was studied recently on the Southern Buh river (Kiosak et al., 2020; Salavert et al., 2020).

Melnychna Krucha is a stratified site which yielded finds dating from the Mesolithic till the Iron Age. It is situated on the left northern bank of the Southern Buh River in the meadow plain. The site was discovered by S.I. Chub in 1930 and was excavated on several occasions from 1931 to 1949 (Gaskevych, Kiosak, 2011). The excavation covered 160 sq. meters and revealed a complex sequence with some scatters of finds. The scatters are somewhat overlapping but distinct enough both stratigraphically and in horizontal plane. Stratigraphic Unit (SU) 1 was found in the modern top-soil. It contained dispersed potsherds and bones of Late Bronze Age and Iron Age. It was not dated. The SU2 was detected in yellow loam under almost sterile layer. It consisted of a dense scatter of bones and debris of decortification of several concretions of yellow-wax flint layer of lithics. Despite absence of pottery in the excavation trench, this habitation should be correlated with local pottery-bearing groups acquainted with products of agriculture but with subsistence still mostly based on fishing, hunting and gathering (so called "Buh-Dniester culture"). The fossils directeurs are represented by T-shaped antler axes found in SU2 and well-known from Buh-Dniester contexts (Danilenko 1969, Fig. 55, 63, 73, 129-130). In excavations of 1949 V. Danilenko revealed nine "Buh-Dniester" potsherds in the similar sedimentological conditions. Two bone samples and two small chips of antler of T-shaped axes were selected in order to date SU2. The animal bones mostly belonged to wild species (Cervus elaphus and Sus scrofa) in the SU2.

SU3 was a layer of lithic artefacts and fragmented bones in the "suspended" state in greyish loam. It brought to light also an elevated percentage of turtle shell plates, avian bones, fish vertebra and bones of small mammals. The lithic inventory is very microlithic with some micro-cores, end-scrapers on flakes, backed bladelets and an isosceles trapeze. Two bones were taken from SU3 for 14C dating.

The lowermost layer (SU4) was detected in 3-4 meters further to the east in the green-grey coastal sandy conglomerate. It formed a "carpet-like" level with sparse finds of auroch bones and lithic implements. The chipped stone inventory included conical cores for fine bladelets and microblades, multiple burins on blade's spalls, blade fragment with ventral trimming and retouch (so called Kukrek inserts) and points with partial abrupt retouch forming a distal acute tip and a notch on the opposite end by a bulb. It finds close parallels in the sites of Kukrek technocomplex. Two bones were sampled from this unit.

Another scatter of finds of Melnychna Krucha (SU-R4) was studied some 150 m upstream from SU2. The former contained para-Neolithic pottery, chipped stone artefacts and animal bones. A single date was obtained on an animal bone from SU-R4.

Taking into account previously obtained radiocarbon dates (Kiosak, Salavert, 2018), there are 12 AMS dates for Melnychna Krucha (See Table 1). They are in reasonable agreement with the site's stratigraphy and expectations based on the typological analogies.

So, SU4 can be dated as early as 7500-7300 calBC indicating that the mesolithic population settled the Middle Southern Buh micro-region during the Early Holocene. The period 6400-6200 years BC was attested in SU3 of Melnychna Krucha. In VIth millennium BC, the pottery-bearing para-Neolithic groups settled Melnychna Krucha twice – 5900-5800 calBC (most probably) and after 5750 calBC. There was also a short episode of presence of comb-ornamented pottery bearers at the Melnychna Krucha (SU-R4) by the beginning of the Vth mill.BC. Thus, the sequence of Melnychna Krucha is a "long" sequence and it covers the 8200 calBP event.

