DFG-Antrag
„Maidanetske: Die Rekonstruktion der Siedlungsprozesse einer Tripolje-Großsiedlung und ihrer Mikroregion“

Anlage 3a

Text und Abbildungen

Maidanetske 2013
New excavations at a Trypillia mega-site

Johannes Müller, Robert Hofmann, Wiebke Kirleis, Stefan Dreibrodt, René Ohlrau, Lennart Brandtstetter, Marta Dal Corso, Welmoed Out, Knut Rassmann, Natalia Burdo, Mykhailo Videiko

Studien zur Archäologie in Ostmitteleuropa, Habelt, Bonn, im Druck

Abstract

In 2013 the first excavation campaign took place in Maidanetske by a joint interdisciplinary Ukrainian/German team. Many aspects of the environment, economy and household organisation of Maidanetske and Trypillia mega-sites (Russian "Tripolye") in general can now be discussed based on a new range of data. There are new arguments for an anthropogenically-induced transformation of the original forest steppe into steppe vegetation during the existence of Maidanetske. Numerous radiometric dates and typochronological discussions demonstrate that it is most probable that the houses of the concentric rings existed contemporarily, resulting in population calculations of approximately 15,000 inhabitants. Important new information on subsistence economy was gathered, especially through the analyses of botanical macro-remains and phytoliths. The excavations also revealed the spatial organisation of one "normal" domestic house(hold) and its "house place", while two pits also indicate feasting and ritual activities, probably not within a single household, but a different 'political' supra-household level. In chronological terms the burning of houses around 3700 BCE is one 'story'; burnt remains in pits (dating to the 39th century BCE) is a different 'story', perhaps linked to the deliberate (also ritual) deposition of earlier house remains.

1 Introduction

For more than 20 years, the tremendous size of some Late Trypillia sites has been recognised not only in Eastern European archaeology but also by the whole European archaeological community (Fig. 1; cf. Chapman et al. 2014b; Kruts/Korvin-Piotrovskiy/Rizhov 2001; Menotti/Korvin-Piotrovskiy 2012; Rassmann et al. 2014; Videiko 2008). Starting in the 1960s with aerial photography and confirmed in the 1970s by geomagnetic surveys and test excavations, Russian and Ukrainian archaeologist were able to identify Chalcolithic sites of yet unknown size: at least nine "mega-sites" were discovered in the Uman region in the Buh Dnipro interfluve (Dudkin 1978; Shishkin 1973; 1985; Videiko 2002, 105). Since then, different chronological concepts have been developed to identify, based mainly on typochronological arguments, not only the intensely discussed Trypillia relative and absolute chronology, but also to verify internal chronological differentiations of the Trypillia B2/C1 phases, in which most of the mega-sites exist, into local sub-groups and sub-phases (Ryzhov 2012a; Ryzhov 1990).

Using newly developed methods of landscape archaeology, different research projects during the last 20 years have started to add information for domestic structures, as well as the internal organisation and environmental reconstruction of Trypillia mega-sites. In the Uman region in particular, the Taljanky project began in 2001 new sophisticated excavations at the 460 ha Trypillia C1 site, which still continue (Kruts 2012; Kruts et al. 2001). In 2009, the Nebelivka project also began with geophysical, archaeological and environmental analyses of the Trypillia B2/C2 site (Chapman et al. 2014a; Chapman et al. 2014b). Since 2007, high precision geomagnetic surveys at different sites offered new perspectives within Trypillia settlement archaeology for dealing strategically with these huge sites (Rassmann et al. 2014).

While settlements of different sizes existed during the entire historical time-span of Trypillia in the fifth and fourth millennia BCE (cf. e.g. Diachenko 2012; Diachenko/Menotti 2012), the new field activities once again confirmed the unexpected size of some sites. In total, 9 Trypillia mega-sites consist of areas larger than 150 hectares and more than 1,000 houses each. The largest sites are Nebelivka, Dobrovody, Taljanky and Maidanetske; each consisting of up to about 2,500 houses and up to approximately 150 hectares of settled space. They are a unique phenomenon and are not known from other European regions; neither from the Pontic steppe nor from other areas of prehistoric Europe (Fig. 2).

2 Research questions

From the European perspective, the term "mega-site" was used to identify huge sites in the Guadalupe region, as well as Vinča sites, as dense population agglomerations (Nocete 2014). While for the former it became clear that the sites were an agglomeration of non-contemporary structures, in the latter new geomagnetic surveys detected an agglomeration of smaller occupation clusters within a huge area that was previously labelled as belonging to one site (Rassmann et al. forthcoming).

Thus, the question of the contemporaneity of the detected houses is still most important for further analyses and interpretations of Trypillia mega-sites: Are we really dealing with up to ca. 1,500–2,500 contemporary house-units at one site? If this is the case, we are dealing with probably more than ca. 15,000 inhabitants per site, which makes them comparable on a demographic scale with early Mesopotamian cities. Furthermore, it is important to come up with an estimate of whether neighbouring mega-sites also existed contemporarily or if the often-proposed model of a population shift from one mega-site to the next is valid (cf. Diachenko/Menotti 2012). Both aspects, the demographic size of one site and the demographic picture within the region, are important for further aspects of economic, political and social organisation, and not lastly questions of environmental developments, in particular carrying capacity of the landscape.

With regards to the political and social organisation of a mega-site, both the level of household organisation and the level of the interacting activities are important. Are house features as standardised as ascertained by research? Does the biography of a house reflect a long or short duration? All these questions are related to the main "bigger" aspect of how it was possible to manage such population agglomerations within Chalcolithic communities.

Of main importance in this respect are the reconstruction of the environment and the economy of the sites. Did Trypillia mega-sites develop in an already open steppe landscape or did they develop in a forest steppe environment? What was the economic base of the communities and did they reach the carrying capacity of the area?

In consequence, the reconstruction of the duration of a mega-site, the chronological resolution for the houses, and the reconstruction of environment and subsistence are the main research topics that also have to be solved by new investigations at a local scale.

For this reason, we started new excavations at Maidanetske in 2013 with an interdisciplinary team (Müller et al. 2014). In this volume we would like to present the results of the first campaign. The site itself has a long research history. Initial excavations by G. Bzuvenglinsky (Videiko 2012, 107) took place in the 1920s, but both the documentation and the material from them are lost. After analyses of aerial photographs by K.V. Shishkin (Shishkin 1973), the first full geomagnetic plan was constructed by V.P. Dudkin from 1972–1974 (Dudkin 1978). Dudkin's plans confirmed the results already obtained via aerial photography. In field campaigns that started in 1971, several houses were excavated by Ukrainian teams (list 1) until 1998 (Shmaglij/Videiko 2003). In 2012 and 2013, the new geomagnetic survey was conducted and excavations began in 2013 with the publication of preliminary results in 2014 (Müller et al. 2014).

3 The Uman region and the location of Maidanetske: Environmental setting – climate, vegetation, hydrology and soils

Maidanetske (48°80'37'' N, 30°68'17'' E, 180–150 m a. s. l.) is located in central Ukraine at the border between the districts of Tscherkassy and Kirovohrad. The mega-site is situated west of the Taljanky River and west of the village Maidanetske on the Chernozem high plateau. The site itself is positioned between the confluence of a small watercourse and the Taljanky River, 170–190 m NHN (Fig. 3). The mega-site Taljanky, ca. 10 km downstream on the Taljanky River, and mega-site Dobrovody, ca. 20 km downstream, are placed in similar environmental locations (Fig. 2). The Taljanky River drains into the Gnylyj Tikych River to the east, which is in turn a tributary of the Southern Buh River flowing into the Black Sea.

The recent climate is a humid continental climate (the Dfb zone of the Köppen classification) with wet winters and warm summers. At the modern village of Maidanetske the mean annual temperature is 7.7 °C and the mean sum of annual precipitation is 575 mm (http://de.climate-data.org/ accessed on 10/04/2015). The recent landscape is dominated by arable fields and small villages, intersected by narrow river valleys. Huge fields are ploughed and sown by kolkhoz (former collective farms) like on most parts of the Maidanetske mega-site itself (Fig. 4), and small fields and gardens are arranged around the ribbon-built villages (reaching the northern fringe of the Maidanetske site). The landscape appears as a cultural steppe with sunflower and soybean as the main cultivars beside cereals. Lines of trees accompany tracks and streets between the fields but generally there is very little tree cover (cf. the tree line within the eastern part of the mega-site, Fig. 4). Satellite images of the region show some areas with woodland cover within a 15 km radius around Maidanetske. These are not natural woodland but planted forests. Nevertheless, they indicate the potential for tree growth in an area that is situated at the intersection of open steppe environment in the South and forest steppe and forest distribution in the North.

Nowadays, Maidanetske is located in a region with a semi-arid forest steppe climate with a dry (but not drought) period. In the region the natural vegetation would be a sub-continental forest and forest steppe environment with oak and oak-hornbeam-woodlands (Walter and Breckle 1986, 146ff.). The forest steppe ecotone forms the transitional zone between mesophilous deciduous broadleaved forest in the north and west, and true bunch grass steppe in the south and east. Krotowinas, infilled burrows dug by the European ground squirrel, have been attested to in soils below modern woodland vegetation through observations at Maidanetske in 2013, thus supporting the assumption that the border between woodland and steppe environment must have shifted in postglacial times (Walter and Breckle 1997, 384). The forest steppes are mosaic-like vegetation types characterised by forest-sustaining, forest-tolerant and forest-hostile patches. In its natural condition, the forest steppe of eastern Europe would consist of deciduous broadleaved forests dominated by common oak (Quercus robur), accompanied in the first and second canopy layer by maple (Acer),common ash (Fraxinus), hombeam (Carpinus), and in particular lime (Tilia cordata), which is a very frost and drought-resistant lime species, alternating with dryland scrub vegetation and meadow steppe or grassland. Patches of old-growth woodlands preferentially occur on drained soils, in elevated areas and on northern slopes, as well as in river valleys and on gorge slopes. Riverine woodlands still accompany the river valley floor, on the adjacent narrow alluvial deposits. While we would expect old growth forest cover across most parts of the Maidanetske mega-site location, the riverine woodlands grow along the Taljanky River near the mega-site.

The limiting factor for old-growth deciduous woodlands is the soil water balance in the summer months, because these woodlands have higher water consumption than grasslands and young trees. As a result, plain loess areas and southwards facing slopes are predominantly characterised by steppe meadow vegetation (Doni�a et al. 2003, 375ff.). Once established, the felted root system from the steppe grasses hinders tree growth. Although young tree shoots may develop, they are outcompeted in the long run due to insufficient water availability.

From the pedological point of view, the landscape that surrounds the mega-site of Maidanetske belongs to the eastern European plain of Quaternary loess deposits. The parent material for Holocene soil formation is calcareous loess. The soils present at the modern surface are classified as Chernozem. The area has the form of a plateau with a low gradient, being dissected by deeply incised river beds (Fig. 2). The mega-site Maidanetske is located at the fringe of this plateau, encircled to the west by a small brook valley and to the east slope to the larger Taljanky River. The difference in altitude from the site to the river equals ca. 30 m.

Regarding former research on buried soils and additional archives from the broader region, palaeoecological and palaeoclimatological reconstructions are summarised in Figure 5. Compared with other European regions, the information about Holocene environmental history for the Ukraine suffers from a low temporal and spatial resolution. There are very few sedimentary archives with continuous environmental records like lakes or mires. Due to the low spatial resolution, the existing information might show very general trends in the mega-region rather than giving an idea about what really happened locally at the Maidanetske site. Curve A in Figure 5 shows pedo-lithogenic cycles and the derived climatic conditions reconstructed by Sycheva (2006). The reconstruction is based on dated Holocene sediments (180 radiocarbon dates, 80 exposures) from the Russian part of the east European plain, east of Ukraine. In Sycheva's model, Holocene soil formation is solely influenced by climate and occurs when there is little or no excess of precipitation compared with evaporation/transpiration. Consequently, warmer and drier phases are characterised by soil formation (labelled S1 to S4), while erosion occurred during colder and wetter periods. Some weak points in this model need to be mentioned: From other regions it is clear that not only climate but also human activity affects Holocene geomorphologic processes (e. g. Dreibrodt et al., 2010, James, 2014). Sycheva (2006) assumes that climate variability triggers processes synchronously on largely different geomorphic scales (like slopes and alluvial deposits) but this is probably more complex. Further, her assumption that more precipitation causes more erosion disregards vegetation effects. A higher density of plant cover could rather reduce erosion during wetter periods. Graph B of Figure 5, representing the lake level changes of Lake Balkhash, eastern Kazakhstan, was taken and calibrated from Krementski (1997). It illustrates that the climate (relative humidity) of Central Asia was clearly connected to eastern European climate change, but it is of limited value for the study site since it is situated more than 1000 km to the East. Graph C of Figure 5 shows a palaeohumidity reconstruction based on the magnetic properties of a Holocene soil buried under burial mounds (Demkin et al. (2014). It illustrates a general problem of reconstructions that rely on the analysis of buried soils; since the number, age and spatial distribution of burial mounds are limited, the same is true for the soils buried below. It is impossible under such conditions to reconstruct the soil history of a region in a continuous manner. To fill such gaps it might be of interest to consider soils buried below slope deposits, since they occur ubiquitously in Holocene landscapes impacted by land use. Graph D provides a summary of southern Ukrainian pollen records of Gerasimenko (1997).

Keeping in mind the low resolution of the given palaeoclimate data sets, at least a look at the investigation interval is meaningful (grey column in Figure 5). In the records of Sycheva (2006) and Gerasimenko (1997), a certain change in environmental conditions appears during the Trypillia period. However, the character of change reconstructed by the authors differs: Sycheva (2006) suggests a change from drier to wetter conditions, while Gerasimenko (1997) found indications for the opposite. This discrepancy might be explained by the different regions studied by the authors; the sites studied by Sycheva (2006) are situated north-east of the one studied by Gerasimenko (1997). It should be mentioned that for the North Atlantic region a short dry spell has been reported at ca. 4000 cal BCE (Bond et al. 1997). The record of Lake Balqash (graph B in Figure 5) and the buried soil in the Volga region (graph C in Figure 5) do not show variability during Trypillia times.

4 Middle and Late Trypillia: typochronology and spatial development

Maidanetske is part of the huge Trypillia-Cucuteni supra-region that includes many different cultural regions; from the Carpathians and Transylvania in the west to the Dnepr regions in the east, and stretching from the Kyiv area in the north to the Black Sea in the south. Thus, Trypillia sites include present day forest steppe and steppe zones. Since the ground-breaking spatial and chronological analyses of Passek in the 1930s and 1940s (Passek 1949), the division into a western and an eastern Trypillia spatial and stylistic tradition has become clear (compare e.g. Ryzhov 2012a, 84). While on the one hand the general periodization and phasing of Trypillia is accepted by Moldavian and Ukrainian archaeologists in general, on the other hand regional and local patterns create typochronologies for regional and local groups that are heatedly discussed (Kadrow 2013; Kruts 2012, 73; Menotti 2012, 2f. Fig. 2; Ryzhov 2012a, 80ff.;Wechler 1994)

Table 1 compiles the relevant Trypillia periods, phases, and local group development with sub-phases and associated sites for the area of interest. In principle, *periods* identify general Trypillia developments that are seen across the whole distribution area, *phases* are the traditional division into general phases, *local groups* represent the typological groups, which differ from area to area, and *associated sites* are the key sites, which are related by Ukrainian research with the typological groups. Maidanetske, whose ceramic assemblages are in general associated with Trypillia C1, is part of the the Volodymyrivska-Tomashivska-Kosenivska local group, which is a kind of "typological container", typological belonging to western Trypillia. While the general chronological development of Trypillia periods and phases is supported by scientific dating, the typological division into subphases within the Volodymyrivska-Tomashivska-Kosenivska local group is under discussion (Diachenko 2012; Diachenko/Menotti 2012). The typological differences during B2 and C1, especially, might partly reflect non-chronological aspects of the Trypillia-settlements (cf. Rassamakin/Menotti 2011; Videiko 2003).

In principle, the typochronological model of Ryzhov 2012 (91 ff.) is still used to describe Trypillia development. Thus, the early B2 Volodymyrivska group is associated mainly with unpainted pottery, while the late B2 Nebelivska local group displays polychrome painted pottery that shows links to Cucuteni. Now about 40 sites exist in the clearly defined cultural region (Ros River basin in the north; Olyshanska river middle course; Ginloy Tashlyk river upper course, Turia rivers; south: Basins of Bolshaya Vys/Yatran river; west: Udich River). Besides the mega-sites Nebelivka and Glybochok (150–200 ha), settlements of only a few hectares are also known.

In the established typochronology, the succeeding C1 Tomashivska local group is divided into four phases, defined by different quantities in the distribution of ceramic shapes and ornamentation, for which the 'Tomashovka-type' painting with, for example, the display of animals in the "'ribbon' manner and the large number of 'tree of the world' drawings" is typical (Ryzhov 2012a, 101) (Phase 1: besides Nebelivka local group elements, the introduction of, for example, table crockery with comet-shaped and simplified line patterns. Phase 2: the sharp-ribbed nature of table crockery types and the standardisation of *Tangentenkreisband* are prominent. Phase 3: sharp-ribbed types and high shoulders are prominent. Phase 4: sharp profiles). The prominent mega-sites are associated with C1 phase 2 (Dobrovody), phase 3 (stage 1: Taljanky; stage 2: Maidanetske), while during C1 phase 4 and the C2 Kosenivska local group the size of sites generally decreases.

Thus, Vladimir Kruts (2012, 73) reconstructed the population of the Tomashivska local group as a sequence of resettlements by the same population group every 50 years (Sushkivka-Dobrovody-Taljanky-Maidanetske-Tomashivka). In his research summary he develops a model for mega-sites of 5–7 members per house in 600–2700 contemporary units (100–450 ha); thus 3,000–14,000 inhabitants

(Kruts 2012, 75). Smaller settlements, which also existed in the vicinity of big settlements, yielded about 200–500 people on ca. 7–15 hectares.

The model, which was developed by the Taljanky team, states that the agricultural zones of different mega-sites did not overlap (5 inhabitants/km² upper limit for agriculture), but that the forest decreased from 50% to 9% of the land during the existence of the mega-site (Kruts 2012, 76). Hence, in the opinion of Kruts, the opening of the landscape attracted stock-keepers from the steppe, which brought an end to most Trypillia sites with the exception of only a few small sites (Moshurov, Gordashevka, Rohi).

Fundamental for this model are calculations based on information regarding the subsistence economy. Kruts et al. (2001) calculated the number of domesticated animals per house for Trypillia mega-sites based on archaeozoological information. Thus, we are dealing in C1 mega-sites with about 1 head of cattle, 0.4 small livestock (sheep/goat), 0.8 pig and 0.2 horse per household and only a small contribution of hunted animals for the diet (Kruts et al. 2001, 85 Tab. 9). They also used available information on plant use; evidence from the – extremely rare – studies of charred plant remains show that the Trypillian crop growing was generally based upon the cultivation of the hulled wheats emmer and einkorn and free-threshing barley. While bitter vetch is already present in the Trypillia A period, broomcorn millet and pea relate to the later Trypillia phases. Crop growing was supplemented by the gathering of fruits in the nearby woodlands and possibly the cultivation of fruit trees in the vicinity of at least some of the settlements, like the Moldavian site Novì Rusešti (cf. Tab. 16 in the section 6.3.2 on archaeobotanical results).

The validity of both the typochronological models and the models on population values as well as environmental development has to be verified by answering the main research questions (see part 2). Different methods have to be developed to solve the questions at different spatial scales of the inquiry; here we are mainly engaged with analyses at the local scale: the mega-site Maidanetske.

5 Research strategy, survey and excavation 2013

5.1 Research strategy

From a technical point of view there are many difficulties in dealing archaeologically with mega-sites. On the one hand it is necessary to develop conclusions for the chronology, function and economy of all parts of the settlement; on the other hand it is impossible to excavate areas of 200 hectares or 3,000 houses with 6,000 pits. It was necessary to develop a strategy that included non-destructive survey methods, target excavations of identified hot spots of interest and very small test sondages to verify the date and function of features of similar categories. To determine probabilities about the contemporary or non-contemporary existence of houses or settlement quarters, such a strategy was most important; excavation of each house and dating the majority of house remains would be ideal, but this is impossible because of the sheer number of houses. For this reason we developed the following strategy:

1 The geomagnetic survey of the site resulted in a settlement plan, which revealed the principle distribution of most of the features (Fig. 4 and 6). The classification of the visible geomagnetic features, and a structural analysis of the spatial pattern of the site, enable identification of the main architectural categories for further analyses.

2 Target excavations of main archaeological features were conducted to enable the reconstruction of the primary contexts (e.g. the evaluation of a house or a pit), including their stratigraphy and dura-

tion, function and economy (Fig. 7). The excavations resulted in documentation of the archive with respect to depositional processes, architectural features, material culture, and archaeozoological and archaeobotanical remains. The reconstruction of social practices that were associated with the structures was possible through detailed scientific, typological and spatial analyses of the linkage between material objects, macro-remains and features.

3 Test sondages in similar archaeological categories were conducted to gather, for example, samples for dating. To give an example, test sondages which focus on geomagnetic features of houses from the concentric house rings, could help in dating the them (Fig. 7). Thus the combination of target excavations and test sondages was used as a strategy to deal with the huge mass of features within a manageable field strategy.

3 Scientific sampling strategies were conducted within the excavation units to increase information about economic and environmental processes. Archaeozoological assemblages as well as soil samples for botanical macro remains, pollen and phytolith analysis were taken. A ‘geological trench’ outside of the settled area helped to detect the relation between soil formation processes and settlement processes (Fig. 7).

4 Surveys in the vicinity of the site examined the potential of the palaeoecological and archaeological archives.

5 Lastly, all results are compared with data from other sites.

Research strategy in 2013 campaign (sub-headings light blue)

In principle, Maidanetske houses are organized in 9 concentric house rings around a central open space (cf. section 6.1 on the geomagnetic results). Additionally, houses that are not organised in concentric rings form quarters to the north and south of the central open space. Most of the houses are associated with one pit. Besides the houses, pits are the most numerous features of the site. “House places” are defined as the space for house-associated pits, the space in the vicinity of a house and the house-unit.

For technical reasons (access to the area, proximity to a water source for floatation) the excavation area was placed in the south-eastern part of the settlement (Fig. 7). Following the previously described research strategy, in 2013 our team excavated one house with the associated pit, and two further pits. Further test trenches focused on 8 other houses from further house rings. A ‘geo trench’ in a non-settled area identified soil processes. In consequence, all 9 concentric rings of the settlement were covered by the excavation in 2013. Table 2 describes the distribution of the 2013 trenches and the reasons for choosing the area. Altogether 365 m^3 were excavated during the campaign. The results could be associated later on with the results of former excavations that took place in the same settlement area during the 1990s (cf. Fig. 7).

The systematic location of the trenches tied to the geomagnetic features and the association between discovered features, artefacts and macro-remains aided in testing four of our hypotheses, which are related to depositional processes, house biographies, and settlement formation:

1 Until now, pits were never of central interest for Trypillia excavations, but they are the most common features of every site with a geomagnetic survey. By excavating pit 52 in close vicinity to house 44 and pit 50 in close vicinity to house 12 („И“, excavation 1983), the relationship of the pit-house dichotomy that is characteristic for “house places” could be analysed. In our hypothesis we charac-

terise the pit as a clay extraction pit for the building of the associated house in its first stage. During the second stage, the pit changed into a garbage disposal for the household. In consequence, the depositional processes of the pit might create an archive which reflects the whole biography of the "house place", while the typical *ploschchadka* burnt remains of the house might mainly reflect the last stage of the development of the "house place".

2 By excavating a further house in Maidanetske we could test different hypotheses on houses: on differently used space within the house, on double storage, on the normative character of Trypillia houses.

3 Excavating further pits enabled us to test the hypothesis that pits had been used for similar purposes.

3 Gaining radiometric dates and stratigraphic information from each concentric house-ring could test the hypothesis that most of the houses were used contemporarily.

4 Linking archaeobotanical remains with the information on stratigraphy and absolute dating could test hypotheses on changes in subsistence economy, and aid in the identification of different activity zones.

4 The archaeobotanical and the sedimentological samples could verify or falsify our hypothesis that the development of steppe vegetation started with the settlement.

5.2 Excavation method, technique and documentation

Large scale, high-resolution geomagnetic surveys, effectuated by the application of 16-channel magnetometers (SENSYS MAGNETO®-MX ARCH) were carried out in Maidanetske during autumn 2012 and spring 2013 (Rassmann et al. 2014). The excavation took place in summer 2013[1]. The excavation team comprised of the authors and 20–30 European students from Ukraine and Germany. The base station was in the old hospital of Maidanetske, where the first storing and handling of artefacts and samples took place and the digital documentation was produced.

Archaeology

The excavation followed the principle of digging along the boundaries of natural and anthropogenic contexts. To identify possible differences within features that are not visible through soil composition or colour differences in the field, the features were not excavated in one step, but by artificial spits. This excavation method ensures both the detection of natural borders *between* different contexts as well as of differences in height and other distribution patterns *within* contexts by artificial divisions. The excavation method has the advantage of providing detailed information on each feature, but also huge plans guarantee general overviews for the excavating team. In contrast to small-scale excavations, this method provides the possibility to handle large areas and artefact quantities in a proper and realistic manner. Furthermore, spatial and stratigraphic associations of artefacts and samples are precisely detailed: each is associated not only with a context, but also an artificial spit within the context and the general topographic information. Depending on the kind of artefact or sample this

1 The local topographical survey of the excavation area was conducted with a Differential-GPS from the company Leica, which was placed with a high accuracy of only a few meters into the world coordinate system (reference ellipsoid WGS84; UTM-coordinate system, zone 36 North).

is the x/y/z coordinate value (for large vessel parts, special decorated potsherds, flint tools, ground stone tools, loom weights, spindle whorls, figurines and macro remains) or the 1x1m quadrant in which a further division of contexts and spits took place during the excavation. In all trenches daub was weighed, counted and the values assigned to contexts, spits and quadrants. Within trenches 50 and 61 an additional classification of the daub material took place, related to material and surface[2].

In all trenches of the 2013 excavation natural sediments without obvious anthropogenic influence were reached. In many cases the identification of the base of a trench as a "natural" layer was difficult as bioturbation (krotovina) mixed materials. In such cases additional deeper profiles were used for clarification.

Geomorphological and pedological studies

The investigation of soils and buried soils is a method which is widely used in Eastern Europe for palaeoenvironmental reconstructions, supplementary to palynology and the analysis of botanical macro-remains (e. g. Demkin et al., 2004, Gerasimenko, 1997, Krementski, 1997, Sycheva, 2006, Mitusov et al., 2009). This is based on the observation that different formations of vegetation and types of land use lead to different soil types; in the case of Maidanetske, namely forest soils, steppe soils and as result of soil erosion, colluvial soils. The pedogenetic alteration of a given material starts at the surface. Thus soils on stable surfaces exposed to these processes over a long time can reflect a multitude of varying conditions (multi-genetic soils), most often strongly influenced by the youngest intensive soil formation phase. Pedo-archives suited for reconstruction of the local environmental history are usually situated at and beneath slopes or below artificial layers like burial mounds. Here, surfaces and thus soils of decreasing age can be found buried and preserved under the subsequently deposited slope sediments (Butler, 1959) or the archaeosediments (e. g. Demkin et al., 2008).

The soil horizons and sediment layers identified in trenches and coring were documented by the usual field methods, considering colour, density, texture, and constituents (e. g. Munsell 1992; Boden 2005). Since filled krotovinas deliver valuable information about palaeoecology and pedogenic processes (e. g. Dreibrodt et al., 2013, Pietsch, 2013, Pietsch et al., 2014) these structures were documented in detail in the profile and 12 of them were sampled for laboratory analysis[3].

The chronology of the soil sediment-sequence of trench 70 is based on optically stimulated luminescence measurements (laboratory of the Silesian University of Technology, Gliwice, Poland), radiocarbon dating of soil organic matter (laboratory of University Poznań, Poland), and the age estimation of embedded artefacts.

The weight of dried (16 h, 105 °C) volumetric samples (steel tubes, 100 cm²) was used to calculate the bulk density of the samples. Loss on Ignition (LOI) at 550/940 °C (2 h each), total carbon/nitrogen,

2 Type 1: Pieces with a flat surface on one side and imprints of split wood on the other site (perhaps likely belonging to the sub-construction of the ceiling; most pieces are hardly tempered with chaff); Type 2: pieces with smoothed surfaces (mainly screed from a burnt clay platform); Type 3: pieces with imprints (negatives) of log woods; Type 4: yellowish crumbling clay material (mainly belonging to clay constructions built on the house floor); Type 5: Pieces with a rough flat surface ; Type 6: foamed clay; Type 7: daub without surfaces or imprints.

3 The positions of the profiles and bore holes were recorded using a total station. All profiles were documented in digital photographs. The trenches 70 and 52 were additionally documented in scaled drawings.

total inorganic carbon, the grain size distribution (laser particle sizer), and magnetic susceptibility were determined for the < 2 mm fraction. The determination of total elemental contents, of all elements with elemental weights larger than Mg, was carried out on ground samples (< 60 µm) with a portable ed-xrf (NITON XT).

Archaeobotany

Systematic sampling for archaeobotanical investigations was applied on the excavation at Maidanetske in 2013. This resulted in 137 macro-remains samples, corresponding to 1,370 litres of sediment from three different archaeological contexts: the house context, the pit contexts and the area outside of the house. Flotation was carried out on the 10-liter-soil samples. Crucial was the use of meshes with a width of 300 µm; consequently, in addition to crop fruits, threshing remains as well as small weed seeds and fruits were part of the analysed subfossil assemblages. All of the c. 6,400 plant remains (seeds, fruits, threshing remains, awn fragments) were charred, with the exception of more than half of the Chenopodiaceae (3,484 out of 6,047 fruits), which are mineralised. Next to the botanical macro-remain analyses, preliminary charcoal identification was carried out exemplarily on those 14 soil samples that provided a reasonable number of charcoal fragments by Vincent Robin, (University of Lorraine, France). If possible, 20 fragments were analysed per sample to ensure that the fragments originated from different trees. In addition, 68 samples were collected on-site for phytolith analysis. A targeted test study on four samples aimed at detecting the state of preservation and the relevance of such microfossils in this site. This preliminary analysis focused on the anthropogenic contexts that were expected to yield phytoliths and give information about plant exploitation, i.e. an ash layer from the pit and two of the many daub fragments that show plant impressions. A phytolith sample from the modern topsoil has been analysed as a control sample. Samples were processed following Madella et al. (1998) and results are expressed as percentage values on a sum of at least 400 single phytoliths from known morphotypes. The percentage values of the silica skeletons are based on the sum of phytoliths from identifiable morphotypes plus silica skeletons (cf. Jenkins et al. 2011).

Others

Palynological samples were taken both on-site in excavated features as well as off-site in different sediments. Animal bones were documented taken in the same manner as the archaeological artefacts. Tiny snail shells from the floated soil samples were documented by Frank Schluetz, Wilhelmshaven.

6 Results

6.1 The mega-site plan: results of the geomagnetic survey

The dimension, spatial layout and different components of the settlement were already well visible in the plan of the geomagnetic survey. The overall size of the site (reconstructed by aerial photography) measures 200 hectares, of which 174 hectares are built space. In the new geomagnetic survey, 150 hectares were surveyed, of which 112 hectares exhibit built structures (Fig. 3; 4; 6). Erosion at the site is minimal and no harm has been incurred by recent village activities. Therefore, the discovered features are representative for the Trypillia occupation.

The geomagnetic features of the new survey could be divided into several categories (Fig. 6):

(1) 1,493 burnt rectangular houses arranged in at least 9 concentric to oval house rows and clusters of radial or concentrically oriented gable-front parallel house rows.

(2) 415 less burnt or even eroded houses are arranged in a manner similar to the burnt houses (Fig. 8).

(3) 9 special buildings, which are characterised by their extraordinary size, are positioned within the space of otherwise mainly empty house rings (Fig. 9).

(4) 1,537 pits that could be found (a) associated with houses and thus also forming concentric pit alignments in accordance with the width size of the houses (Rassmann et al. 2014, 116ff. Fig. 23–27; 29), (b) in the empty spaces probably demarcating houses that are not visible in the geomagnetic plan (Rassmann et al. 2014, 116ff. Fig. 26; 27), (c) seldom in scattered context outside or inside the settlement (Rassmann et al. 2014, 116ff. Fig. 23–24). Pits are of quite different sizes and represent different functions and depositional processes.

(5) Some round anomalies with high nT-values that might represent kilns (Rassmann et al. 2014, 119 Fig. 29).

(6) 3 possible ditches that surround parts of the settlement (Rassmann et al. 2014, 113ff. Fig. 21–22).

Taking into account both the geomagnetic features of the new survey and the features of the old geomagnetic survey and the former excavations, the overall patterning of the site is quite clear (Fig. 6). Centrally located is an oval space of 26 hectares with nearly no discovered features. Around this central space at least 9 rows of parallel houses with their gables radially oriented towards the centre are detected. They form empty rings in between the rows, usually 20–30 m in width. An exception is one main ring with a distance to up to 100 m between the neighbouring house rows. To the south and to the north of the site, the previously mentioned ditches are visible, partly overlapping with pits.

Besides the main design of Trypillia Maidanetske (an empty central space, concentric to oval house rows, the main ring, ditch systems), in the inner part of the site the settlement of the empty space obviously also started with the construction of house clusters that do not fit into the general ring-pattern. Here both radially as well as concentrically oriented houses are visible.

To the north, at least two lines of houses parallel to their longitude axis with associated pits are displayed on the plan. Their positioning differs from the orientation of the other concentric rows (Fig. 10). They obviously represent a different phase of the settlement.

Special buildings are positioned both radially oriented to the centre – mostly within the gateways of the settlement – or on a concentric axis, mainly within the main ring of the site. They are characterized by wall trenches (*Wandgräbchen*). The spatial position of the 4 western special buildings in the main ring might indicate a distance of at least about 250 m.

Amoeba-like structures to the south might be interpreted as geological structures, for example, as bog iron in certain depressions, and not as the remains of mounds (Fig. 4).

The combination of Dudkin's plan (Dudkin 1978) with the new plan permitted us to calibrate the old results with the new. It became clear that Dudkin identified more or less half of the geomagnetic structures that were identified in the same areas by the new survey, including only one quarter of the non-burnt houses. In consequence, we arrive at 2,300 burnt and about 670 unburnt house structures at Maidanteske (Tab. 3).

6.2 Houses and pits: results from the archaeological excavations

6.2.1 The house and the pit

For the excavation, one "house place" unit was chosen which could be identified in the plan of the geomagnetic survey; composed by a house and a pit which obviously belong together (Fig. 7 and 11).

House 44

In trench 51 the house 44 was excavated that was displayed as a long oval geomagnetic feature (15.3 x 5.6m) in the geomagnetic survey (Fig. 11–13). Unfortunately, on a weekend during the excavation campaign an illegal excavation by pottery looters took place, during which part of the already excavated and partly documented feature was destroyed[4]. Despite this, the description and interpretation of the stratigraphy, the domestic structures and the artefacts is sufficient.

The stratigraphy (Fig. 14–15)

The burnt daub of the house was covered by sediments of 0.5 m (above the house) or 0.8 m thickness (beside the house). The top layer is a black soil with a very high concentration of humus (feature 51001), followed by a more greyish-brown sediment with less humus (feature 51002). Below these layers that were more or less without artefacts follows the daub package from the burnt house (feature 51011), with about 0.2–0.3 m thickness. Especially in the south western part of the house a differentiation of the daub package into two layers was possible. The ca. 10 cm thick top layer with small pieces of daub (with nearly no organic intrusions) showed only a few wooden imprints (Fig. 11). Beneath this layer the surface of the floor surface with smoothed horizontal daub pieces became visible (feature 51009; Fig. 12; 16). The burnt floor layer consists of daub of a mineral tempered pavement of 3–5 cm thickness and a 3–6.5 cm thick ground floor with negative imprints of timber stakes at their bottom. Most of the further clay or other installations that will be described later were constructed on top of the ground floor and beneath the upper daub layer.

The ground floor itself lies on top of a loess soil with a conserved fA_1 horizon (feature 51006a). The upper edge of the loess soil beneath the floor level is characterised by different artefacts (pots, querns) that were placed there. In the areas outside the ground floor layer, the loess soil probably developed more as a result of domestic activities (feature 51007a). This greyish loess sediment was partly covered by the top daub layer. Beneath the conserved loess soil and the anthropogenically-influenced loess soil, the sediment of a fBw-horizon is visible that was hardly influenced by the bioturbation through which several potsherds were transported to the bottom (features 51006b and 51008).

Table 4 summarises the stratigraphy and indicates a plausible interpretation of the depositional processes. Accordingly, the burnt floor with the negative impressions of split boards (Spaltholzbohlenabdrücke) has been interpreted as a second floor above an open space with areas for storing. When the house burnt down, the material from top floor walls etc. was also spread over parts of the occupation layer situated beside the house.

The feature

The assemblage of daub that was fully excavated during the campaign implies a maximal size for the

4 About one third of the house area was rifled. Since the earth seemed to be systematically removed towards Northeast, nevertheless, we collected finds within this disturbed area in 2 x 2 m quadrats by sieving it in order to rescue at least some information.

house of 15.5 m x 5.0 m, but because of the disturbances in the northeast a clear identification of the border there is difficult. Mapping of the daub weights makes it plausible that the real size of the feature was originally 14.0 m x 5.0 m (Fig. 12–13; Plate 1–2). The house itself has a NE-SW orientation.

Since the daub layer displayed no perforation and irregularities at its edges, which usually occur if daub falls into postholes, no posts can be reconstructed for the walling (Fig. 13). The greater thickness of the daub (up to 40 cm) layer along the central axis of the house and the decreasing thickness towards the borders could imply that the daub which was situated at the top of the layer represent parts of the burnt roof or an inserted ceiling, which obviously also had clay as one component of the building material (Fig. 14–16).

The top floor ("second floor") of the house was the main floor. This floor was constructed from horizontal split timber boards (Spaltbohlen) that were oriented axial to the house and formed the bottom of the ceiling, visible in the negative imprints. On top of the timber boards a chuff-tempered clay screed was distributed (3–6.5 cm thick), with a further mineral-tempered clay screed (3–5 cm thick) placed upon that, which was then smoothed. The width of the timber imprints varied between 1 and 15 cm, with a mean of about 6.75 cm. Thus we would reconstruct a ceiling of about 15 cm thick horizontal timber boards that were overlaid by about 10 cm of clay-like floor.

Directly on top of this floor, different features were found or can be reconstructed. In the much destroyed eastern part of the house a "trough" was discovered (see below) that was not free-standing but associated on its SW side with a former wall – probably a partition wall that can also be reconstructed by the NW end of the podium (see below). Thus, the top floor was divided into an entrance room (5 x 5 m) and the main room (9 x 5 m).

Within the main room, four installations placed directly on top of the floor, were excavated:

(1) On the south-eastern longitudinal side of the main room, about 1.4 m before the outer limit of the daub, the remains of a clay construction with rounded edges and a smoothed surface was detected, built from yellowish, crumbly clay (6.3 m x 1.4 m x 0.2 m) (Fig. 13; 17; Plate 3). The bottom part showed negative imprints along the axial orientation of the house. The construction itself was originally built from both timber and clay. Usually in other contexts this type of installation is labelled a "podium" for displaying or storing items; the artefact distribution supports such an interpretation (see below).

(2) On the floor an oval area of 2.15 x 1.5 m was covered with thin, small broken daub flakes (1 cm thick) in several layers. The spatial position in quadrant I–J/15–16 (feature 51010), thus in the centre of the main part of the south-western main room, makes it likely that we are dealing here with a kind of installation which is labelled in other cases as the "altar" (Fig. 18).

(3) In the northern corner of the main room, near the reconstructed partition wall (quadrant H–I/11–12) massive daub pieces formed a square construction (1.3 x 1.3 m) (Fig. 13, see also Plate 4–5). The heavily burnt daub possibly indicates a "fireplace" as identified on other sites in this spatial setting.

(4) A further installation might also have existed near the partition wall in the quadrant L/11, where the negative impression of a former vertical wooden pillar was detected (Fig. 19, see also Plate 6). Perhaps we identify here a part of the entrance construction to the main room.

From the mostly destroyed entrance room, one further installation could be still reconstructed:

(1) A U-shaped, ca. 0.6 m wide and 0.9 m long construction existed at the north-eastern wall of the house, also linked to the partition wall. The installation consisted of a 10–15 m wide and at least 10 cm high small rounded wall that was built with heavily chuff-tempered clay, and which was constructed in different successive layers (Fig. 20).

While on the second floor at least three installations were reconstructed, no further installation was found on the bottom floor, which was obviously formed only by the poor loess surface. Different ceramics and querns were found here, partly beneath the remains of the second floor (quadrants: I/17; K/10–11, K/12 and I/7).

In conclusion, house 44 displays a construction and installations which are similar to Trypillia houses that have been known for a long time (cf. Chernovol 2008; 2012). In principle, house 44 is a kind of two-storey rectangular house with two rooms on the top floor and an activity zone in the surroundings of the house, forming the "house place" (Fig. 11–13). The artefact distribution within and around the house could aid in the identification of household patterns of household production and consumption.

The artefacts

Approximately 1,900 artefacts (Tab. 5) are associated with house 44. They are distributed in the layers of the ground floor, the first floor, and the surrounding activity zone of the house. In principle, our interest is focused on:

- spatial differences in the distribution of different artefact categories between and within the three spatial units, to identify functional differences within the house and between internal and external activities;

- a reconstruction of the quantities associated with the household activities within house 44, in order to develop estimates which could be used in connection with chronological considerations for the calculation of household "needs";

- a typological characterisation, mainly of the ceramics, to make the house inventory comparable with other inventories from Maidanetske and other Trypillia sites.

All these issues are related to taphonomic questions about the observed artefact distribution and depositional processes before, during, and after the use of the house. Since no signs of later activities within the house place were observed, the moment of "burning", and therefore the deliberate destruction of the house, is associated with the "closing" of the inventory. The artefacts, which are associated with the ground and first floor of the house, give the impression of being *in situ* and clearly associated with the last activities within the house, or at least the storing of tools on the ground floor. Hence, artefacts from the surrounding zone might also reflect "secondary" waste that is associated with earlier activities at the site, or mere waste contemporary with the house occupation. Since both radiometric dates and typochronological considerations point to a short duration (less than 100 years?), it might be best, for practical reasons, to handle all artefacts as one "house inventory".

In principle, the house inventory contains a huge amount of pottery (Plate 7); 1,735 potsherds, from which at least 50 pots can be reconstructed (list 2). In contrast, the almost complete lack of flint tools, whilst also known from other Trypillia C1/C2 sites, is still surprising (e.g. Kruts et al. 2001, 63f.). The quantity of millstones and other ground stone tools might parallel expectations related to the duration of the household (see below). The small number of bone tools and bones, as well as archaeozoological and archeobotanical macro remains is probably due to the preservation conditions (high temperature fire).

In general, the artefacts that were found in trench 51 were concentrated in the house, while their number in the surrounding area is quite small. Ceramics are distributed with up to 5 kg/m³ in the central part of the house but less than 0.5 kg/m³ in the open area (Fig. 21). Animals bones display the opposite distribution pattern, but this might be due to the differential influence of the house fire (Plate 8). Perhaps this pattern might alternatively reflect specific behaviour of keeping the internal house areas clean of consumption waste.

Besides such general observations, the observation that the distribution of artefact categories differs clearly not only within the top floor as well as within the ground floor, but also between both, is most important. Furthermore, clear differences in the artefact distribution are visible between the house area and the open space around.

The following spatial distribution patterns were observed, related to the top floor and the open space:

(1) Bowls are concentrated in L/9 and L/12 within the house (south-east corner of the entrance room and north-east area of the main room on the podium) and along the two longitudinal walls, mainly in front of the south-eastern wall, outside of the house (quadrants M/14–18 und F–G/8–16, Fig. 21; Plates 9 and 10).

(2) Beakers and goblets are also distributed at the outer edge of the south-eastern longitudinal wall, but also along the south-western latitudinal wall. A concentration is visible between the fireplace and the “altar” of the main room (quadrant I/13, Fig. 21; Plate 10).

(2) Tableware is concentrated in the main room between the “altar” and the fire place, as well as between the “altar” and the podium (quadrants I–J/14–15, Fig. 21; Plate 11). Otherwise only a thin scatter of tableware was observed.