Table 1. AMS dates for Melnychna Krucha

SU	Lab. Number	Date BP	SD	Period/Culture	CalBC (1 σ)	CalBC (2 σ)
SU4	BE-7636	8368	23	Kukrek	7509-7379	7520-7357
SU4	BE-7635	8311	24	Kukrek	7454-7345	7480-7315
SU4	BE-10309	8344	23	Kukrek	7483-7362	7497-7347
SU3	Poz-67496	7520	50	Late Mesolithic	6448-6361	6461-6252
SU3	Poz-67497	7380	40	Late Mesolithic	6356-6216	6380-6100
SU3	BE-7639	7436	23	Late Mesolithic	6367-6256	6381-6241
SU3	BE-10308	7404	23	Late Mesolithic	6352-6233	6365-6230
SU2	BE-7637	6980	24	para-Neolithic	5962-5815	5976-5787
SU2	BE-7641	6986	24	para-Neolithic	5966-5841	5977-5794
SU2	BE-7638	6985	22	para-Neolithic	5963-5841	5976-5798
SU2	BE-7640	6812	24	para-Neolithic	5722-5674	5736-5651
SU-R4	BE-10319	6008	21	para-Neolithic	4936-4849	4973-4836

The event itself is marked by a notable gap in the sum of the available 14C dates (Fig. 3). It can result from a lack of anthropic sediments of this age at the site. The latter could be caused by erosional events or by a lower intensity of human habitation in region in general, or by a shift in the subsitence patterns, when Southern Buh lowland lost its attractiveness to local inhabitants. Despite the option to choose, it is clear that 8200 calBP event found its reflection in the materials of Melnychna Krucha.

This observation can be reinforced by analysis of the soil sequence of Melnychna Krucha. Paleopedological analysis was carried out on the eastern wall of the square 6 of Melnychna Krucha. The wall contained the following sequence. There are three consecutive soils in the sequence (Fig. 4).

Upper soil (0.0-0.85 m (measurements taken from the surface above the profile)):

Hd – 0.0-0.05 m – light grey, loose, dusty-sandy light loam with some root traces.

Hk – 0.05-0.4 m – light till dark grey humus horizon with light brownish shade, loose, grainy crumbly, dusty sandy light loam. It is saturated with grass roots and burrowing animals holes filled with grey material.

Hpk – 0.4-0.7 m – pale yellow, light-grey horizon, which is more loose and lighter by colour than the horizon above. It is grainy powdery by structure, dusty-sandy loam with many burrowing animals holes.

Phk (Pk of upper soil) – 0.7-0.85м – it is visibly lighter by clour than the one above. It is light grey – pale yellow, loose, crumbly, sandy – dusty light loam with many burrowing animals holes. It is well visible as a lighter horizon in the sequence.

Middle soil (0.85-1.7 m):

Hk – 0.85-1.1 m – pale yellow grey. It is visibly darker than the one above. It is well-humusized, loose, grainy crumbly, with clear structure, dusty light lowm with many burrowing animals holes.

Hpk – 1.1-1.4 m – humus transitional horizon, pale yellow – grey, lighter by colour than the one above, loose, crumbly, grainy powdery, dusty light loam with many burrowing animals holes.

P(h)k – 1.4-1.6 m – greyish pale yellow, lighter by colour than the one above, with uneven colouring, loose with tongues of humus and spots of carbonates with many burrowing animals holes.

Pk – 1,6-1,7м – light pale yellow, sandy dusty, with a high content of sand light loam, crumby with pale and grey burrowing animals holes.

Lower soil (1.7-2.1 m):

Hpk (gl) – 1.7-1.9 m – humus horizon with interchanging layers of grey and brownish-grey stripes 5-7 cm wide. The higher layer is loose, sandy dusty, ligt loam, which contained shell fragments and small pebbles. The layers are divided by rusty-brown lines indicating a periodic hydromorphic regime.

Phkgl – 1.9-2.1 m – horizon is similar to the one above, but is lighter by colour and contains more sand.

Pk – 2.1-2.15 m pale yellow grey sandy loam, continues under the bottom of the excavation pit.

The SU2 remains are associated with middle soil (horizons Pk and P(h)k), SU3 with the lower soil (horizon Hpk (gl)), while SU4 was uncovered in the lower soil (Phkgl horizon).