(3) Storage vessels display a quite similar spatial distribution; with a concentration again between the fire place and the “altar”, but additionally including the direct area of the “altar” (quadrants I/13–15, (Fig. 21; Plate 12).

(4) Two ceramic balls are located in the entrance room (quadrants I–J/9–10 and M/8), two figurines possibly in the north-eastern and middle part of the podium of the main room (quadrants I–J/9–10 and M/11), and one spindle whorl outside the house in front of the south-eastern longitude wall (quadrant N11) (Fig. 21; Plate 13).

(5) Querns are distributed in the south-western corner of the entrance room, and in the main room between the fireplace and the “altar” (quadrants I/13 and K/10–11, Fig. 21; Plate 14).

(6) The few flint artefacts are distributed outside the house except for one burnt object from near the fireplace (quadrant I13, Fig. 21; Plate 15).

(7) The few remains of cereal grains, pulses and threshing remains are distributed all over the house (Fig. 21; Plate 14).

We could use these distribution patterns to reconstruct the spatial order of production and consumption in the upper floor and the surrounding of house 44, if we take possible taphonomic processes into consideration. Most of the artefacts were found *in situ* (e.g. the pots still standing on their bases, Fig. 18), with the distribution of cups and storage vessels at and outside the south-eastern wall of the house as especially obvious. We believe that they fell into this position during the collapse of the wall, and we would therefore associate them with the interior of the house; e.g. hanging on the inner wall or placed on the podium.

Regarding the reconstruction of activities, the spatial division within the main room in particular is possible in a model that takes the activities which we can associate with the artefact categories into account. Besides the location of vessels, figurines and other items for storage or representation in the area and probably on the podium along the south-eastern wall, the division of the remaining space into an area for many activities to the east of the "altar" and an area west of this without signs of activities is evident (Fig. 22). Thus, space for cereal processing, food consumption, but also for storage facilities, existed between the fireplace and the altar, while the south-western part of the main room was probably used for relaxing (including sleeping). Due to the recent robber disturbance, the reconstruction of activities in the entrance room is not possible. However, the production of flint tools and the deposition of some waste (animal bones) obviously took place outside of the house.

On the ground floor, the artefact distribution was totally different (Fig. 21; Plate 16). Storage vessels were concentrated in the quadrants L/8–9 (Fig. 21; Plate 17) as well as within two vessel concentrations in quadrants H–I/10–11 und G–H/17–18, together with bowls and a kitchen pot. Thus, their distribution was the inverse of that of bowls, kitchen ware and storage vessels on the top floor. Additionally, cups and goblets that were distributed mainly at the borders of the house on the top floor were also distributed on the ground floor beneath the inner part of the ceiling. Querns, which show at least some similarity in distribution pattern to those on the top floor, are nevertheless distributed in a special way: They were found alone or in pairs at in four locations – I/7, M/9, J–K/10–12 und I/17; at each of the last three locations, a base and a runner were deposited together (Fig. 23–24). Beside these obvious distribution patterns, the lower part of a figurine (in quadrant K/16, cf. Fig. 24) and some botanical macro remains should be mentioned, of which 20 peas (quadrant J/12) were found in the direct vicinity of a group of querns (Fig. 21; Plate 17).

Even if the evidence is still weak and the artificial modern disturbance in the north-eastern area of the house does not really allow clear conclusions, the interpretation of the base floor as an area for storage facilities – both for items in storage vessels as well as for tools like querns – might be the most plausible interpretation of the artefact distribution.

Ceramic typology

With respect to the 50 ceramic vessels and their 24 decoration patterns from house 44, there is quite a lot of pottery that fits very well in the general pattern of C1 pottery: e.g. kitchen ware from the house and its surroundings (Plate 19, 1), a metopic decorated pot, and a so called segmented-shaped biconical pot (Plate 19, 2–3) that are from the occupation layer of the house vicinity indicate typological similarities, which are usually identified with the C1 ceramic style of the Tomashivska regional group.

The ^{14}C-dates

Besides one ^{14}C-date from a disturbance on top of the daub layer (layer GEO 3/ARCH 4) that represents a *terminus ante quem* (ca. 750–450 cal BC), two ^{14}C-dates are relevant for dating the house. Poz-60162 (5015+-35 bp; *Sus*) belongs to the daub layer (ARCH 2), Poz-60161 (4965+-35 bp; *Sus*) to the occupation layer of ARCH 1 that indicates the usage of the house. The combination of the radiometric results (Tab. 6), and of the vertical stratigraphy between both layers (Fig. 14), makes a usage of the house in the 38^{th} century BCE plausible (Tab. 6), as also indicated by the sequential calibration of the two dates (cf. Fig. 56 in the section 7.1 about the chronology of the structures).

Pit 52

The feature

9 m southwest of house 44, a geomagnetic feature of 5m diameter with up to 10 nT indicated a pit-like structure (1.5 m deep; 4.6 m upper diameter). The pit was buried under a colluvium (0.8 m thick) and appeared during the excavation at 171.3m ASL (Fig.25–26) with a diameter of 4.6 m. The fill was a homogenous black-brown sediment without daub. A further sedimentological division was not possible. The base of the pit was reached 1.5m deeper (at 169.9 m ASL): its form was still roundish with a diameter of 1.2 m. At least 9 m^3 soil was extracted during the Chalcolithic; due to erosional processes we can reckon with 10 m^2.

The artefacts

In comparison to the other excavated pits and features, the artefact density of the pit was very low (Tab. 7). Furthermore, the few finds, including animal bones and daub, were concentrated at the base of the pit and near its borders. The two pots were reduced to small pieces; if at all identifiable, they belong to a biconical vessel and a bowl (Plate 20, 1).

The ^{14}C-dates

Four ^{14}C-dates come from the deeper part of the pit (list 3). Two of them represent *termini post quem* (possible old wood effect – 60190 and 60347 *Quercus*), the two others *termini ad quem* (Poz-60292 4920±40 bp (*Bos*) from spit 1e (3713–3651 cal BC), and Poz-60296 4955±35 bp from spit 1f (bone of a large mammal): 3775–3695 cal BC). Thus the depositional processes probably took place in the 38th century BCE (cf. Fig. 56 in the section 7.1 about the chronology of the structures). Accordingly, there is a high probability that pit 52 existed contemporarily with house 44. It possibly originated as an extraction pit for building purposes.

6.2.2 Further houses

For the purpose of gaining additional information, especially hints for dating and botanical analyses, sondages were conducted in houses from different house rings (Fig. 7). These sondages were placed across 8 different house rings, so that – together with the house and pit in trench 51/52 – all 9 house rings of the south-western part of Maidanetske would yield information. Unfortunately, only 5 of the 8 rings ended up with samples that could be used for radiometric dating. In spite of this, the spatial distribution of the dated houses allows for judgement about the probability of contemporaneity or non-contemporaneity across the site.

In all trenches the house stratigraphies were, in principle, similar to house 44. For example, in trench 71, on the southern border of the ca. 10 m long and 4 m wide geomagnetic house feature, a 1 x 2m sondage was opened. The house 45 belongs to house ring no. 3 (Fig. 7). Beneath black Chernozem layers, a more greyish layer was visible on top of the daub layer (Fig. 27). Beside the house a greyish layer also marked areas that were obviously associated with the use of the house. Beneath the daub layer of the house a further layer with loess, but including some daub, yielded some artefacts. In principle, the stratigraphy is quite similar to that of house 44. Ceramics from house 71 reflect kitchen ware, a bowl, biconical vessels and metopic decoration (Plate 20, 2–5).

A similar stratigraphy was observed in trench 72, where the sondage revealed the remains of the geomagnetic feature of house 46 (ca. 12 m x 5m). Pottery came from within and beneath the daub layer (Plate 21, 1–8). Goblets, common pots, kitchen ware, bowls and biconical vessels are present. Probable pear-shaped decoration as well as decoration with simplified lines could be identified The ^{14}C-date Poz-60298 (4290±40 bp, medium mammal, 2928–2879 cal BC) came from a layer on top of the house and represents a *terminus ante quem* (Tab. 8).

In trench 73, again a very similar stratigraphy informed us about the depositional processes of not only of one, but of two houses that are visible as the geomagnetic features 47 (15 m x 5m) and 48 (15 m x 5m). They are part of ring 4 (Fig. 7). The small trench included the only ca. 0.5 m free space in between the two houses 47 and 48 (Fig. 28). Context 73005a represents the greyish layer of domestic use in the space between the houses, while beneath it the darkish layer 73005b is interpreted as the result of a soil process, probably after the settlement was abandoned and a darkish humus agglomeration started to develop. The ceramic remains that do not show differences between the layers represent kitchen ware (Plate 22, 1.3.4), goblets (both as tableware as well as fine ware) (Plate 22, 2.5) and bowls. From the daub layer, one bowl has comet-shaped decoration (Ryzhov type 231) (Plate 23, 6), and a kitchen ware vessel has fingernail-imprints on the rim (Plate 22, 3). From the layer beneath the daub came a goblet with a metop-sceen painting (Plate 22, 2). In principle, the ceramic assemblage represents elements of the Trypillia C1 Tomashivska local group.

From the layer of domestic use between the houses two samples represent *termini ad quem* of house use (of both houses?), which dates to the 37th century BCE, probably to the first half of this century: Poz-60351 with a longer span (4710±35 bp (*Ovis*/*Capra*) 3672–3378 cal BC) and Poz-60199 with a shorter span (4895±35 bp (medium mammal) 3697–3649 cal BC) (Tab. 8).

In trench 74, a small sondage revealed the remains of a house 49 from house ring 5, but neither dating samples nor artefacts could be gained. In trench 75 (ring 6) the burnt remains of the house 50 (geomagnetic feature, 13 m x 4 m) and the associated layers on the eastern side of the house were excavated in the 1 x 2 m sondage (Fig. 29). A goblet beneath the daub layer indicates a similar artefact situation as in the other trenches (Plate 23, 1). A sample from the greyish layer on top of the daub beside the house represents a *terminus ante quem*. Nevertheless, the date from the second half of the 37th century/first half 36th century BCE (Poz-60352) is in line with other dates from the site (Tab. 8).

In trench 76 (ring 7) house 51 within a geomagnetic feature (12 m x 4 m) could also be identified by a small test pit; however, no samples for dating could be gained (Fig. 30). A ceramic vessel represents a lid (Ryzhov type 912; Plate 24, 1) with a painted decoration. In trench 77 (ring 8), parts of house 52 and the northern area beside house 52 were included in the sondage (Fig. 7). From the layer beneath the daub, a leaf-shaped decorated spherical vessel was discovered (Plate 24, 2). Within the stratigraphy, a sample of context 77003 from the daub layer represents a *terminus ad quem* for the use of the house, which obviously dates to the 38th century BCE (Tab. 8).

In trench 79, house 53 of inner ring 9, with strongly burnt walls, was identified in the test sondage (Fig. 7). Both layers directly on top of the feature, as well as the greyish layer that could be associated with the period of use of the house, yielded samples for radiometric dating. While samples Poz-60200 and Poz-60201 represent *termini ante quem* of the 37th century BCE, Poz-60195 represent a *terminus ad quem* (associated with the daub layer) of 3761–3661 cal BC. Linked with its stratigraphic position beneath the TAQ samples, a date in the second half of the 38th century is most probable for house 53 (Tab. 8).

In summary, the test excavations provided important further information. Both the stratigraphies as well as the geomagnetic and archaeological features that were surveyed and excavated lead to an interpretation of the houses similar to that described for house 44. Thus, a ground floor and a first floor with a surrounding activity area are probable for the eight houses that were additionally investigated. The ceramic assemblages obviously belong to Trypillia C1 of the regional Tomashivska group. For a more detailed typochronological matching, which must be based on quantitative differences in vessel type and decoration, the size of the assemblages is too small. ^{14}C-dates imply the existence of the houses at the end of the 38th century BCE.

6.2.3 Further pits

During the 2013 campaign, two further pits were excavated (Fig. 7): Pit 50, to gain information about a pit associated with a house from ring 4 which was already excavated in 1984, and pit 60, which possessed an unusually high nT-value and is probably associated with a house from ring 5. Both pits revealed quite different features and artefacts; the excavation of three pits in total clearly demonstrated the diversity of this kind of feature.

Pit 50

The pit belongs to house 12 (“И”), some metres to the southwest within ring 4, which was excavated in 1983 by a Soviet team under the leadership of Michail Videiko ((Shmaglij/Videiko 2005,62 –63) (Fig. 31).

Stratigraphy and Feature

Beneath the top layer of black soil (0.7 m) the rectangular pit (3.85 m x 3.4 m; 178.4 m ASL) with rounded corners became visible; it represents the archaeological remains of the oval geomagnetic feature with the strength of 20 nT > (Fig. 31–32). The pit was oriented transversely to house 12 and dug into the loess soil, which is disturbed with a lot of krotovinas. The loess soil was comprised of a buried humus horizon (fA_1) and the fBw horizon.

The pit itself was 0.8–1.2 m deep, changing into an oval form, and the bottom of the pit was reached at a height of 177.3–177.0 m ASL, slightly inclined, and 3.9 x 3.0 m in size. After the pit had been dug out, a huge fire burnt on the bottom of the pit, which made the soil partly reddish in colour (Fig. 33). The deepest fill (ARCH 1a) was grey-brown and followed by a similar fill with some additional daub mixed in (ARCH 1b) (Tab. 9). On top of this layer, two cattle skulls, many bones and different pots were deposited (Fig. 34–35), before the infilling of huge masses of daub started (ARCH 2a), which became less frequent in the top parts of this fill (ARCH 2b). The fill on top of the described artefact concentration was just debris, of which the daub pieces were sorted; with bigger pieces at the bottom and smaller ones on top. As the density of daub also decreases, a deliberate infilling is visible.

The artefacts

The Chernozem top soil above the pit was almost free of artefacts, while the pit layers yielded quite different artefact densities. Most of the artefacts came from the fills ARCH2b and ARCH 2a, while few came from top of ARCH1b. The ceramic density is up to 3.5 kg/m³ (Fig. 36). Daub, ceramics, cattle skulls and other bones belong to one layer. Beneath that, the artefact density decreased again immensely (ARCH 1). In consequence, the overall distribution of artefact categories (Tab. 10) is concentrated on the deposition of the two cattle skulls.

Despite the different fills, the ceramics from pit 50 generally makes a uniform stylistic impression. The first fill, second layer (ARCH 1b) yielded:

- Plate 24, 3: A bowl (Ryzhov Type 1-1-1) with a comet-shaped decoration on the inner surface that is comparable to a similar pot from Taljanky, house 34 (Kruts et al. 2008, 90 Fig. 3,3).

- Plate 24, 4 – Plate 25: Two biconical vessels (Ryzhov Type 3-1-1 and 3-1-2), one with a tangent-like decoration (Ryzhov Type 6-1?), which is already known from excavations in Maidanetske (Ryzhov 2012a, 102 Fig. 4.8) and the other with a complex band decoration of tangent type (Ryzhov Type 6-3-1), which is also known, e.g. from Chirchirkozoka (cf. Ryzhov 2012a, 102 Fig. 4.8, 21).

- Plate 26, 1: An amphora (Ryzhov Type 6-1-3) with a tangent decoration (Ryzhov Type 6-2-3).

- Plate 26, 2: An undecorated lid of Ryzhov Type 9-3-3-2).

The decoration is painted; monochrome black.

The second fill, first layer (ARCH 2a) comprised of:

- Plate 27, 1: A cup/goblet (Ryzhov Type 2-2-1-1) with a complex decoration of two horizontal lines beneath the middle, the tree-symbol on a mound-like elaboration on the shoulder, and leather and band motifs also on the shoulder. Very similar pots with nearly the same ornamentation are known, e.g. from Taljanky, house 47 (Kruts et al. 2013, 66–67 Fig. 41, 2 and 42, 4) and Dobrovody (Ryzhov 2012b, 156 Fig. 6.4, 70).

- Plate 27, 2: A cup/goblet (Ryzhov Type 2-1-1-2) with a simple band decoration on the shoulder (Ryzhov Type 1-1-paint-3) as is also known, for example from Taljanky, house 47 (Kruts et al. 2013, 64 Fig. 39, 6 and 65 Fig. 40, 8).

The decoration is painted; monochrome black on a reddish surface.

From the second fill, second layer (ARCH 2b) two pots were recovered:

- Plate 28: A biconical vessel (Ryzhov Type 3-1-2) with two bands of volute-like decorations (Ryzhov Type 10-4-1), which is comparable, for example, to a similar vessel and its ornamentation from Taljanky, house 47 (Kruts et al. 2013, 71 Fig. 47, 6);

- Plate 27, 3: An amphora (Ryzhov Type 6-3-1) with a crossing pattern and tangential lines that are comparable to a similar sherd from Taljanky, house 47 (Kruts et al. 2013, 69 Fig. 45).

Two other unique round-bottomed bowls, one of which has a handle (Plate 29, 1–2), are not decorated. They might belong to a different phase than the other fill.

All ceramics belong, from a typo-chronological point of view, to Trypillia C1, phases 3 and 4. As there is no typological difference between the assemblages of the different fills this might underline the infilling of the whole pit during a very short moment after the deposition of the first fill with the cattle skulls.

The ^{14}C-dates

The seven radiometric samples from the pit are distributed across the different fills (Tab. 11). Since in three cases the sample material is from long lived species (*Quercus* or *Fraxinus*) they should be handled as *termini post quem*. Of the remaining samples, Poz-60189 (5065±35 bp, bone, *Bos*, 3944–3801 cal BC) is relevant for the deepest infilling (ARCH 1a), Poz-60159 (5020±30 bp, bone, *Bos*, 3933–3766 cal BC) for a following infilling (ARCH 2b), Poz-60158 (5020±35 bp, bone, *Ovis*, 3936–3725 cal BC) for a middle fill, and Poz-60157 (4810±35 bp, *Bos*, 3645–3534 cal BC) for the youngest infilling of the pit. While the first three samples mentioned are clearly *termini ad quem*, the last also could be a *terminus ante quem* for latest infillings. In principle, there is a high probability that the first infilling took place in the 39th century BCE, the second in the 38th century BCE, and the third in the 37th century BCE.

Interpretation

The pit was probably a raw material extraction pit for construction purposes at house place 12 („И“). The first fill seems to be waste from an older phase of the settlement that is not represented in the burnt house plans. The cattle remains and the pottery might be remains of a festivity, which took place in connection to the destruction of one house and the building of another. The further infilling with mainly daub is again a representation of a razed house. The last activities at the neighbouring “house places” are dated to the 38th or 37th century BCE.

Pit 60

At the beginning of the excavation in 2013, an area with an extraordinarily high magnetic flux density of 50 nT was selected for excavation. The pit was filled with an immense mass of daub and belonged probably to ring 5 or 6 (Fig. 7; 37).

Stratigraphy and features

Beneath the 0.5 m thick Chernozem of the top soil (180.7 m ASL) a cluster of daub ca. 5 m in diameter became visible, which formed the top of an oval pit (Fig. 38). The 1.5 m deep pit changed in its lower part to a rectangular form (4 m [N–S] x 3.5 m [E–W]) with rounded edges (Fig. 39). The base of the pit, reached at a depth of 178.7 m ASL, was quite uneven (Fig. 40–42). The pit is the result of a series of three or four cuts and fills. These separate pits had rounded bottoms and smoothed walls, and were obviously refilled very sudden. The substrate of each of these sub-pits was, in general, very loose and ashy, but in every case enriched with unsorted daub pieces. The top layers showed a more humic character; the bottom layers a strong infiltration with daub.

The artefacts

Table 12 displays different categories of artefacts that could unfortunately only partly be associated with the three to four phases of the pit. From the middle phase came a decoration schema with simplified lines and an s-shaped volute on biconical pots (Plate 30, 1–2); furthermore, bowls and sphere-conical vessels are known besides kitchen pottery (Plate 30, 4–6). Kitchen pottery with round stamps (Plate 31, 1), a bowl with simple inner decoration (Plate 31, 2), a spherical bowl with marcations (Plate 31, 3) and a scalloped ornamentation (Ryzhov type 12,2,3) on a pear-shaped pot (Ryzhov type 8,3,1) (Plate 30, 3) are known from deeper layers. All typological elements belong to Trypillia C1 of the Tomaschovskha group.

The ^{14}C dates

The five radiometric dates are distributed over each phase of the pit (Tab. 13). While two dates represent *termini post quem* because of the longevity of their sample material (*Quercus*, *Fraxinus*), three could be termed as *termini ad quem*: Poz-60350 for the oldest phase, Poz-60349 for the middle phase and Poz-60348 for the youngest phase. If we take into consideration the life span of the samples, the oldest phase 1 dates into the 39th century BCE, the second phase in the turn of the 39th/38th century BCE, and the last phase into the 38th century BCE.

Interpretation

In principle, the pit is a depositional place for daub from destroyed houses. If this is the case, the oldest phase has to be associated with the probable oldest phase of the settlement. The occupation of the area under discussion (parts of ring 5 or 6) lasted until the 38th century, judging from the youngest ^{14}C-dates. This is also in line with the typochronology of the ceramics.

6.3 Environment and Economy: Results from the natural scientific investigations

6.3.1 Geotrench 70: Geomorphological and pedological studies

The preliminary ideas about the local Holocene soil history presented in the following are based on a catenary transect formed by a small exposure (geotrench 70) at a slope adjacent to the excavation (Fig. 7), supplementary auger drillings, and observations of soil profiles within archaeological excavations (trenches 50, 51, 52).

At the base of trench 70, a calcareous loess of younger Quaternary age was found (Fig. 43). Whereas the lowest 0.3 m of the loess are unaltered, the upper ca. 1.3 m of the loess were altered by a soil formation after deposition. A dark brown buried humus horizon is preserved at a thickness of ca. 0.2 m at ca. 1 m depth. With a thickness of ca. 1.1 m, a brownish yellow buried cambic horizon, with a slight tendency to argillic clay accumulation, is preserved below. This horizon was subdivided in three sub-horizons.