The upper and middle soils were formed under subaerial conditions, while the lower soil developed in a very moist environment, which was probably periodically flooded. The margin between middle and lower soils is very clear and likely represents an erosion event. It corresponds also to an interruption of soil formation processes, when organic matter was largely reduced and instead yellow dust and sand formed the lowermost horizon of the middle soil.

New series of AMS dates for Melnychna Krucha places SU3 and SU2 at the fringe of 8200 calBP paleoclimatic event. This fact helps us to treat the "ceramization" of the region, taking into account another environmental context. The pre-pottery sites exclusively existed prior to the 8200 calBP event, while pottery-bearing population flourished in the valleys of the Southern Buh and Dniester after the event.

CONCLUSIONS

Thus, combining various lines of inquiry we can conclude that the 8200 calBP event resulted in the lower intensity of human habitation in the region, and also in certain erosional episodes. The lower soil of Melnychna Krucha was formed in a periodically watered environment, while the middle and upper soils developed under dry conditions. It indicates the change of water regime in the vicinity of the site at the 8200 calBP event. Notable changes in the beds of several rivers were described in some regions of Europe at the time of 8200 calBP. It is important to note that some large bogs started to function immediately after the event in the valleys of Southern Buh (Troitske, (Bezusko, 2010)) and Dnieper (Kardashynske, (Kremenetski, 1995)), probably indicating a major shift in the water level.

The gaps in the long sequences covering the 8200 calBP event were noted all over the Mediterranean: in Grotta dell'Edera and Grotta dell'Uzzo, Theopetra cave and Romagnano rockshelter etc. (Biagi, Spataro, 1999-2000). It seems that similar gap can be suspected also for Crimean caves like Shan-Koba (Biagi et al., 2014). Melnychna Krucha adds up to this long list. While we can discuss what exactly caused the gap: anthropogenic factors (rather absence of them) or erosional events, the existence of this gap is a firmly established fact. And human depopulation and erosion are not exclusive factors. When rivers became stormy and turbulent enough to remove certain amounts of sediments, their banks were likely less attractive for human groups as a suitable placement for a camp.

These observations made the Melnychna Krucha a reference site for research on riverine societies under influence of 8200 calBP event. There are some more sites with sequences covering the event in the North-Western Pontic region. In particular sites of Gard (Tovkailo, 2014), Dobrianka III (Zaliznyak et al., 2013), Hyrzheve (Stanko, 1967; Stanko, Kiosak, 2010) and Myrne (Stanko, 1982; Stanko, Svezhentsev, 1988; Stanko, Kiosak, 2010) require additional attention in this context.

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КЛІМАТИЧНА ПОДІЯ 8200 р. тому ТА СОЦІАЛЬНА ДИНАМІКА В РЕГІОНІ ПІВНІЧНО-ЗАХІДНОГО ПРИЧОРНОМОР'Я

Відкриття масштабу та обмеженого часу розгортання стрімких змін клімату голоцену змусило переосмислити підходи археологів до екологічної обумовленості життєдіяльності давніх суспільств. Очікування плавних кліматичних трендів з наступною повільною еволюційною суспільною відповіддю не виправдались. Кліматичні події розпочинались раптово і сягали максимуму лишень за кілька десятків років – життя кількох поколінь. Стрімкий характер кліматичних коливань потребував нового, більш точного підходу до кореляції кліматичних подій та соцієтальних параметрів, реконструйованих за археологічними джерелами. Ці методичні виклики потребують вирішення низки питань, кожне з яких не має остаточної та однозначної відповіді.

Стаття розглядає археологічні джерела з Північно-Західного Причорномор'я у пошуку слідів події 8200 років тому. Застосовуються два різних підходи: суми радіовуглецевих дат та орієнтований на окремі пам'ятки.

Окремо підраховано суми радіовуглецевих дат 1) для аналізів, проведених у Київській лабораторії 1998-2008-го рр., 2) для інших конвенційних дат, в тому числі одержаних у Києві до та після вищезазначеного проміжку, 3) для визначень отриманих методом прискореної мас-спектрометрії. Очевидно, що суми по-різному відображають стосунок інтенсивності заселення до події 8200 р. тому. Київські дати масово потрапляють у часовий проміжок похолодання, графік ж суми конвенційних дат має виразний мінімум під час події, а високоточні AMS дати уникають цього проміжку.