As a result of the deposition of colluvial layers, the aforementioned soil (a Cambisol) became buried and preserved. Three colluvial layers enriched in organic matter (M1 to M3) were deposited at the slope. The start of Holocene soil erosion at the investigated slope was paralleled or alternated with the onset of steppe soil formation. The obvious enrichment of a large amount of soil organic matter in crumb peds of the upper layers, numerous filled krotovinas that penetrate the lower soil horizons to a maximum depth of almost 2 m, and secondary carbonates in the upper 1 m all indicate the formation of a Chernozem since the burial of the Cambisol at the base. A total of 119 krotovina fills were counted in the walls of trench 70 (Fig. 43b). Most of them were found in the buried soil horizons; the number of preserved krotovina fills decreases towards the present surface. The majority of them exhibited brownish colours similar to the buried surface horizon (fAh) and the first colluvial layer (M1). None of the krotovina fills that penetrate the buried B horizons show indications for alteration by the brunification that led to the formation of the buried Cambisol as has been observed at other places (e. g. Dreibrodt et al., 2013). A large potsherd was found embedded at the base of M1.

In trench 52 (Fig. 44), a pit dug and filled during the inhabitation of the Trypillia settlement was studied. It was dug into the soil (Cambisol) described in trench 70. A humic A-horizon with a thickness of ca. 25 cm was present at the surface during Trypillia times. Later, the pit fill and surface were buried by A-horizons, probably due to bioturbation processes triggered by animals (as occurred for the remnants of the houses). These humic horizons formed a steppe soil preserved to a cumulative thickness of ca. 70 cm in the modern trench 52.

Chronology

The results of radiocarbon and OSL dating are given in Table 14. The three OSL-samples (positions indicated in Fig. 43) gave depositional ages for the loess i and ii of the Weichselian Pleni-Glacial (ca. 27 ka) and Late Weichselian (ca. 11 ka). The OSL dating of colluvial layer M1 resulted in an early Holocene age (ca. 7 ka).

The soil organic matter of the buried surface horizon (fAh) has a radiocarbon age similar to the Trypillia mega-settlement. The soil organic matter of the colluvial layers becomes younger with decreasing depth. The radiocarbon ages of M1 fit to the Bronze Age and those of M2 to the Iron Age. The dating of soil organic matter of the krotovina fills resulted in radiocarbon ages spanning from ca. 1,500 years older to ca. 1,000 years younger than Trypillia occupation. The base of layer M1 dates to the Bronze Age (ca. 2000–1400 BC) based on the typology of a large potsherd (Plate 31, 4).

Geophysical and geochemical data

The grain size distribution, bulk density, magnetic susceptibility, organic matter and carbonate content of samples from the east-profile of trench 70 are shown in Figure 45. The grain size distribution graph shows the dominance of silt (namely the coarse silt fraction) in the Holocene soils and sediments of the site inherited from the loess. The sand content is below 5 %. Clay varies from ca. 10 % in the lower (unaltered) part of the loess to ca. 15 % in the buried Bw-horizon. The bulk density values are low in the upper and lower part of the profile (1.2–1.3 g/cm²) and show a maximum of 1.4 g/cm² in the central part (fBw). Magnetic susceptibility values increase throughout the profile with minima in the unaltered loess, slightly increased values in the buried Bw horizon, and maxima towards the recent A-horizon. Calcite contents in trench 70 shows a strong decreasing trend with pronounced steps from the base to the surface. The calcite content of the unaltered loess exceeds 20 weight-percent. The buried soil horizons contain 15 % (fBw2), 10 % (fBw1) or 5 % (fAh) calcite. M1 and M2 contain further decreasing calcite contents (3–4 and 1–2 % respectively); the recent ploughing horizon is free of carbonates. The organic matter content in the loess and the buried B horizons is below 2 % (perhaps some organic matter originating from overlooked krotovina fills). It increases with increasing stratigraphy to values from 2.3 % (fAh) to 4.3 % in the recent ploughing horizon.

The total elemental composition is dominated by Si, Ca, Al, and Fe, reflecting the minerals of the parent material (Tab. 15). The correlation matrix reveals some elements clustering together and processes that explain this behaviour (Fig. 46). Alumina (abundant in clay minerals) and iron (primary minerals, as well as enriched in pedogenic oxides) occur together in a mineral group of elements (Ti, Mn, Zn, Rb, K and Si). Silica seems to belong to a second “organic” group as well as being indicated by the high and significant correlations with P, Zr, Y, Rb, Mn, Ti and organic carbon content. This indicates the presence of phytoliths in the sequence. Carbonates are strongly negatively correlated with the organophile and mineral elements. The role of magnesia is a bit similar to silica; obviously related to the two groups of carbonates (perhaps as high magnesia calcite or dolomite) and of the clay-related elements (adsorbed iron on the surface or within the structures of vermiculite or chlorite). Considering the palaeoclimatic indicators used for the steppe soils of Russia, there is only indication for the occurrence of gypsum (used as indicator for palaeohumidity, e. g. Borisov et al., 2005) in the lower part of the sequence. Considering the complete profile, sulphur is very weakly related to Ca as well as organic matter content; but a separate look at the upper and lower parts of the sequence reveals correlations with organic matter content in the upper, and Ca (probably as gypsum) in the lower part (Fig. 47). However, the total values of sulphur are much lower than reported from the Russian steppe region (e. g. Borisov et al., 2005) and therefore not relevant as a climate indicator.

The results of the elemental composition are reflected nicely in the sediment layers and soil horizons identified in the field. Plotting a PCA graph (correlation, 1st Component: 64.5%, 2nd Component: 16.6%, 3rd Component: 5.6%) shows that the specific properties of the unaltered loess, the buried Bw horizon, and the horizons and layers (colluvial sediments) enriched in soil organic matter cluster clearly in separate groups (Fig. 48a). A separate analysis of the upper part of the sequence results in 4 clusters representing the layers and horizons identified in the field as well (PCA, correlation, 1st component: 46.1%, 2nd component: 17.4%, 3rd component: 11.1%, Fig. 48b).

6.3.2 Archaeobotanical results: Macro-remains and phytoliths

Altogether, about 6,400 charred and mineralised plant macro remains were found (Tab. 15). Average find concentrations of botanical macro-remains consist of five finds per litre of soil. Central European Neolithic excavations have yielded even lower find concentrations (Kirleis et al. 2012; Bogaard and Jones 2007). The preservation conditions of the charred remains are at a medium stage, thus most of the identified cereal caryopses fragments belong to the Cerealia indet. group.

a) Charred plant remains related to crop growing and food processing (Plate 18)

Altogether, six crop species were found at the Maidanetske site. There is evidence for four potential cereals, listed here in order of frequency according to the charred grain finds: Emmer, einkorn, barley and broomcorn millet. The finds of threshing remains follow the same species ordering in sheer numbers; however, as find numbers in both categories are low, this does not necessarily relate to the relevance of the species as food plants. Glume bases are the threshing remains retrieved from hulled wheat species emmer and einkorn. In contrast, only rachis fragments were identified from barley. However, no threshing remains from millets were present. It is not clear whether millets already belonged to the spectrum of cultivated plants in this period, whether the two ideally preserved finds have to be interpreted as indicators for disturbance from younger material, or if they have to be interpreted as fruits from a cereal accompanying weed species. For Moldavian sites of the late stage of Trypillia (mid to late 3rd mill. BC), broomcorn millet is considered as domestic plant based on an increasing number of clay imprints of this species (Kuzminova 1989).

Next to the cereals, pea and lentil present two pulses species that supplemented the crop spectrum at Maidanetske. The pulses originate from the house context. For the spatial distribution of the plant remains see Plate 14 and 17.

In general, the Maidanetske finds are in accordance with the expected crop spectrum for the Trypillian culture (Kirleis and Dal Corso 2015; Kruts et al. 2001; Kruts et al. 2008; Pashkevych and Videiko 2006; Pashkevych 2014), although there is no hint of bitter vetch (Tab. 16–17). Further analyses will have to prove whether the bitter vetch from Trypillia A was replaced by other pulses (pea and lentil) in the later Trypillian periods.

Next to the domestic plants, five weed species were identified, which indicate nutrient rich soils and cereal harvest at ear-level: Cleavers (*Galium aparine*), caryopses of brome (*Bromus secalinus*-type), common knotweed (*Polygonum aviculare*), black nightshade (*Solanum nigrum*) and most numerous, fat hen (*Chenopodium album*). Furthermore, there is evidence for the two Panicoideae species green foxtail (*Setaria viridis*) and cockspur (*Echinochloa crus-galli*).

The only gathered plants in the archaeological plant assemblage from Maidanetske are hazel and possibly black henbane (*Hyoscyamus niger*).

b) Plant remains and snails from the natural environment

The main component of the charcoal assemblages is ash (*Fraxinus*), followed by oak (*Quercus*) and elm (*Ulmus*) (Fig. 49). They all belong to the deciduous broadleaved oak-dominated forest species, which are typical for the regional natural forest steppe (Fig. 50). Ash charcoal was also identified on the neighbouring site of Taljanky by colleagues from Basel, Switzerland (Kruts et al. 2008). Willow (*Salix*) supplements the wood spectrum at Maidanetske; it is indicative for riverine woodland that most probably grew alongside the Taljanky River in the vicinity of the site.

Charred, curled-up awn fragments, most probably from feather grass (*Stipa*) occur regularly in the samples (Fig. 51). Most of these fragments (>100 in total) were found in trenches 51 and 60, and in the uppermost layers of the excavation (Tab. 18, example from trench 60). They concentrate in the upper excavation layers; in particular, in those covering the cultural layers. The fragments are tiny and thus may have easily been dislocated into deeper layers, but this is hardly seems to be the case. The finds in the upper occupation levels and above may hint to an extension of steppe meadows in the phase shortly before and after abandonment of the mega-site, which at this stage of investigation may carefully be interpreted as a possible sign of overexploitation of the semiarid forest to forest steppe environment (Kirleis and Dreibrodt 2015). Feather grass awn fragments are light in weight and easily transported by the wind. Thus, the awn fragments may well have been transported over long distances and give a regional signal for the expansion of grasslands. The first central European feather grass finds stem from the Czech Republic and date to the Early Bronze Age (Bieniek and Pokorny 2005).

Preliminary analyses of snail shells from the macrobotanical soil samples of feature 60 show that shells of Clausiliidae and Acicula/Platyla occur in the lower excavation layers but fail in the uppermost layers. These snail shells are indicative for shady conditions or even the presence of woodland (pers. comm. Dr. Frank Schluetz, Wilhelmshaven).

First results and discussion of the phytolith samples

In the phytolith samples analysed for this preliminary study (Fig. 52), the microfossils present a good state of preservation that allowed counting from a minimum of over 400 to a maximum of over 900 phytoliths from identifiable morphotypes per sample. The sample from one daub layer (sample 51317) is the richest, followed by that from the ash layer (sample 60084) deposited in the pit (feature 60).

As it is usually the case, dicotyledons are highly under-represented (Fig. 52), while phytoliths from monocotyledons dominate the assemblages. Within the monocotyledons, several types of grass short cell phytoliths (GSCP) have been identified which are diagnostic of different Poaceae subfamilies. The Pooideae, represented by rondel and trapeziform GSCP (Fig. 53a and b), are widely attested in all samples. This suggests that C3 grasses were common components of the plants used on-site and possibly of the local vegetation. Accordingly, cereals of the Neolithic “package” can be expected, and indeed dendritic long cells typical of wheat and barley chaff have been attested (also confirmed by the macrobotanical evidence). In addition, bilobate (Fig. 53c) and polylobate GSCP, which are indicative for C4 Panicoideae grasses, are present in the archaeological samples in very small quantities. They are slightly more abundant in the topsoil. This presence of Panicoideae corresponds with the macrobotanical record that contains both wild and domestic millets (Tab. 16–17), although phytoliths typical of millet inflorescences (Lu et al. 2009) have not been determined so far. Finally, the ash layer in the pit contained saddles, which are grass short cells that are usually related to the Chloridoideae subfamily.

While the phytoliths presented above merely provide taxonomic information, other grass phytoliths also provide information about the presence of various plant parts, because they reflect the shape of cells with a recognisable anatomical origin. Such phytoliths have been found both as single cells and as conjoined aggregates of cells forming so-called silica skeletons (Fig. 54). The silica skeletons from Maidanetske can be safely related to plant use by people, because they are concentrated in the archaeological contexts and absent in the topsoil (Fig. 54). Dendritic long cells (Fig. 53d) are usually attributed to the inflorescences of domesticated C3 grass, i.e. to chaff of *Hordeum* sp. or *Triticum* sp. (cf. Albert et al. 2008; Ball et al. 2009). Echinate long cells are also usually attributed to grass inflorescences (or leaves); not of domesticated grasses but of wild grasses instead (possibly weeds). Indeed, while dendritic long cells are concentrated in those samples from the daub and ash layer contexts, where they are also present in silica skeletons (Fig. 54), echinate long cells are present in all samples (Fig. 52). The presence of cereal chaff in the daub indicates the intentional use of crop-processing remains as temper, as is supported by the observation of plant impressions in many more daub fragments. The presence of dendritic and echinate long cells from grass inflorescences in the pit might derive from the waste after on-site crop processing activities (de-husking?). Apart from silica skeletons providing information about the use of grass inflorescences, there is also evidence of silica skeletons characterised by psilate long cells, pointing to the presence of culms/leaves (Fig. 54). Such cells are also ubiquitously found in the assemblage of single phytolith cells (Fig. 52). These skeletons most probably represent grass culms, because typical phytoliths from grass leaves such as bulliform cells (Fig. 52) are very rare and stomata are completely absent.

6.3.3 Pollen studies

As natural archives suitable for pollen studies, like lake sediments or peatbogs, do not exist in the area nearby Maidanetske, the potential for landscape reconstruction by means of pollen analysis is very limited. A well-dated record from investigations at Dovzhok swamp some 180 km to the West of Maidanetske was published by Kemenetski (1995). In his record, the late Atlantic landscape is dominated by a mixed oak forest with oak, lime, elm, and hazel. Unfortunately, the time between 4500 and 2900 BCE shows a very slow peat growth and thus a relatively poor resolution. Nevertheless, this time is characterised by a regression of the deciduous trees and an increase in pine and non-arboreal pollen, indicating some severe changes in woodland composition. Steppe-indicating plants like Poaceae and Chenopodiaceae do not increase before medieval times at this western spot. This is in contrast to a diagram from Kardashinski swamp, some 300 km to the South-south-west of Maidanetske (Kemenetski 1995). Here, deciduous trees have much lower values in the late Atlantic and early Subboreal and pine dominates the arboreal spectrum, while high values of Artemisia and non-arboreal pollen indicate an open landscape with steppe components. Without local studies, where Maidanetske would be between these extremes at the time between 4500 and 2900 cal. BC cannot be distinguished.

Pollen records from pits and archaeological features, taken during the 2013 excavation, reveal generally bad pollen preservation. From 16 samples, six yielded insufficient pollen for analysis. The others showed selective pollen preservation. Accordingly, the interpretation has to be treated with care. Pine was the most common tree taxon in all of the samples (Fig. 55). Oak, lime and hazel occurred with just single grains in some of the samples. Thus, there is an indication for the existence of trees in the surrounding of the settlement. High values of Liguliflorae (Cichorioideae) show a strong selective decomposition of pollen in the soil. A single sample shows high values of Chenopodiaceae but again this can be interpreted as pollen selection. Cereal pollen is recorded in just a single sample (S52 – 200 cm) while a sample from the surface of a grinding stone (S51 – no. 11) did not yield any cereal pollen. Thus, the local pollen record can prove the presence of some tree stands in the vicinity of the settlement, but no statement is possible regarding the density of tree coverage or the openness of the landscape. Imprints of leaves in the clay of settlement structures, as well as macro- and micro-charcoal, prove the use of timber for house construction and thus make a local occurrence probable.

7. Interpretation and discussion

7.1 Dating settlement structures

The series of 35 radiocarbon dates from Maidanetske (Fig. 56) and the critical evaluation of their context provide information about the chronological relevance of different features. For the first time, it was possible to gain dates from all different rings of a Trypillia settlement and from pits. The results are twofold:

1 The radiocarbon dates display statistically identical dates for all houses which were dated. They support the model of contemporary existence around 3800/3600 BCE (Tab. 19; Fig. 56). Furthermore, all other dated structures finalise in a similar timespan. In consequence, burnt material from the houses and the upper fill of the pits represent the latest settlement event: The time at which (most of) the site burnt down. The close vicinity and the complete burning of whole houses, resulting in nearly rectangular remains of daub, was obviously a deliberate act. As such, the 2,297 burnt houses date to the aforementioned timespan. Perhaps we also could add 671 partly eroded or unburnt houses, but perhaps they belonged to a different stage in the development of the settlement.

2 In contrast to most of the houses, whose remains represent the latest stage of the development, pits contain different stages of infillings that represent longer histories of the place. Evidence from pits 50 and 60 confirms that the earliest activities already took place around 3900 cal BC at the latest. As pits are associated with single houses, this seems to confirm a dismantling of house structures from time to time, so that primarily the latest structure remained in the neighbourhood of the pits. As pit 60 contains sophisticated waste management, with burnt daub sorted and deposited according to its size in different fills of one pit, obviously most of the damaged material was taken away. This hypothesis could explain the small amount of daub.

In consequence, most of the settlement existed contemporarily around 3700 cal BC. Both pits as well as houses were in use.

The typochronological estimation of the excavated assemblages places Maidanetske at a final stage of the C2, phase 3 of the Tomashivska group (Tab.1).

7.2 Dating pedological developments

The deposition of the loess was dated to the Weichselian Pleni Glacial (ca. 27 ka) and Weichselian Late Glacial (ca. 11 ka) via OSL. This is very similar to reported ages from central Europe (e. g. Hilgers et al. 2001) and therefore probably reliable.

Field observations and laboratory data at Maidanetske testify to a pedogenic alteration of the upper 1.3 m of the loess after its deposition. This is indicated by a change in colour, density, magnetic susceptibility, grain size distribution, and elemental contents. A Cambisol with slightly increased clay and pedogenic iron content has formed. Since Cambisols are typical Holocene forest soils, their presence indicates a phase of woodland development at the site. The buried Bw horizon was found to be present at the whole excavated area (at the slope as well as on the plateau). Thus, the pits of the Trypillia settlement were dug into the soil horizon and testify to the pre-Trypillia age of the soil formation. Although information on the canopy density and the tree composition of this woodland is sparse, it can be concluded from the pedological and geomorphological data that the landscape of Maidanetske was probably completely forested during the early Holocene.

A co-evolution of a steppe soil with the Maidanetske settlement is indicated by the radiocarbon ages of the soil organic matter of the respective layer (fAh) and krotovina fills (k1, k2, k3). The surface A-horizon of the soil grew in thickness, and intensive bioturbation by dwelling animals (probably ground squirrels) began. The apparent age of the soil organic matter filling the deepest dated krotovina fill (k1) is about 1,500 years older than the houses of the settlement and the buried remnant of the surface horizon. This shift to apparently older ages makes sense, since the radiocarbon age of the organic matter of buried soils reflects the stage of equilibrium of input of young organic matter and decomposition reached at the time of burial, called the "apparent mean residence time" of organic matter (e. g. Campbell et al., 1967, Paul et al., 1964). Similar equilibrium ages for buried soils of 950–1550 years were found by Alexandrovskiy and Chichagova (1998) in buried soils of the Russian part of the eastern European steppe, or 550–2000 years at sites in Germany (Dreibrodt et al., 2009, Dreibrodt et al., 2013). Therefore, the radiocarbon age of k1 might reflect the onset of intensive bioturbation associated with the start of settlement activity at the investigated site. The presence of a wooded landscape before and at the beginning of the occupation phase at Maidanetske would explain both the buried forest soil (Cambisol) and the large number of concurrent houses consuming an immense amount of wood for construction, fuel and artefacts.

The large number of krotovina fills that exhibit the same colour as the Trypillia surface horizon (fAh), further supports the idea of coincidence of the onset of Chernozem formation and the Trypillia settlement. Additionally, the contexts of the house in trench 51 explicitly excludes a greater age for the Chernozem compared to the Trypillia settlement, since the Chernozem was clearly situated above the *ploschchadka*.

Since there is hardly any pronounced climatic indication to explain the shift in soil formation processes (Fig. 5), local clearance by the settlers and subsequent land use might explain the change of edaphic conditions.

After the initial deforestation resulting from occupation, the landscape remained open, as indicated by the younger radiocarbon ages of further krotovina fills in trench 70. This is also confirmed by the presence of a Chernozem profile of at least 0.5 m (the preserved part) above the filled pit in exposure 52 and the remnants of the houses (see section 6.2.1 about house 44).

Clear indications for landscape openness at Maidanetske after the studied occupation are provided by soil erosion at the upper slope, and the deposition of colluvial layers at the lower part of the slope facing towards the south. The separate statistical evaluation of the geochemical data of exposure 70 results in groups reflecting the four different soil horizons / sediment layers identified in the field (Fig. 48b). Another indirect indication for phases of soil erosion at the investigated slope is provided by the observable preservation record of the krotovina fills. They are present in all layers except for the modern surface layer. Their absence in the latter is explained by the yearly ploughing activity of the farmer. The few krotovina fills preserved in M2 have probably formed since it was buried by the recent surface layer (M3) and consequently the destruction of krotovina fills by ploughing was no longer possible at that depth.

The still ongoing formation of a steppe soil alternating with the addition of slope deposits delivers an explanation for the secondary enrichment on carbonates in the buried part of the profiles as well (Fig. 45–46).

A first phase of soil erosion happened after occupation at Maidanetske, probably at around 2000 cal BC. This is indicated by the large buried potsherd in exposure 70 and the radiocarbon age of the organic matter of the layer. However, OSL ages for the material of the deeper layers of M1, poor in organic material, point to an age of Aeolian deposition of the loess in the early Holocene (Tab. 14). A sufficient bleaching of the mineral grains is usually ensured by the Aeolian transport process. This is different when considering Holocene soil erosion by water at the investigated, slightly inclining, slope at Maidanetske. Here, a high stability of the soil aggregates should be taken into account, additionally considering the high soil organic matter content of the topsoil. Together, these factors are very likely to result in inadequate bleaching of the mineral grains during the short transport process at the slope, and thus result in an overestimation of deposition age by OSL dating.

Two additional phases of soil erosion, which according to the available age information and properties of the layers probably occurred during Iron Age and Modern Times, resulted in the deposition of two colluvial layers. An extensive survey resulted in traces of a settlement related to the colluvial layers. The deposition of three colluvial layers at the investigated slope, which alternated with ongoing Chernozem formation and the growing Chernozem profiles above the Trypillia layers, all indicate a persistence of landscape openness since that time. No indication for a longer period of reforestation with the formation of an intensive forest soil could be inferred from the given record so far. Compared with the present palaeoclimate data from the region, the formation of the Chernozem at Maidanetske reflects the environmental conditions of an agricultural steppe rather than a climatic one.

7.3 Environment

The Ukrainian vegetation history in the timespan of 4500–2900 BC is characterised by a mode of change. The central Ukrainian site Maidanetske was then situated between an area in the West, where a change in the woodland cover is observed, indicated by a regression of deciduous trees, increase in pine and increasing openness; and an area in the South with a pine dominated forest steppe and high degree of openness with steppe components. On-site plant remains from Maidanetske hint at the existence of some trees in the immediate vicinity. However, estimates of the degree of woodland cover are not possible. From soil sciences, there is a clear indication of the coincidence of the onset of Chernozem formation with the Trypillia settlement. From 4000 BC onwards, the early Holocene Cambisols on calcareous loess have been transformed into Chernozem-like soils. This local development of steppe environment was triggered by woodland clearance and subsequent land use activities by the settlers of the Maidanetske site. Supporting evidence for the alteration of the local vegetation is provided by macrobotanical and snail shell data. The charcoal record shows that deciduous trees were available and used during the occupation of the settlement. Snail shells indicative for shady conditions or even the presence of woodland occur in those excavation layers that relate to the onset of the settlement phase. In contrast, charred botanical macro rRemains of a steppe environment (cf. *Stipa*) date from the latest settlement phase to the post-settlement phase; they cumulate in the uppermost excavation layers.

7.4 Estimation of population size

The results of the dating of the settlement structures enable us for the first time to calculate the population size of Maidanetske with a solid basis. While preliminary population estimations were based either on a general assumption that the contemporary existence of structures was visible from the symmetrical ground plan, or on calculations of the carrying capacity, the radiometric dates make the contemporaneous existence of the houses more reliable. The reflection of house classes in the geomagnetic plan which were detected in former and recent excavations, displays different types, but in general a standardisation is obvious (cf. Chernovol 2012, 200). If we built a model of population size on this baseline, at least 2,297 houses existed contemporarily, perhaps even 2,968. The average house size of 77m² enables us to calculate the number of inhabitants against the background of known space requirements for persons in sedentary societies.

There have been several attempts to calculate the correlation between house sizes and the size of the group of inhabitants living in a house. Classical intercultural studies by Naroll, Casselberry and Brown result in the need for 6–10m² for one person (Naroll 1962; Casselberry 1974; Brown 1987), modified by Porčic with an index of mobility to an average of 6.97m² (Porčic 2012). If the deviations from the general median are taken into account, the synthesis of these ethnographical observations confirm that a person needs 5–15m² in a house, averaging, for example, the 6.97m² from Porčic.

The estimated population of Maidanetske adds up to about 12,000 inhabitants, under conservative estimations, with positive motions about the contemporaneity of houses ca. 46,000 inhabitants and a probable average of 29,000 inhabitants (Tab. 20).

7.5 Economy

Economies involve aspects of subsistence and resource management, but also aspects of transportation and waste management. The results of the 2013 campaign contribute mainly to the mode of subsistence economy of a single house, the resource management of building activities, and the waste management.

Subsistence Economy

The plant economy at Maidanetske is traced through macrobotanical remains and microfossil phytholith finds. It can be concluded that the plant-based part of food consumption relied on pulses and the hulled wheat species emmer and einkorn, with the addition of barley. Broomcorn millet is present in the later stages of the settlement (Tab. 17–18). The daily diet was supplemented by gathered plants like hazel. According to the weed spectrum, and in agreement with the results from pedology, rich loamy soils were available for crop growing. The growth height of the weed species further suggests that the cereals were harvested at ear-level.

An ash layer with a high content of phytoliths from a pit (trench 60) with household waste, shows that the dehusking of hulled wheat was carried out within the settlement. Thus, together with the evidence from the charred glume bases, it can be concluded that both hulled wheat species were most probably stored as spikelets and that dehusking was therefore part of daily food preparation. Besides the information on food production, plant remains from daub reveal the intentional use of C3-cereal chaff as temper. At the moment, it remains an open question whether, and to what extent, crop by-products were also used as animal fodder.

Zoological analyses on the animal bones from Maidanetske are still in progress. From the preliminary analyses it is clear that cattle played an important role in husbandry. At the moment, there is no reason not to accept the model of Kruts from 2001, who calculated the number of domesticated animals per house for Trypillia mega-sites. Thus, we would deal in C1 mega-sites with about 1 cattle, 0.4 small livestock, 0.8 pig and 0.2 horse per household and only a small contribution of hunted animals for the diet (Kruts et al. 2001, 85 Tab. 9).

The excavated features of the 2013campaign, especially the reconstruction of the activities within house 44 based on the distribution patterns of artefacts and macro remains, underlines a clearly organised spatial order for activities that relate to subsistence. Obviously, different millstones were stored on the ground floor of the house and probably used only occasionally for processing. The different sizes of the querns imply their possible use for different plant species, as documented from ethnographic analysis (e.g. Schön/Holter 1988; Fullagar/Field 1997).

While the dehusking and winnowing of cereals took place in the entrance room or outside of the house, grinding took place in the residential room of the first floor near the fire place, and perhaps also in one corner of the entrance room (Fig. 22). Consumption and storage also has to be associated with the areas that are identified for that purpose by different vessel categories: Mainly in the centre of the residential room on the second floor.

As both animal bones, as well as the few hints for the use of secondary products (spindle whorl), are mainly distributed around the house (Fig. 21; Plate 8; Plate 13), processing and production activities that are related to animals probably took place in the activity zone of the “house place”. This still has to be verified by animal bone analyses.

Where animals were kept and arable land was located, is not clear. The most pronounced model would imply the keeping of stock near the houses by the household communities (Kruts et al. 2001, 79 ff.), but keeping them all in the central free space at Maidanetske could also be an option. Also, usually arable land is linked to the direct surrounding of a settlement, but again that also could have been possible within the central area.

From an economic point of view, the cutting of trees for the huge timber amount that was necessary for house construction, and the necessity for working tools, would imply a recognisable amount of timber working tools and other tools and waste artefacts for their production. Both are missing or very rare (some silex artefacts at least indicate tool reworking in household 44), and no real estimations of tool production quality and quantity are possible based on the results of the 2013 campaign.

The high percentage of storage vessels and the importance of cattle keeping of, for example, household 44, indicate an economy that is based on longer-term planning and even the accumulation of subsistence goods. Indications for differences between households (Müller et al. 2015) would indicate that Maidanetske house 44 had a household economy that was engaged primarily in primary subsistence, while other (larger) houses were mainly engaged in secondary subsistence activities or even ritual economies.

Building economy

From an economic point of view, the construction of Maidanetske architecture makes a clear resource management necessary. Besides the already extensive discussion of the timber raw material that is necessary (e.g. Kruts et al. 2001, 77), the results of the 2013 Maidanetske campaign also make an estimation of the clay resources possible.

The results of the 2013 excavations allow the systematic comparison of pits and houses, with regards to the amounts of building materials used, the assemblage compositions, finds density and fragmentation; thereby contributing to improved understanding of the functions and biographies of pits. In two cases, the excavations uncovered associated pit-house assemblages (trenches 51 and 52) as well as pits, which could be connected to previously excavated houses (trench 50).

In a classification from René Ohlrau (Ohlrau 2014, 77–83), in the pits visible in the plan from the geomagnetic survey were divided into three classes based on their magnetic field strength, the excavated pits represent different classes[5]: The features in trenches 50 (max. 20 nT) and 52 (max. 22 nT) belong to the by far most prevalent class 1, whereas the features from trench 60 belong to class 2 (max. 53 nT).

Some of the key data about the investigated pits are summarised in Table 21, and contrasted with those from the house in trench 51: According to these data, the excavated volume of the pits lies in a relatively limited range between 10 and 13 m^3. For the house-pit assemblages in trenches 51 and 52, an excavation volume of 10 m^3 for those pits is in contrast with the ca. 25 m^3 volume of the house remains. Accordingly, there appears to be certain discrepancy between the amount of material which was necessary to build a house, and the size of the pits considered to be the source of this material.

This apparent disparity can be explained by various different factors: On the one hand, the daub from the house feature is not compact; rather it has many voids within it, which are filled with soil. On the other hand, the density of a not insignificant part of the raw material was reduced by the inclusion of chaff or similar material.

If the problem is approached from the perspective of the weight of the building material, a different picture emerges: According to observations by Stefan Dreibrodt, the compactness of the natural underlying loess material amounted to 1.3–1.4 t/m^3 (see section 6.3.1 about geomorphology and pedology). Thus the pit documented in trench 52 yielded 13 to 14 t of clay material. The documented weight of the daub from the house in trench 51 amounted to 4.5 t. In this comparison we need to bear in mind a not inconsiderable loss of small daub fragments which were not weighed. The actual amount of daub may, therefore, have been higher. The expulsion of water through the heating of the clay minerals results, on the other hand, in a loss of weight between 10 and 29%, depending on the type of clay minerals involved (Tan/Hajek/Barshad 1986)[6]. The weight of the clay material used for the construction of the house in trench 51 may have been between 5 and 6 t. To this must be added an unknown amount which results from the portion that could not be weighed.

The result of this consideration is that the material from the pit would easily have sufficed for the construction of the house. The assumption that the primary function of the pits which lie in the direct vicinity of the houses was to provide building materials is currently not in question. It stands to reason, given that the size of the pits reflects well the actual amount of material required for the houses. The pit complex investigated in trench 60 tends towards a size too large to fit this schema; however, its origins could lie in several independent extraction events.

Waste Management

Some aspects of the 2013 excavation inform us about the waste management of Maidanetske.

Based on the documented features, different secondary functions of the pits could be determined. In the case of the pit in trench 51, a later use as a place for waste disposable was documented. However, the concentration and total amount of deposited finds, projected as 10 kg of ceramics (<1 kg/m^3) and 1 kg of bone material (0.07 kg/m^3), are rather low and hardly suggest a long-term, intensive use of the pit as a refuse tip (Tab. 4). The concentration of the finds materials in the lower spits and the

5 Class 1: -3,5–25 nT; Class 2: 25–60 nT; Class 3: 60-77 nT.

6 Water content=-loss (weight-%): Temp. (°C): Kaolinite 17.4 350–1000, Illite (Mica) 11.2 150–1000, Montmorillonite 28.6 250–1000.

homogenous humus fill, which was empty of finds, make a systematic (intentional) infilling appear unlikely.

The amount of finds which were clearly identifiable as “secondary waste” in the area surrounding the houses is also relatively low in relation to the size of the house inventories (cf. Fig. 27). In pits higher finds concentrations appear, above all, in connection with the demolition and rebuilding of houses. Therefore, it remains to be explained how these rather low amounts of refuse can be reconciled with the comparatively long settlement duration of at least 150 years (cf. Korvin-Piotrovskij et al. 2015).

Summary

The contribution of the new results from the excavation to the reconstruction of the economy is manifold. In respect to subsistence economy, the use of cereals could be verified, especially dehusking within the settlement, and the spatial organization of the processing of subsistence within the household. Furthermore, the clay for building the house was taken from the pit nearby. Waste management also included at least the pit that was excavated.

7.6 Features, functions and material culture

The excavation of house 44 in trench 51 left no doubt that the house was used for domestic purposes and the daily activities of a household community. The separation into a ground floor (mainly for storing tools and special resources) and a second floor for food processing and consumption, perhaps also house rituals, indicates a clear spatial pattern of activities. Additionally, tool production took place in the direct vicinity of the house. The spatial patterning of the installations reflects patterns which are also visible in house models like the one from Sushkivka, Cherkasy district, which was excavated in 1916 by V. Ye. Kozlovska (Ciuk 2008, 180). In particular, the podium to the right of the entrance in the main room, the fireplace to the left and the central altar is quite similar to the model from Sushkivka. Both the ceramic types and the other tools reflect a special distribution that could be linked with daily activities. Linked to this is the inventory of pit 52.

In contrast to the domestic activities, which are linked to the house place, the complex re-use of pits 50 and 60 could be explained by non-daily, probably ritual activities.

The pit in trench 50 allows for the reconstruction of at least four reuse events: 1. Fire activity on the base of the pit led to its red colour. 2. The lower fill originated from an initial infill-phase. Sterile material above some traces of fire could suggest that the pit then stood open for a while. 3. Two cattle skulls, bones, and ceramic vessels were deposited on the surface of the first fill layer. 4. Afterwards, the pit was largely filled with the debris from a burnt-down house.

The large vessel fragments, which in many cases fit together, appear to support the idea of a short-lived character to the upper fill, and that the finds material orginated directly from the burnt-down house. However, the intenvories of the pits in trenches 50, 52, and 60 are differentiated from the inventory of house 44 through their higher proportion of bowls and lower proportion of other vessel forms. Whether these (different) ceramic assemblage compositions, which similarly range within the scope of the general variability, represent a coincidence, are based on varying probabilities of fracturing for the different classes of vessels, or reflect special activity in pits, has to be determined based on the wide material basis. The latter scenario could be supported by the observation that the inventory of the pits, also with regards to the high density and low fragmentation of bones, is different from those of the houses. Since the majority of bones from the houses are clearly burnt, the bones from the pits may therefore have originated from another context.

Even though no equivalent deposit like that from trench 50 could be determined in trench 60, the genesis of the investigated "pit" in trench 60 is also considerably more complex than previously assumed. Through the repeated cutting of pits and their final infilling with debris, a pit complex developed here within a small area of a few square metres. The partial enrichment of the upper layers with humus material could indicate longer hiatuses between phases of use. The inventory of this feature also contains a higher proportion (compared with that of house 44) of serving vessels (dishes).

The deposition of daub in the deeper parts of pit 60 seems to indicate a conscious decision to clear away older remains of houses from the top soil or any living area in the surroundings. This deposition might indicate the burial of at least part of a house, as no other deposited remains of half=destroyed houses or similar been found. Figure 57 shows a model of the depositional activities related to pit 60. Judging from the ^{14}C-dates, in the 39th century BCE part of a house was deposited in the pit, while in a second stage during the 38th century BCE, the pit was used for the waste deposition of a house, of which the remains are also visible in the burnt *ploschchadka*. If such an interpretation is valid, the higher nT-values of a group of pits in the southwestern area of the site could be interpreted as the remains of the oldest settlement at Maidanetske, which is "stored" in the pits.

In principle, the 2013 excavation indicates on the one hand the daily processes within a single household, and on the other hand ritual activities, which are linked to festivities and intentional depositions with special purposes. These differences are not only detectable in different contexts and the reconstruction of depositional processes, but also in material culture: Pits whose fills are interpreted as "ritual" yield more bowls than tools for the consumption of food.

7.7 Maidanetske and Trypillia development

With the new data we are able, on the one hand, to better place the site Maidanetske in the overall Trypillia development, and on the other hand, to contribute in general to knowledge about the Trypillia environment and society. In respect to the environment, both archaeobotanical and sedimentological evidence point to the construction of the site in a forest steppe landscape, which is changed by deforestation into grassland steppe vegetation during the settlement period. The sum of radiometric dates from Maidanetske is younger than the sum of the dates from Nebelivka and Taljanky (Fig. 58). In principle, this would suggest a "wave" of increase and decrease in the population from Nebelivka via Taljanky to Maidanetske. While an overlapping duration in the existence of the settlements is probable, a population flow from Nebelivka to Dobrovody to Taljanky and Maidanetske nevertheless seems to be plausible.

An argument in this direction is also provided by the typo-chronological development of the inventories. Taking Ryzhov's basic approach to ornamentation and shape classification (Ryzhov 1999) as valid parameters for correspondence analyses of Trypillia B2 to C1 sites in the Tomashivska group, both the distribution of types as well as the sequence of ^{14}C-dates indicate a chronological development. The newly excavated features from Maidanetske fall at the end of the development, slightly separated even from Taljanky (Fig. 59).

While the general chronological development indicates a tendential population development from the west to the east, contemporaneity of most of the structures in Taljanky and Maidanetske is also plausible.

At the site level, the contemporary existence of most of the Maidanetske houses is highly probably. In consequence, the number of people living in the mega-site is estimated at around 15,000 inhabitants. While two other C1/2–3 sites were discovered within a 5–10 km distance from Maidanetske, the majority of the population seems to stay within the mega-site Maidanetske. A similar pattern could be shown for Taljanky.

Both the organisation of the domestic households as well as the layout of the settlement plan seems to be very similar across the various mega-sites.

8. Summary and consequences

Due to the important results of the 2013 excavation campaign, many aspects of the environment, economy and household organisation of Trypillia mega-sites can now be discussed using a new range of data. There are new arguments for an anthropogenically-induced development of the original forest steppe into grassland steppe vegetation during the occupation of Maidanetske, which was the result of the need of a huge population for construction wood, fuel, areas for herding and arable land. The radiometric dates and the typo-chronological discussions highlight the probability that the houses of the concentric rings existed contemporarily, resulting in population calculations of about 15,000 inhabitants. The excavations also revealed the spatial organisation of a "normal" domestic house(hold) and its "house place", while further excavation of pits also indicated feasting and ritual activities, probably not by one household, but at a different 'political' level. The burning of houses around 3700 BCE is one 'story', and burnt remains in pits (dating to the 39th century BCE) is a different 'story', perhaps linked to the deliberate (also ritual) deposition of earlier house remains.

Nevertheless, a lot of open questions remain for the disentanglement of the development of the mega-site Maidanetske, as many of the described results are first probable interpretations that are related to the outcome of the campaign 2013.

1 For the clear reconstruction of chronological and social processes, it is still necessary to excavate many as yet untouched features:

a) The strategy of "target-excavation" of geomagnetic features has to be applied in other areas of the settlement to test the developed model. For example, although we currently interpret the concentric house rings as contemporary based on data from the Southwest settlement, the possibility of an internal chronological shift within each ring still cannot be excluded using currently available data. In consequence, we need more radiometric dates from other areas of each house ring. Furthermore, dating evidence from the quarters still is lacking. Thus, the contemporaneity of the quarters and rings is probable in principle, but no more than a suggestion at the moment.

b) Besides domestic houses, there are also megastructures at Maidanetske. The purpose of these megastructures, which we see within visible (thus public) space within the settlement, can only be verified through further excavation. Since a kind of size-hierarchy of houses exists, and there are also hints for differences in the economic role of these houses, the excavation of one or two further houses of different sizes is necessary.

c) The excavation of further pits and anomalies is necessary to indicate the role of feasting and other activities on the site. Further target excavations are especially necessary due to the older dates from pits with daub depositions; a possible indication of an earlier settlement phase. Furthermore, the ditch system of the site has never been excavated and has to be taken into consideration.

2 On-site and near-site sampling for botanical macro-remains, phytoliths and pollen is necessary to add as much information on subsistence economy as possible, as the conditions of preservation are very poor at most Trypillia sites. This is also true for archaeo-zoological analyses, which have the same sampling necessities.

From a methodological point of view, this preliminary study suggests that especially phytolith analysis supplements the analysis of botanical macro-remains and should be considered for future investigations. The combination of macro-remains and phytoliths will not only allow the reconstruction of the crop assemblage from Maidanetske, including the importance of millet, but can also obtain information about crop processing activities, as well as the presence/absence and use of plant parts that are not represented by the macro-remains assemblage (e.g. grass culms/leaves), which may provide further information about social and technological aspects of Chalcolithic Maidanetske (cf. Harvey and Fuller 2005; Fuller et al. 2014). Moreover, the study of further phytolith samples from profiles and contexts from before, during and after occupation can help to delineate changes in the grassland vegetation, including the role of C4 grasses, and may help to detect plant use in contexts where botanical macro-remains are not preserved.

3 Further research in the region is necessary to verify the change from forest to grassland steppe; ideally integrating a sound Holocene palaeo-environmental record for the region as a base for considerations about human-environmental interrelations prior to, during, and after Trypillia times.

Nevertheless, the 2013 excavation campaign at Maidanetske indicated the extreme value of the results that an interdisciplinary team can achieve through target excavations against the background of geophysical plans.

Figures

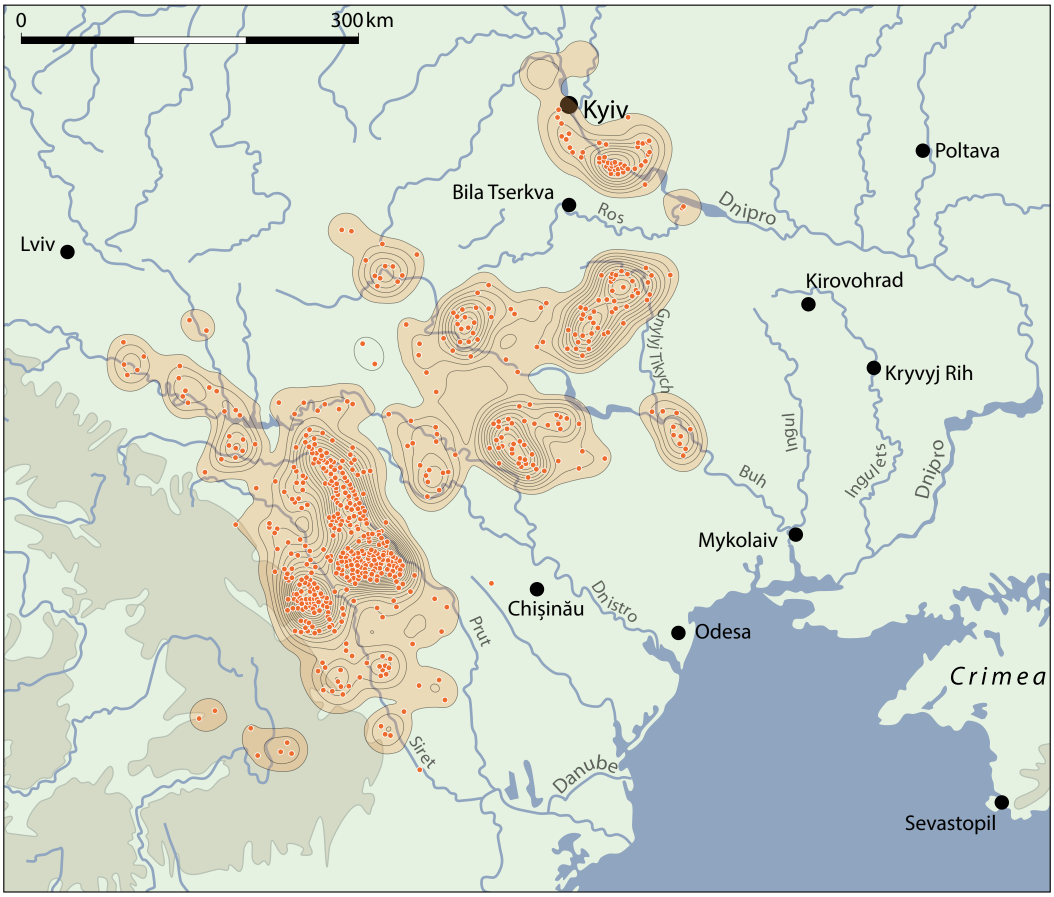


Fig. 1. The distribution of Trypillia C1 sites (kernel density; KDE Radius 30km) and the distribution of Trypillia mega-sites.