В рамках пам'ятко-орієнтованого підходу автори звертаються до матеріалів стоянки Мельнична Круча, яка містить послідовність шарів, яка охоплює 7500-1200 р. до н.е. Дванадцять AMS дат унаочнюють ймовірний розрив в заселенні пам'ятки біля 6250-6000 р. до н.е., очікуваної хронології для палеокліматичної події. Схоже, подія 8200 супроводжувалась потужними змінами у водному режимі великих річок Причорномор'я, таких як Південний Буг та Дніпро.

Ключові слова: різкі зміни клімату, радіовуглецеве датування, схеми існування, послідовність ґрунтів

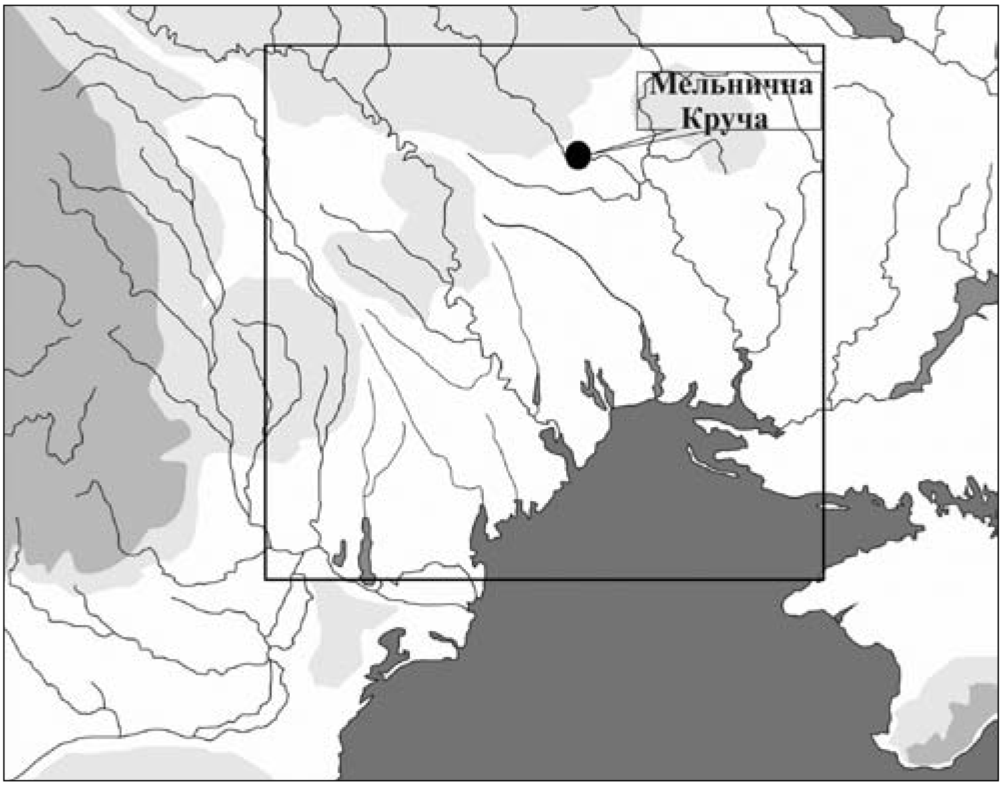
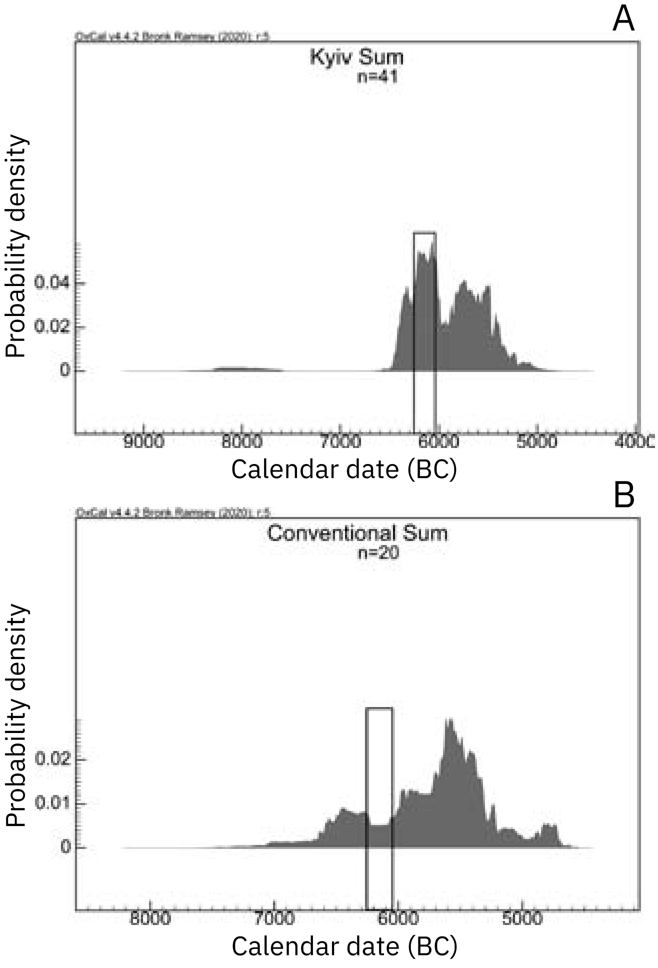