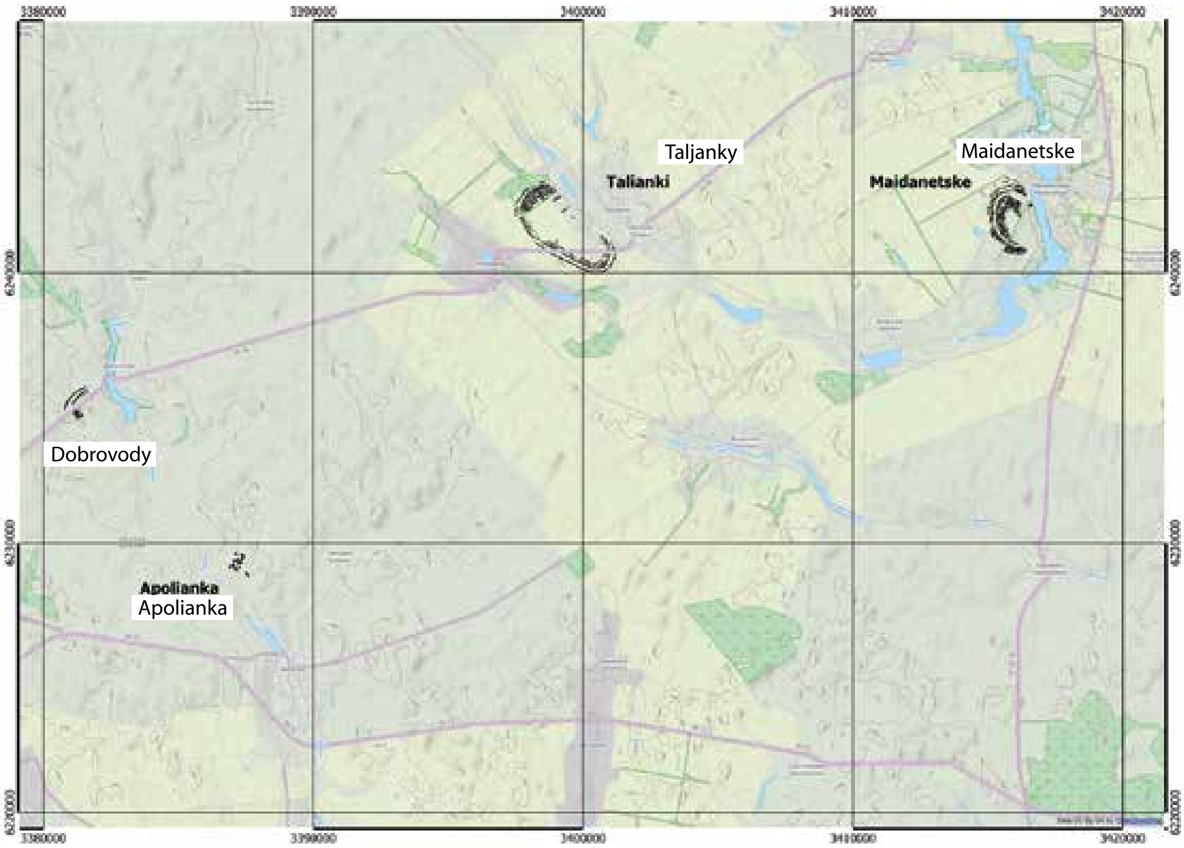


Fig. 2. Location of the mega-site Maidanetske. Besides the canyon system of the small rivers, the location of three mega-sites at approximately 15 km distance from each other is visible (Dobrovody, Taljanky, Maidanetske). The features represent the geomagnetic plans of the sites.

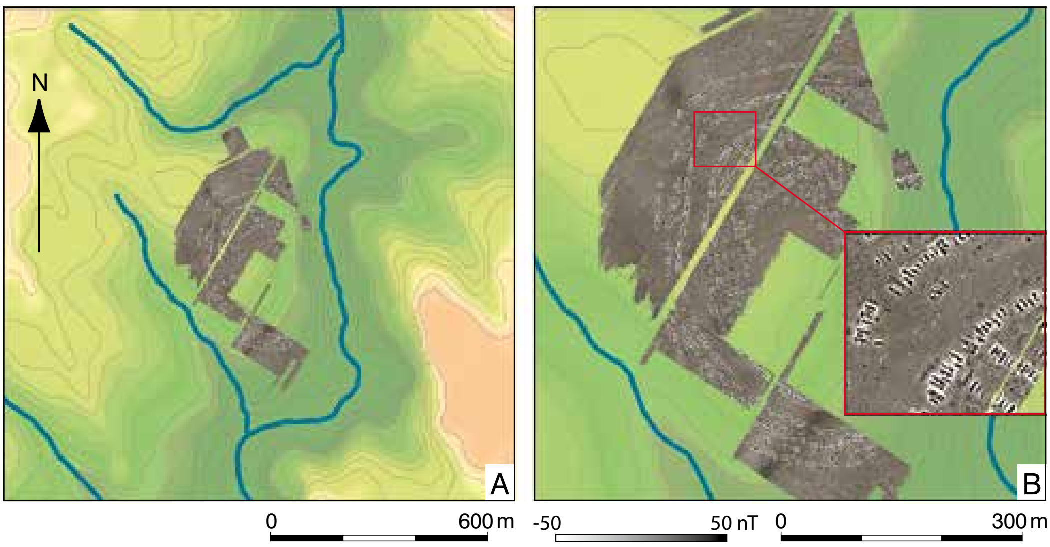


Fig. 3. Maidanetske (Cherkasy Oblast). **A**. Overview of the topographical situation around the site. **B**. Overview of the geomagnetic survey area (c. 150 ha) with a more detailed view of the northern area.

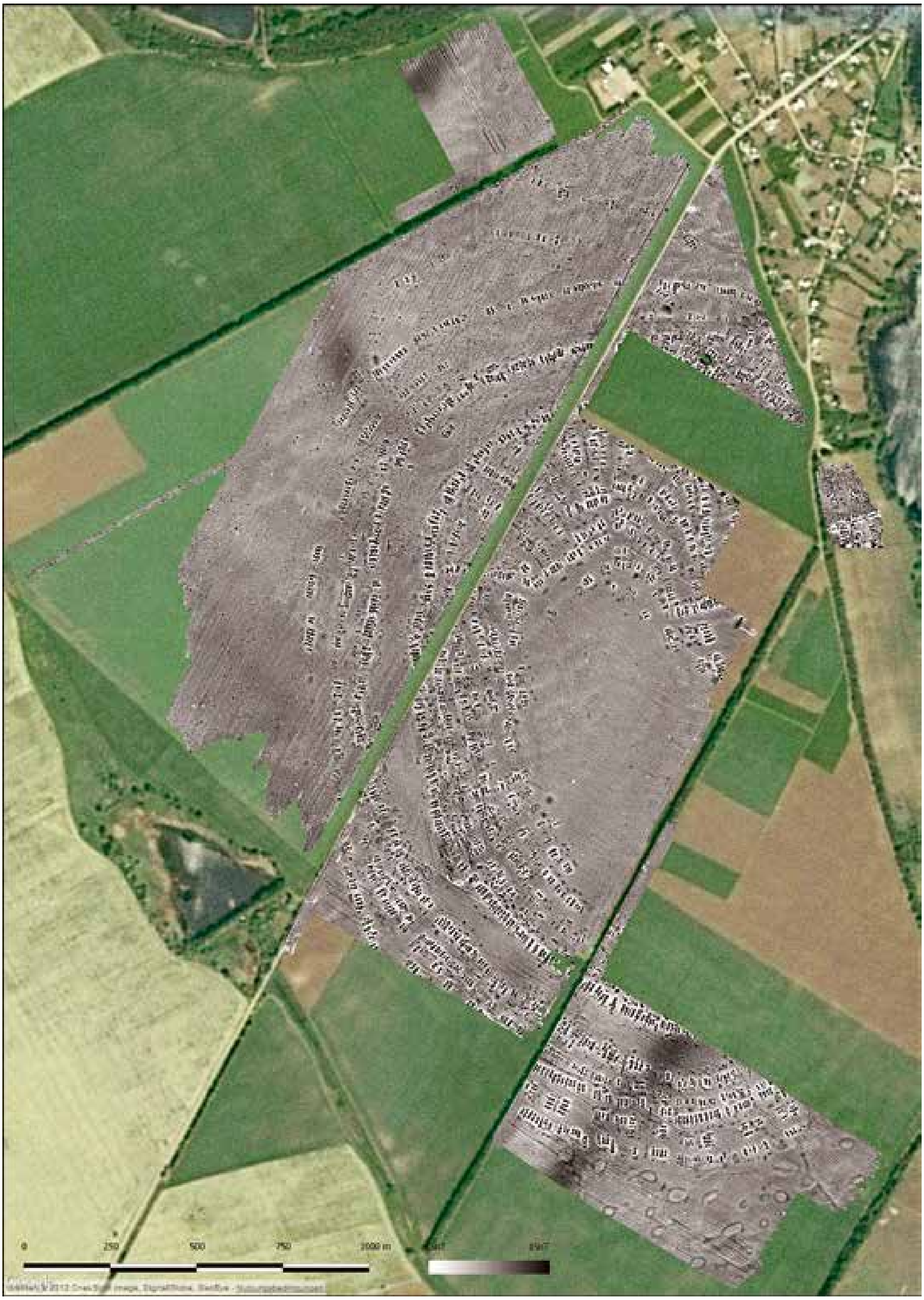


Fig. 4. Geomagnetic plan of Maidanetske.

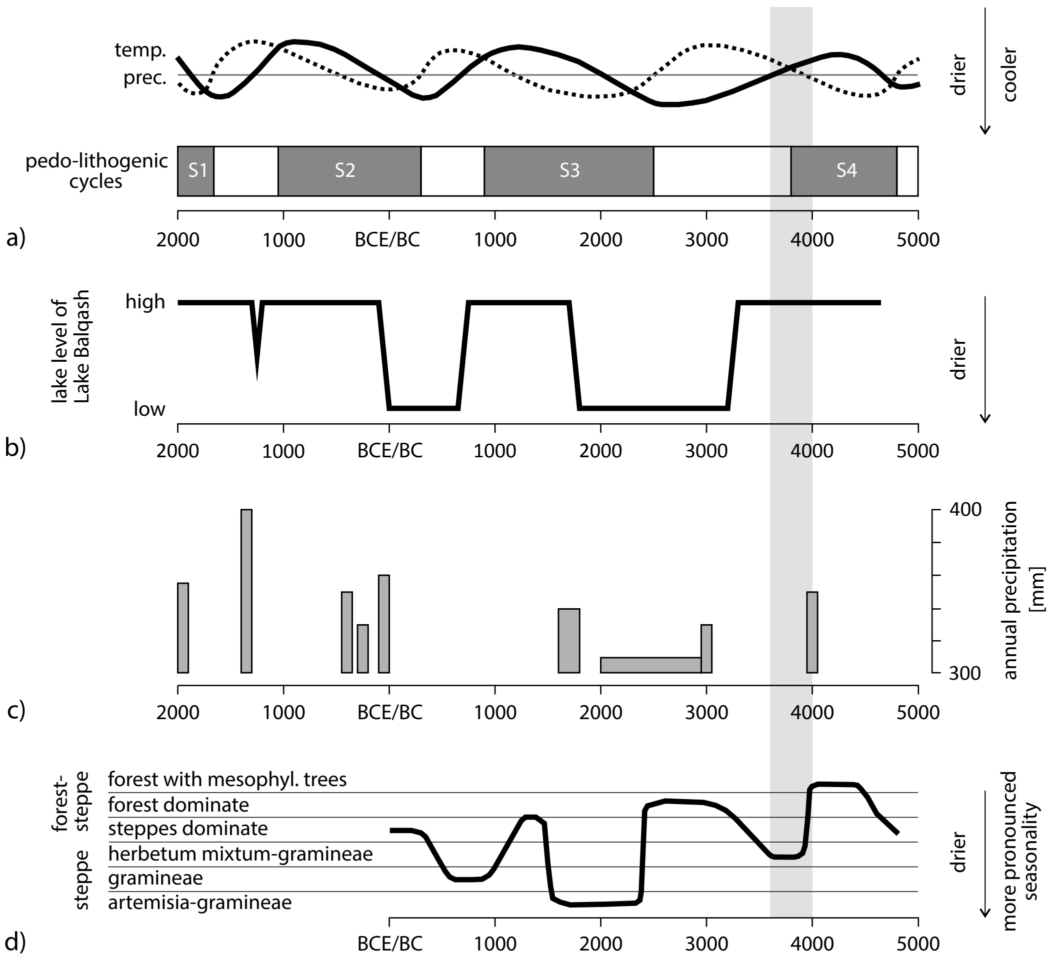


Fig. 5. Summary of palaeoecological and palaeoclimatological reconstructions for the wider region. **a**) Pedo-lithogenic cycles reconstructed by Sycheva (2006). S 1–4 represent regional phases of slope stability and soil formation, interrupted by erosive phases. Temperature and precipitation estimates are reconstructed from the record of soils and sediments. **b**) Lake level reconstruction for Lake Balquash from Kremenetski (1997) (radiocarbon ages recalibrated). **c**) Reconstruction of paleo-precipitation based on the magnetic properties of soils buried by burial mounds (after Demkin et al. 2014). **d**) Holocene palaeoclimatic summary of the pollen diagrams given by Gerasimenko (1997) (radiocarbon ages recalibrated).

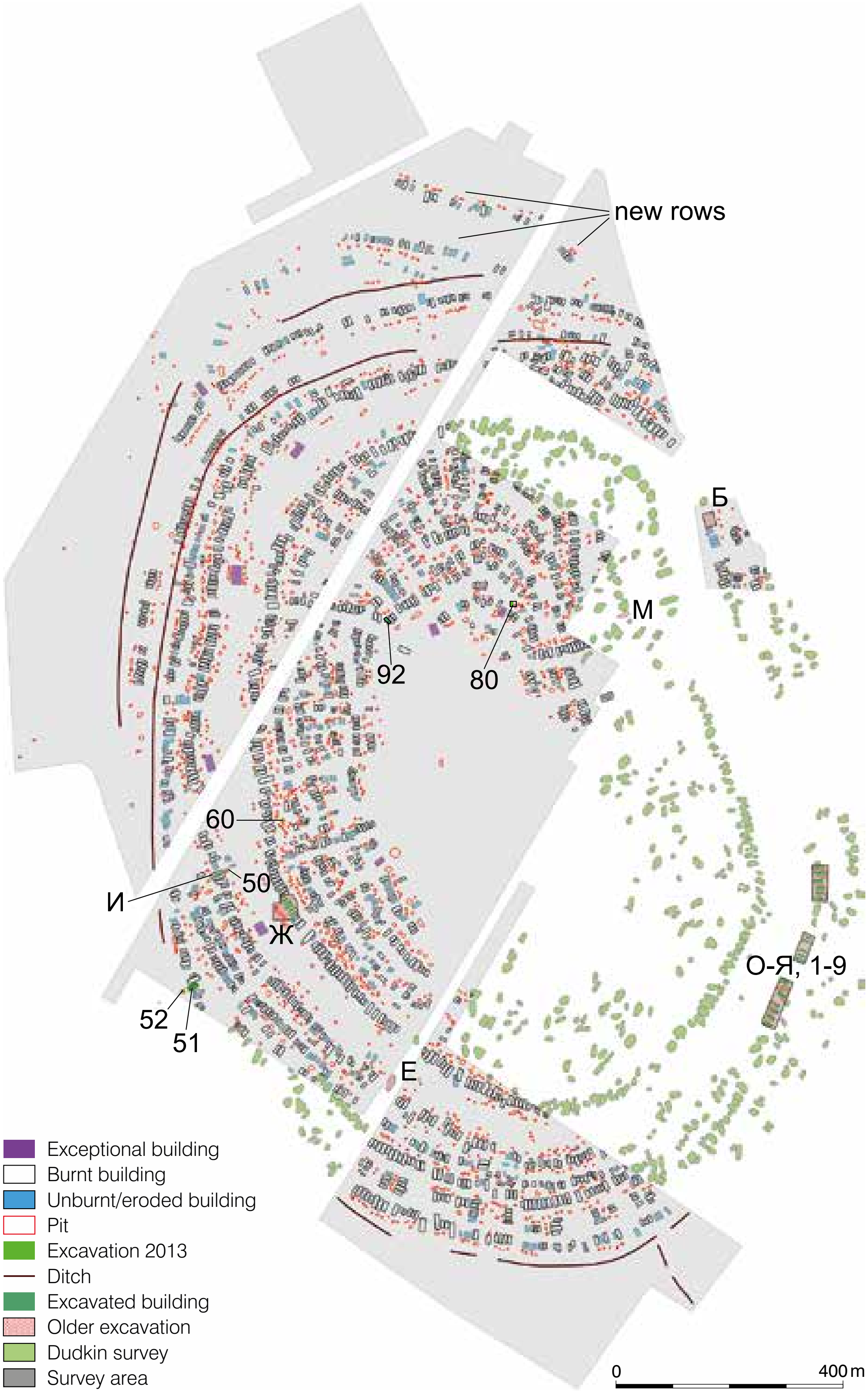


Fig. 6. Interpretation of the geomagnetic house anomalies on the basis of the recent surveys. The anomalies detected by Dudkin’s survey are shown for the western settlement area.

Fig. 7. Maidanetske, SSW part of the settlement. The 9 house-rings, the excavation trenches and the numbers of the houses (H) that were test-trenched or fully excavated (house 44). Pits 50, 52, and 60 are located in trenches with the same numbers.

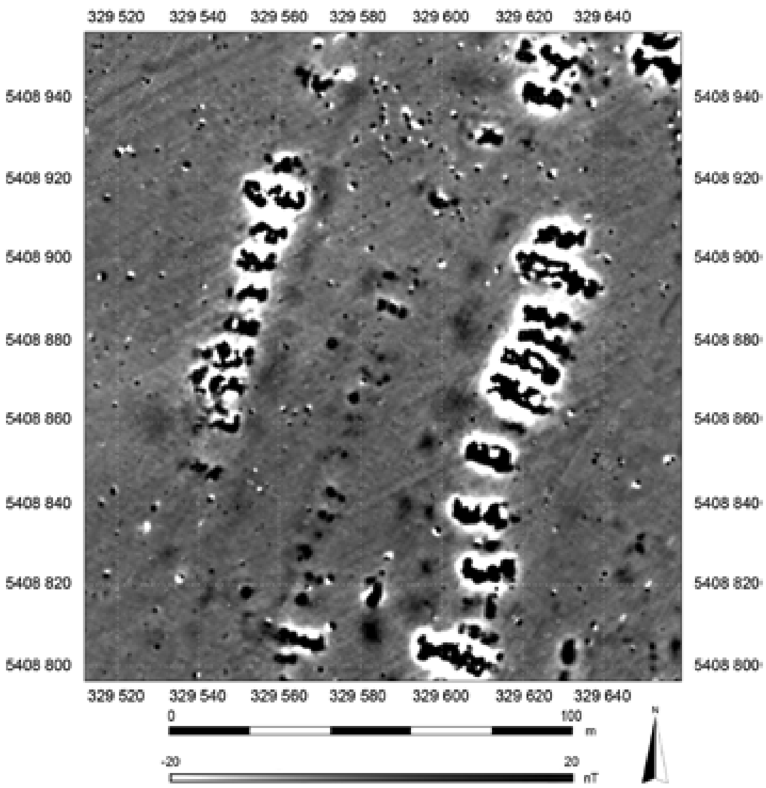


Fig. 8. Eroded or unburnt houses in a house-row.

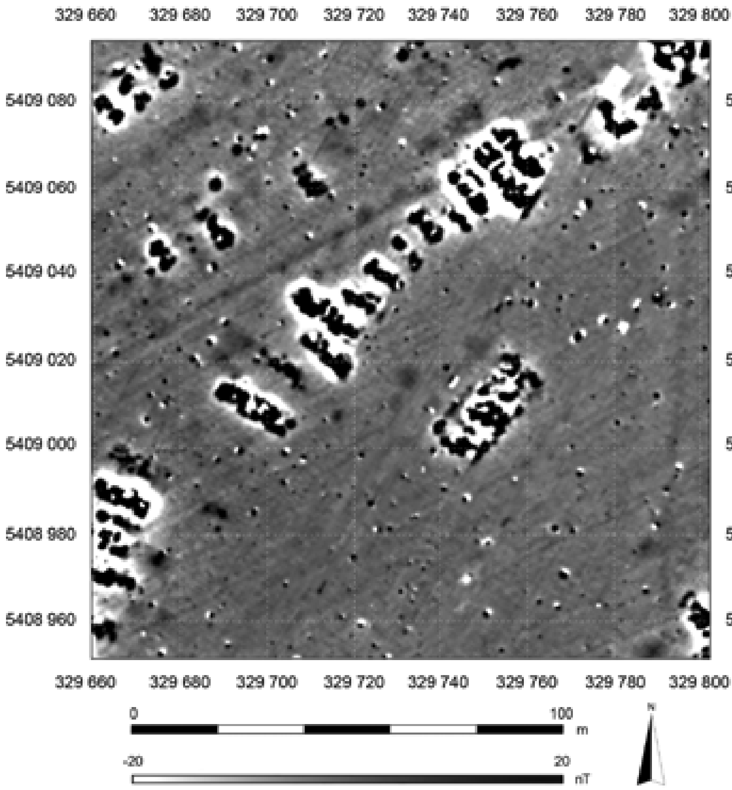


Fig. 9. Different house sizes, a possible overlap, and a mega-structure.

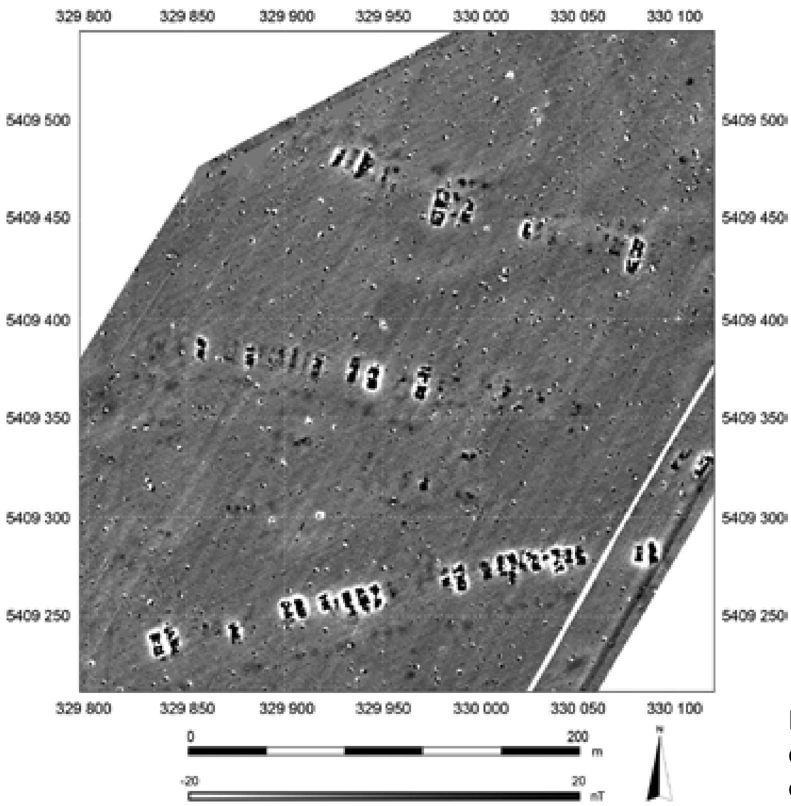


Fig. 10. House-rows with different orientations in the northern part of the site.

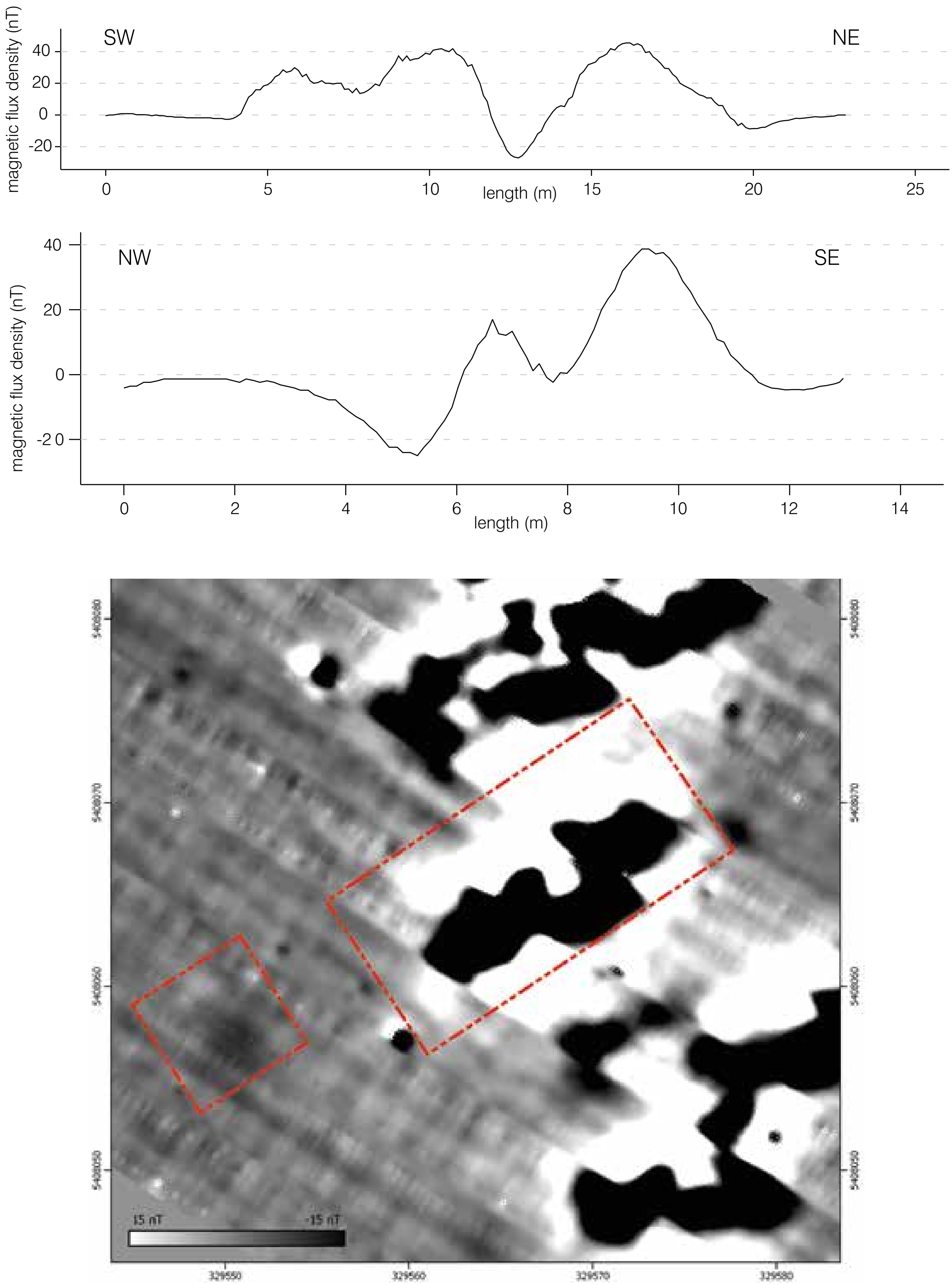


Fig. 11a–c. House place 44. The geomagnetic flux densities (nT) of different profiles and the house place with geomagnetic pit and house features.

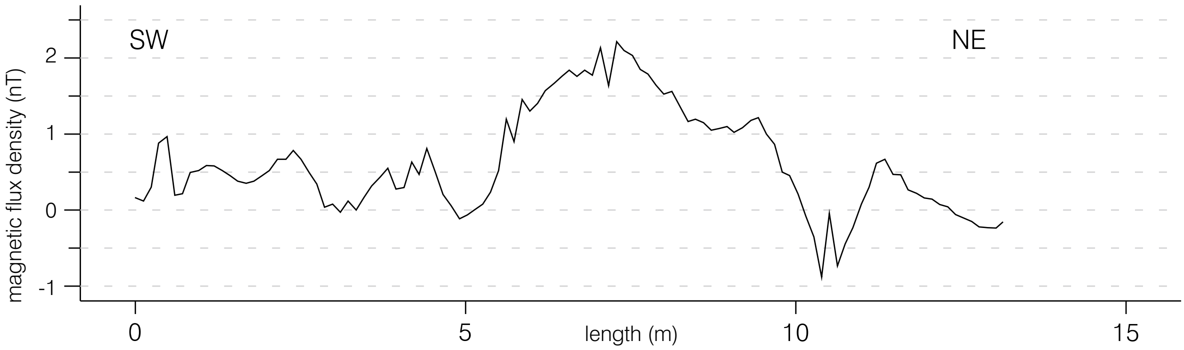


Fig. 11d. House place 44. The geomagnetic flux densities (nT) of different profiles and the house place with geomagnetic pit and house features.

Fig. 12. House 44 during the excavation. The top layer of the house is visible.

Fig. 13. House 44 displays a typical *ploschchadka* with internal divisions into several features that are known from most domestic Trypillian C1 houses (cf. Chernovol, 2012).

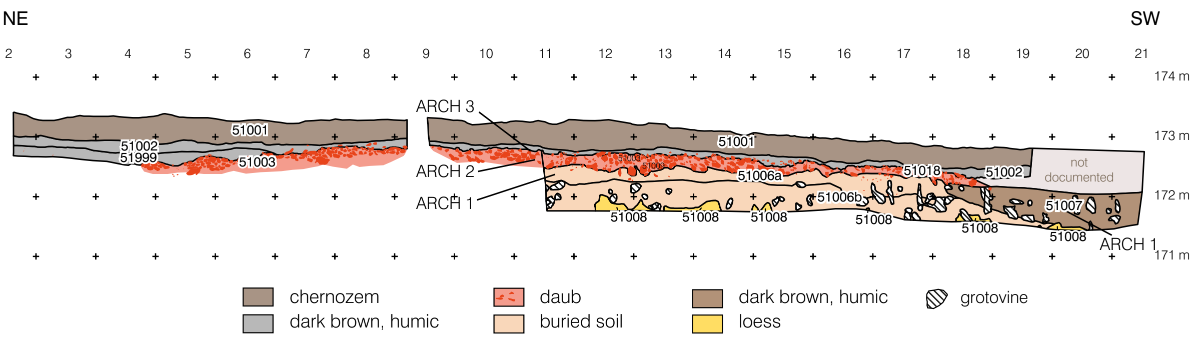


Fig. 14. House 44. The longitudinal profile displays the stratigraphy of the daub of burnt walls and the roof (ARCH 3), the second floor (ARCH 2) and the placement of items on the ground floor (ARCH 1) that is also associated with the shallow layers of the occupation layer (*Laufhorizont*) in the vicinity of the house (cf. Tab. 4).

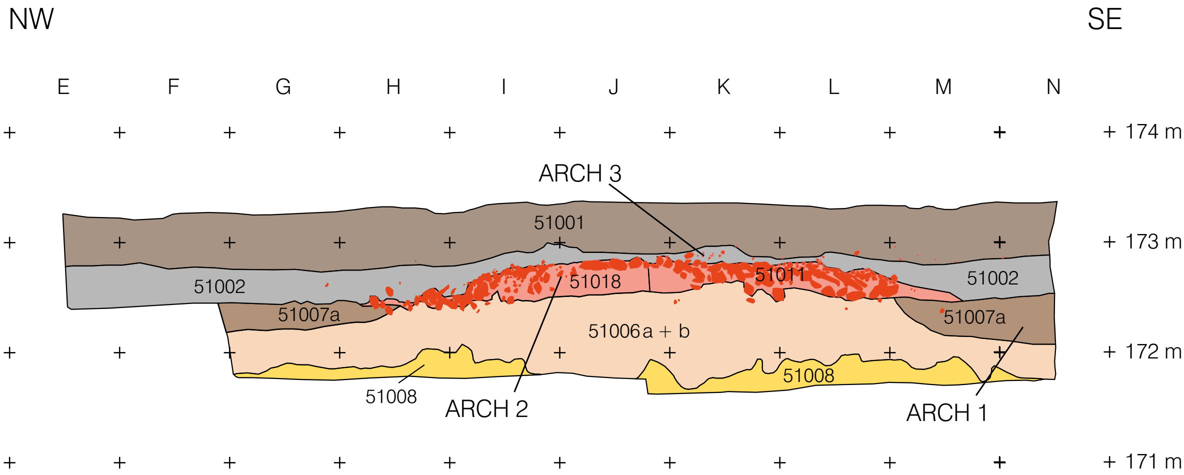


Fig. 15. House 44. The latitudinal profile also displays the stratigraphy that is visible in Fig. 14.

Fig. 16. House 44. The photograph shows a cross section through house 44. The biconical vessel (right side) indicates ARCH 1 beneath the main daub layer of the second floor (ARCH 2).

Fig. 17. House 44. Remains of a clay construction with rounded edges and a smoothed surface (a) on the top floor (b) beside an inner wall (c).

Fig. 18. House 44. The centre of the main part of the south-western room (top floor) with pots still standing on their bases.

Fig. 19. House 44. The partition wall in quadrant L/11, where the negative impression of a former vertical wooden pillar was detected. Perhaps we can identify here part of the entrance construction to the main room. Different layers of daub are visible (a–d).

Fig. 20. House 44. A U-shaped, ca. 0.6 m wide and 0.9 m long construction existed at the north-eastern wall of the house, also linked to the partition wall. The installation consisted of a 10–15 m wide and at least 10 cm high small rounded wall.

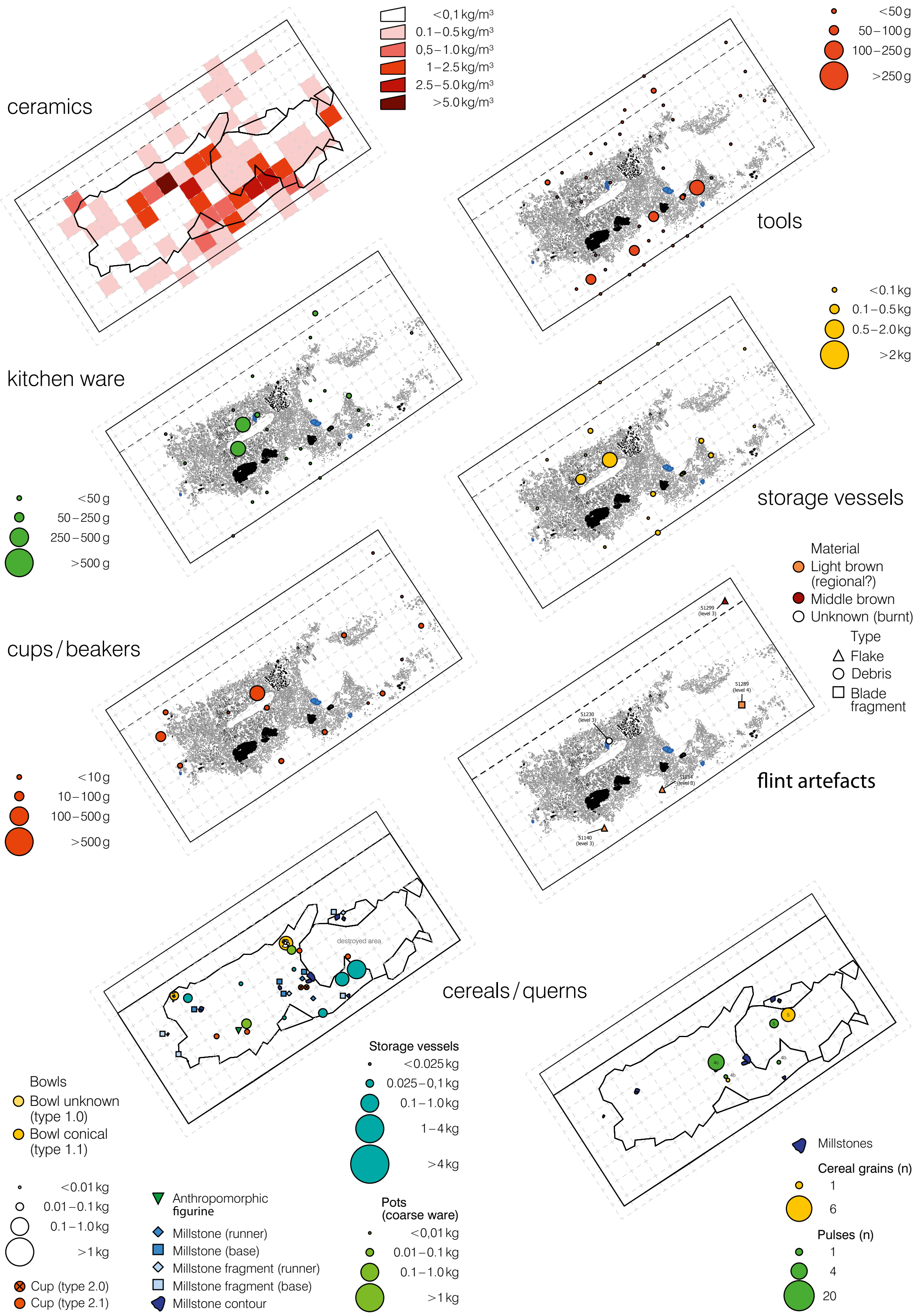


Fig. 21. House 44. Artefact distributions related to house 44 display different spatial patterns that aid in the reconstruction of activity areas within and around the house.

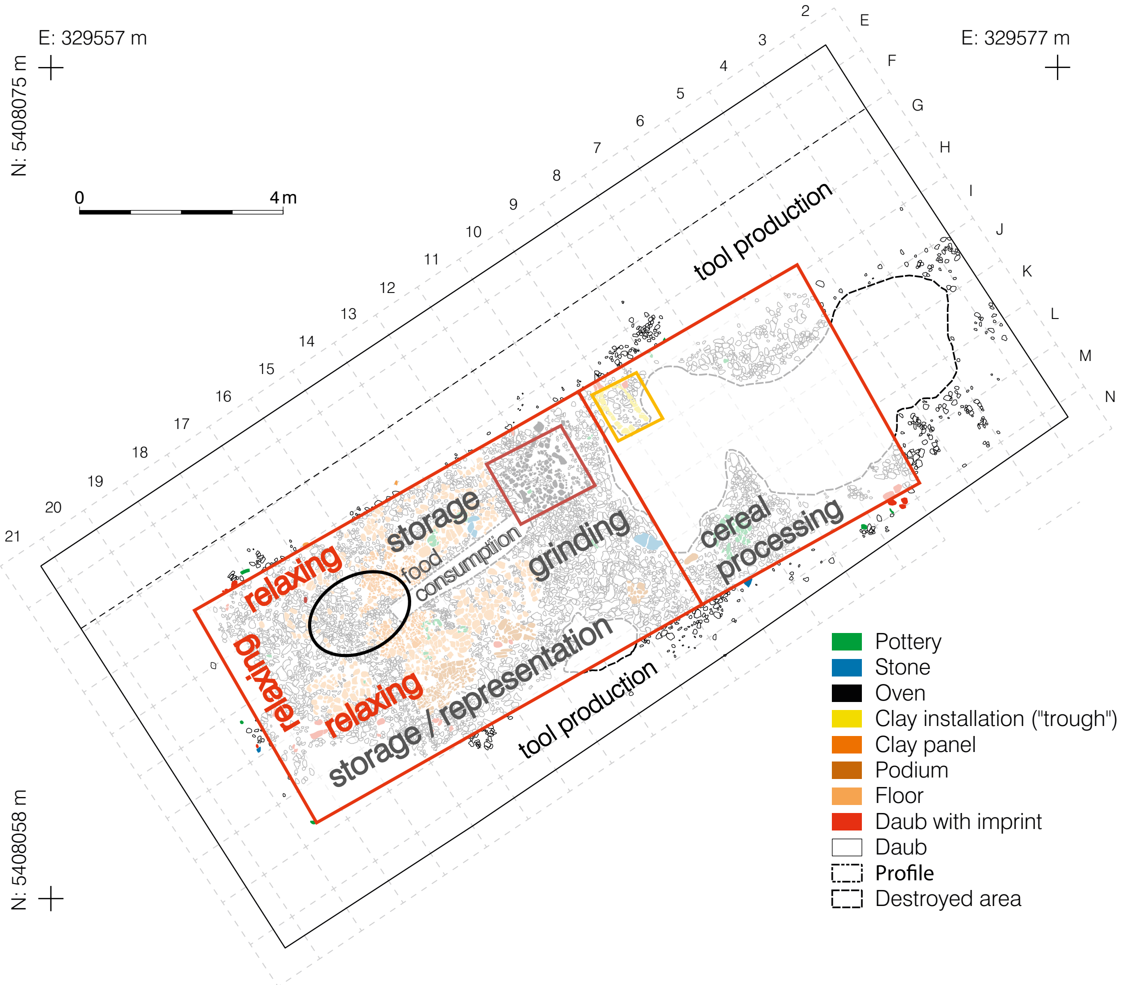


Fig. 22. House 44 with reconstructe d activity areas (cf. Fig. 21).

Fig. 23. House 44. The distribution of ceramic vessels and querns/ runners on top and beneath the main daub layer.

Fig. 24. House 44. Deposition of a quern and a runner, plus a figurine on the ground beneath the top floor.

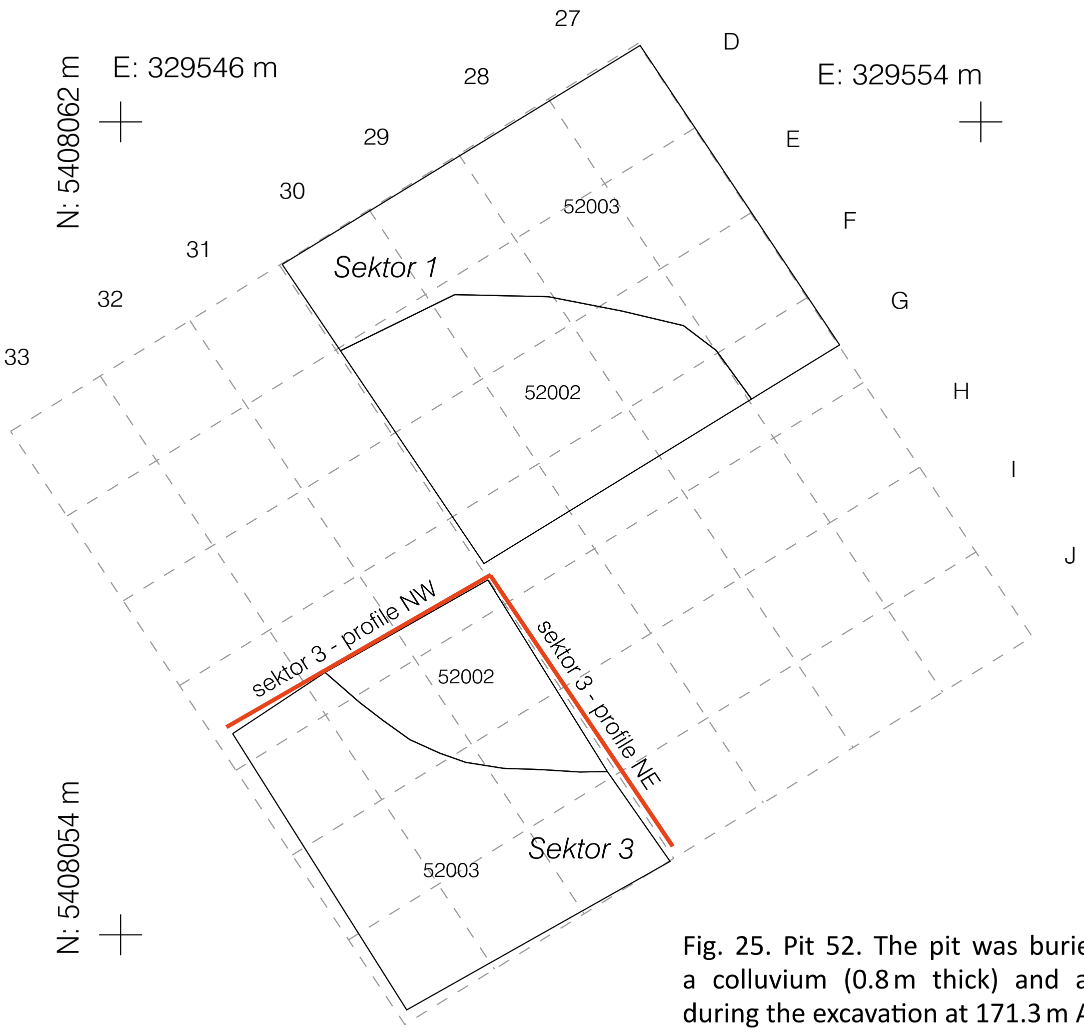


Fig. 25. Pit 52. The pit was buried under a colluvium (0.8 m thick) and appeared during the excavation at 171.3 m ASL.