Fig. 1. Location of the region nder study (rectangle) and the Melnychna Krucha site (circle)



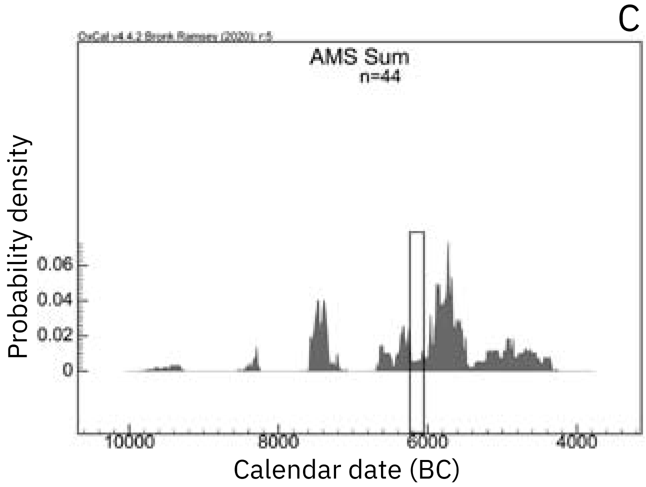
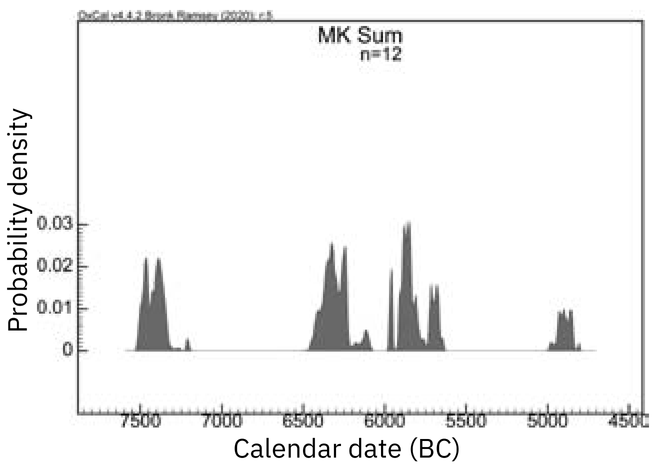


Fig. 2. Sums of radiocarbon dates. A: obtained in Kyiv lab in 1998-2008; B: other conventional dates including Kyiv dates prior to 1998 and postdating 2008; C: AMS dates made in the OxCal (Bronk Ramsey et al. 2013)

Fig. 3. Sum of AMS dates for the Melnychna Krucha site made in the OxCal (Bronk Ramsey et al. 2013) ▼



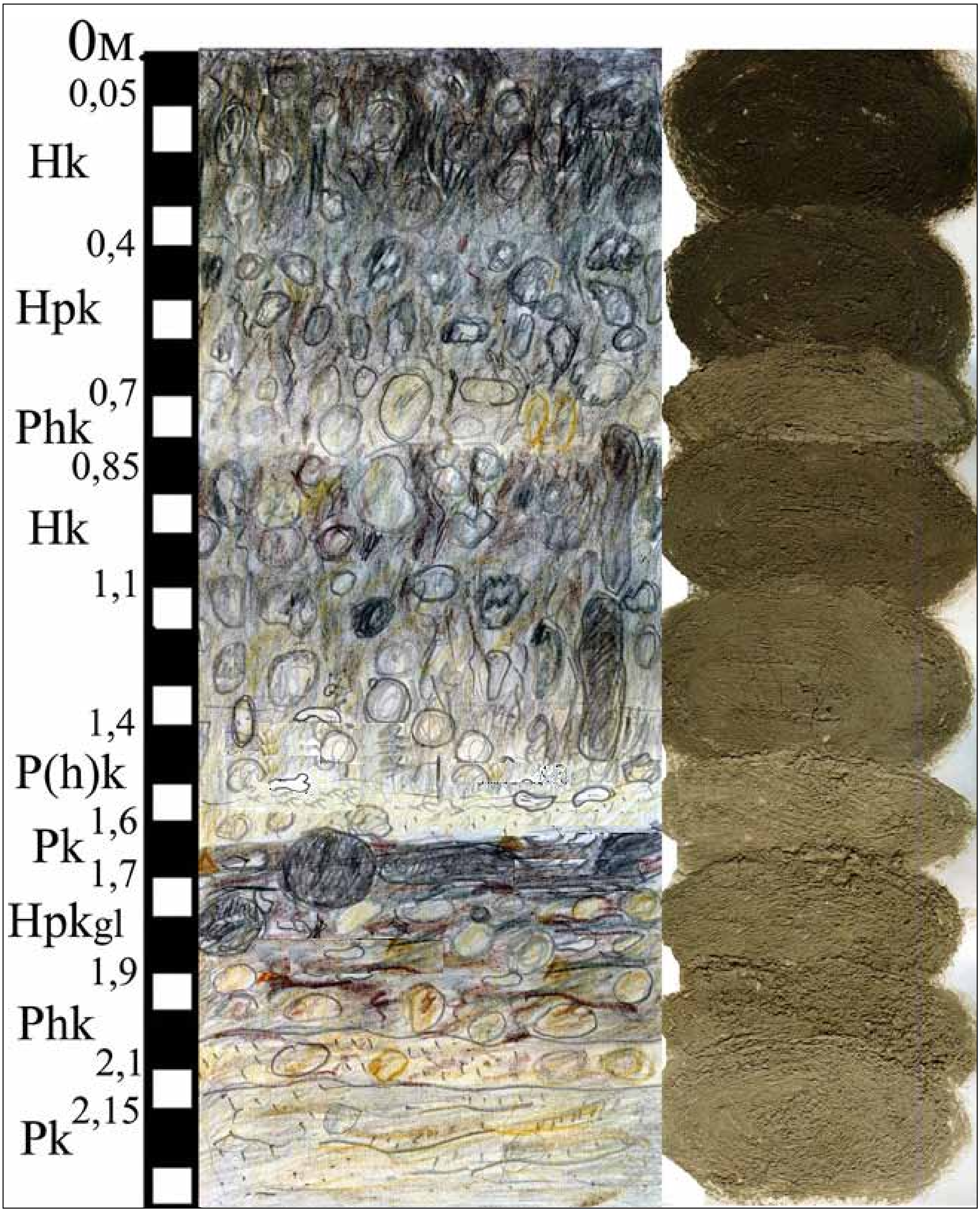


Fig. 4. The profile of the Melnychna Krucha trench 1, square 6 (drawing by Zh. Matviishyna)