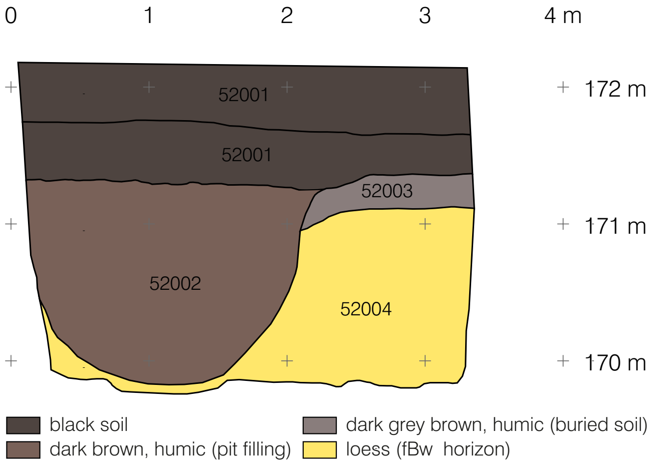
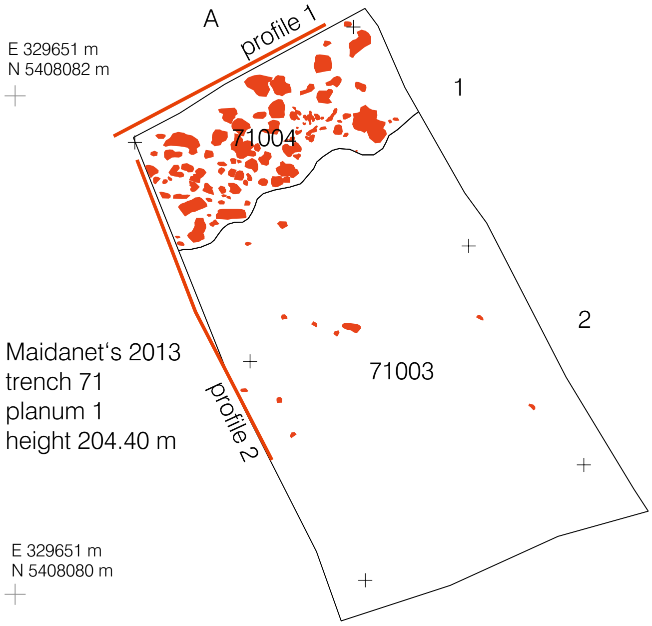


Fig. 26 Pit 52. Cross section.



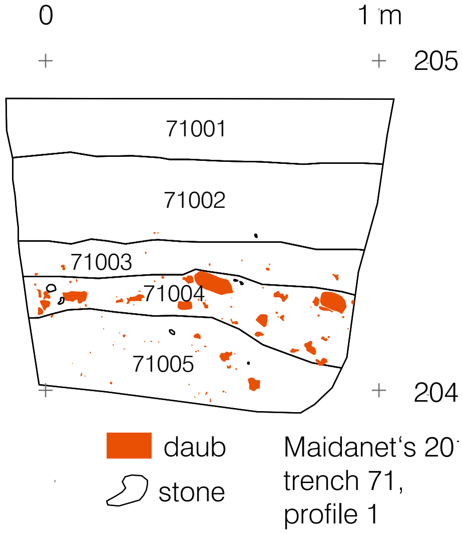


Fig. 27a–b. House 45 in trench 71: the border of the house and the cross section.

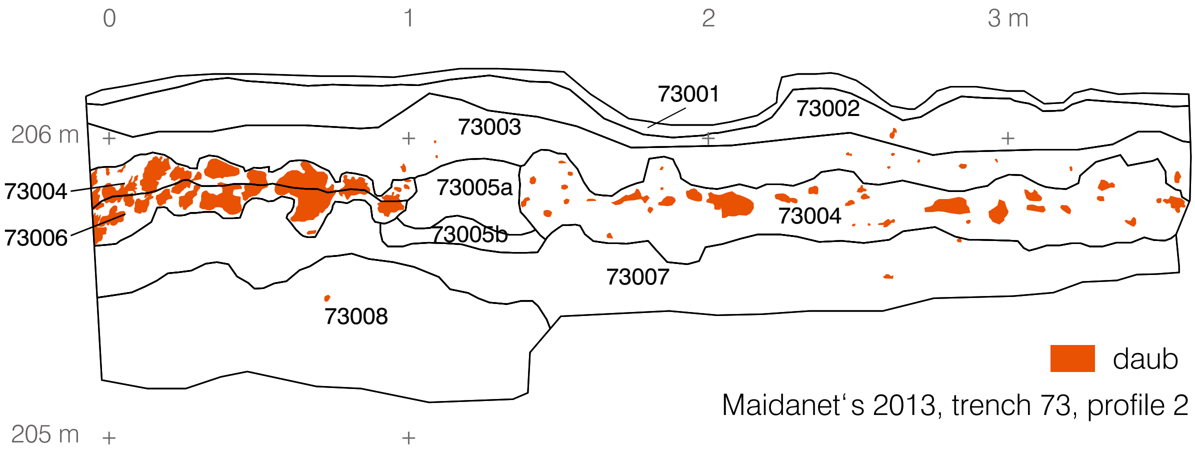


Fig. 28. Houses 47–48 in trench 73: the cross section.

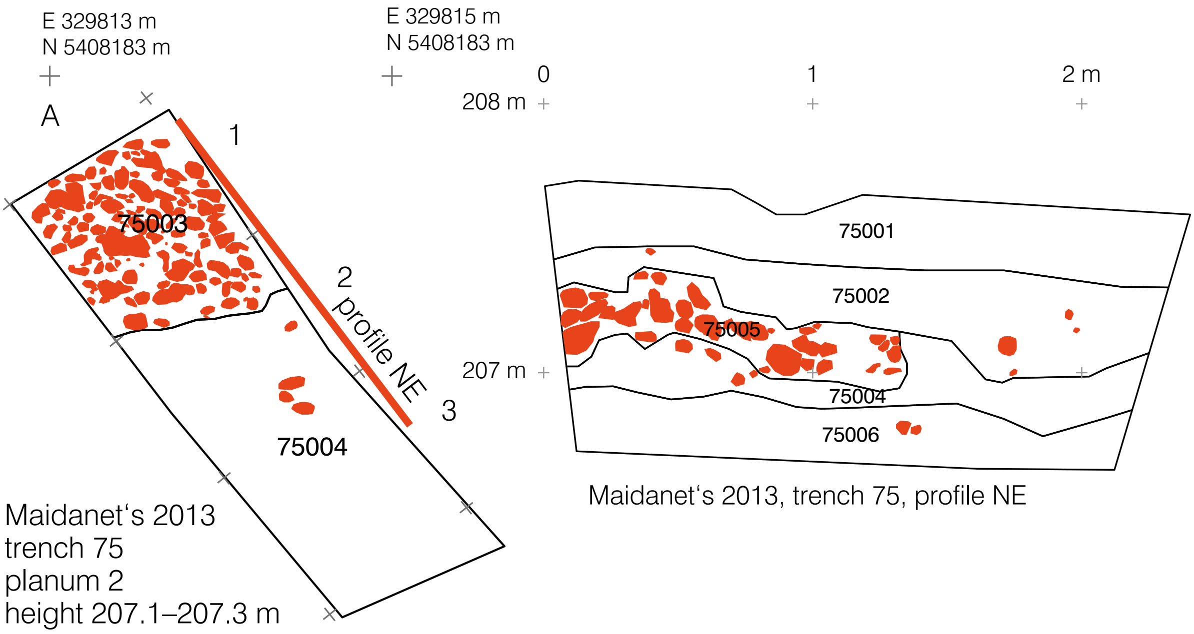


Fig. 29a–b. House 50 in trench 75: the border of the house and the cross section.

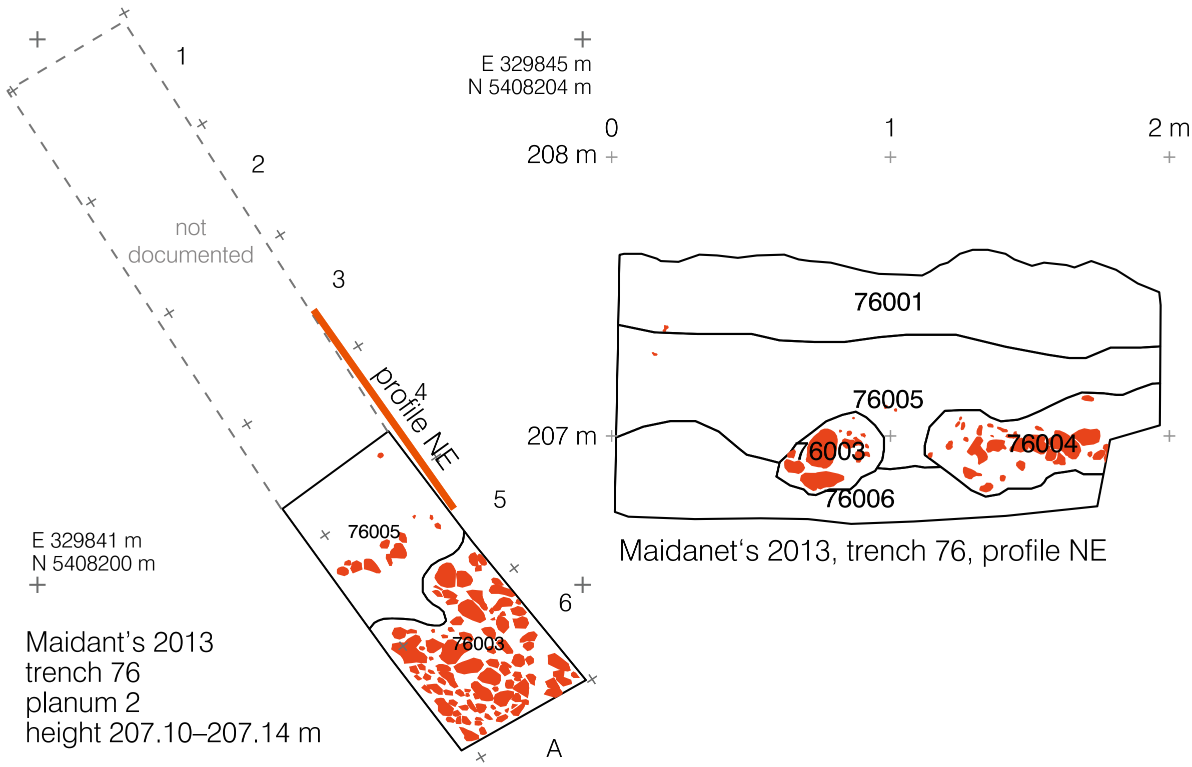


Fig. 30a–b. House 51 in trench 76: the border of the house and the cross section.

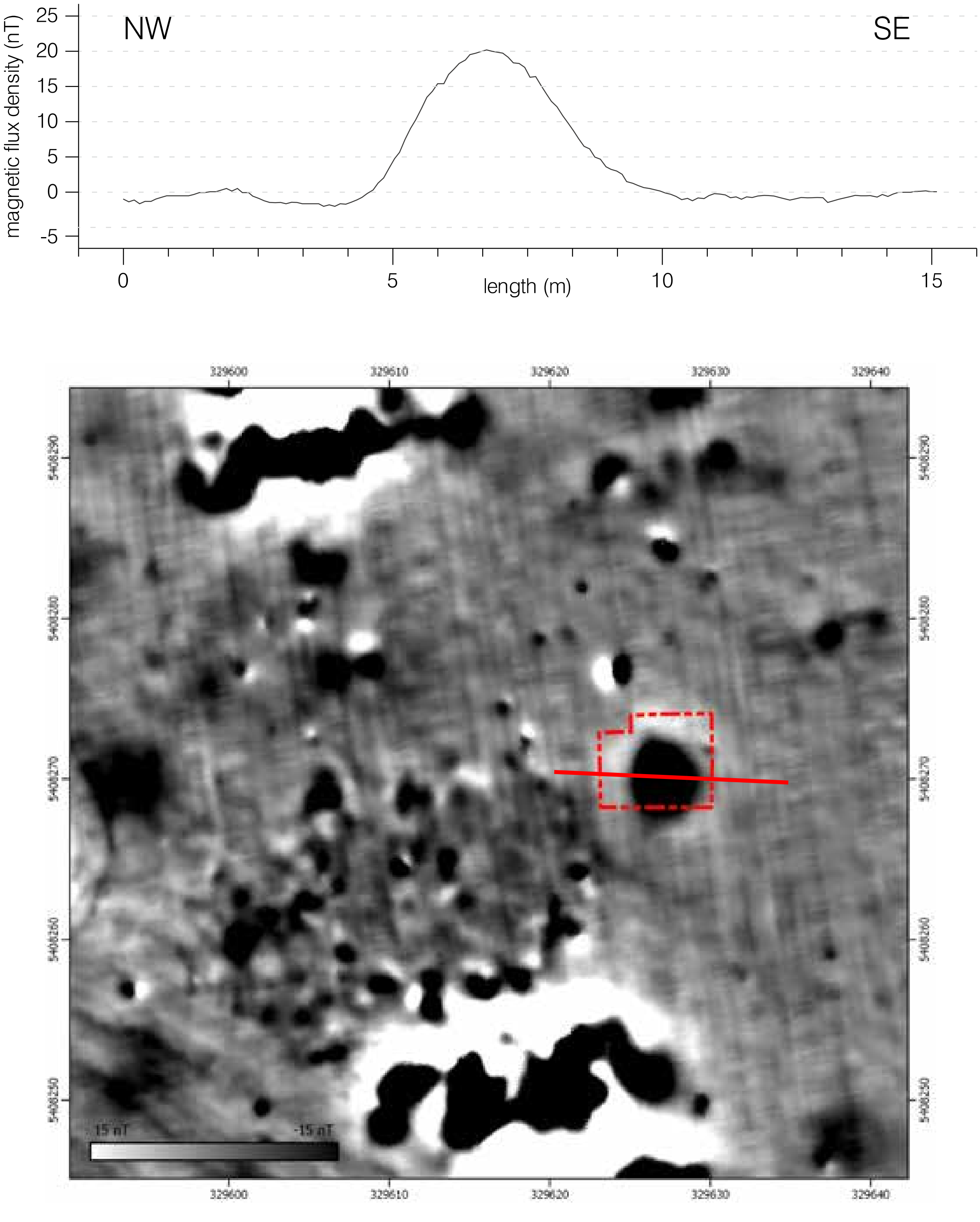


Fig. 31a–b. Pit 50. Geomagnetic feature.

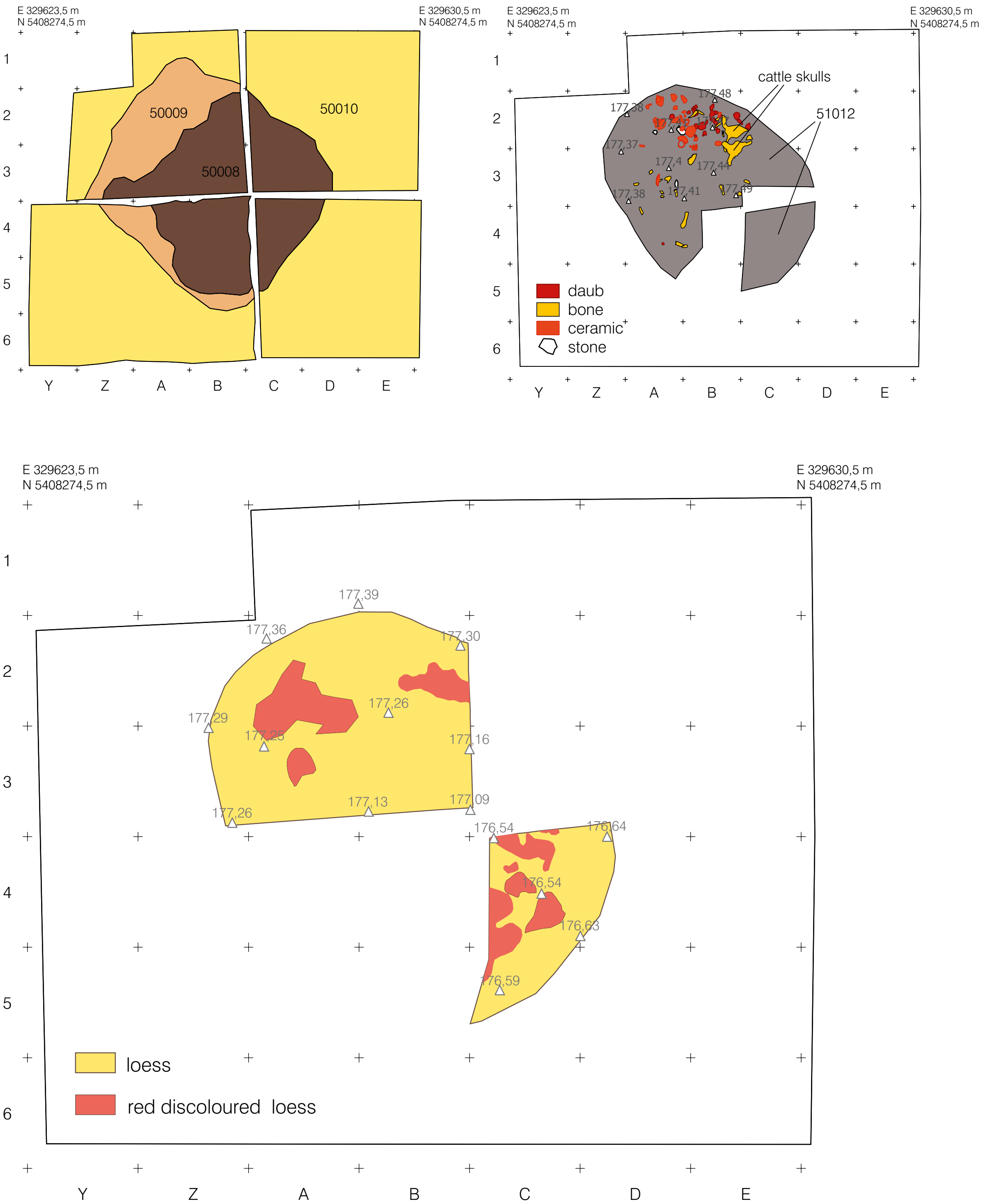


Fig. 32a–c. Pit 50. Different plana of the rectangular pit with rounded corners. The deepest planum 5 displays deposited daub, planum 4 the cattle and artefact remains, and planum 2 the top part of the pit.

Fig. 33. Pit 50. After the pit had been created in prehistory, a fire burnt on the bottom of the pit, which made the soil partly reddish in colour.

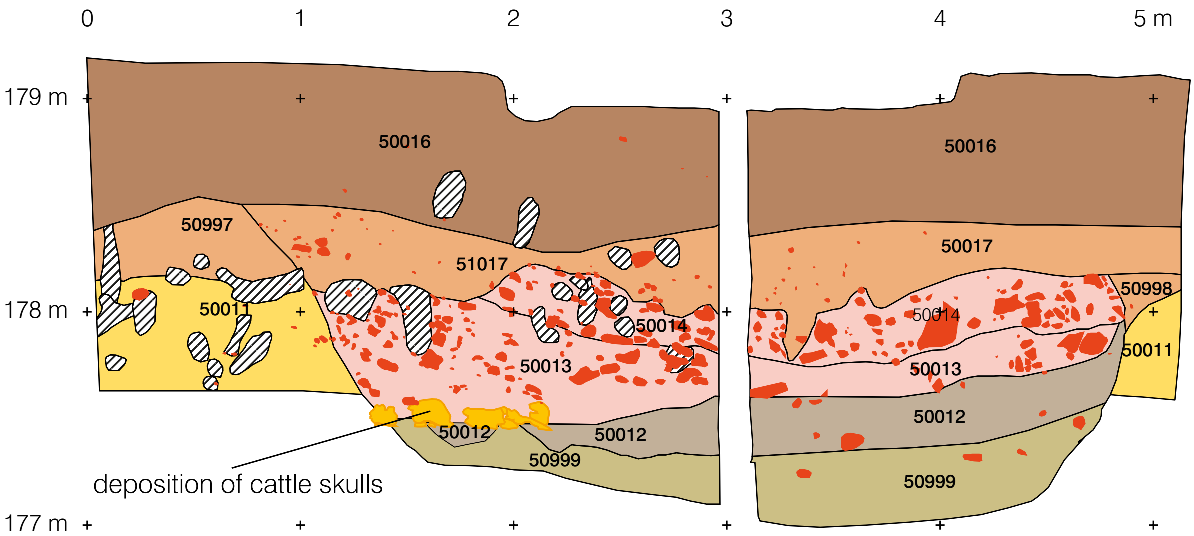


Fig. 34. Pit 50. Cross section. The archaeological layers are labelled (cf. Table 9 and for ^{14}C-dates table 11).

Fig. 35. Pit 50. On top of the deepest grey-brown infills that show an additional admixture of daub, two cattle skulls, many bones and different pots were deposited, before the infilling of huge masses of daub began (cf. Fig. 34).

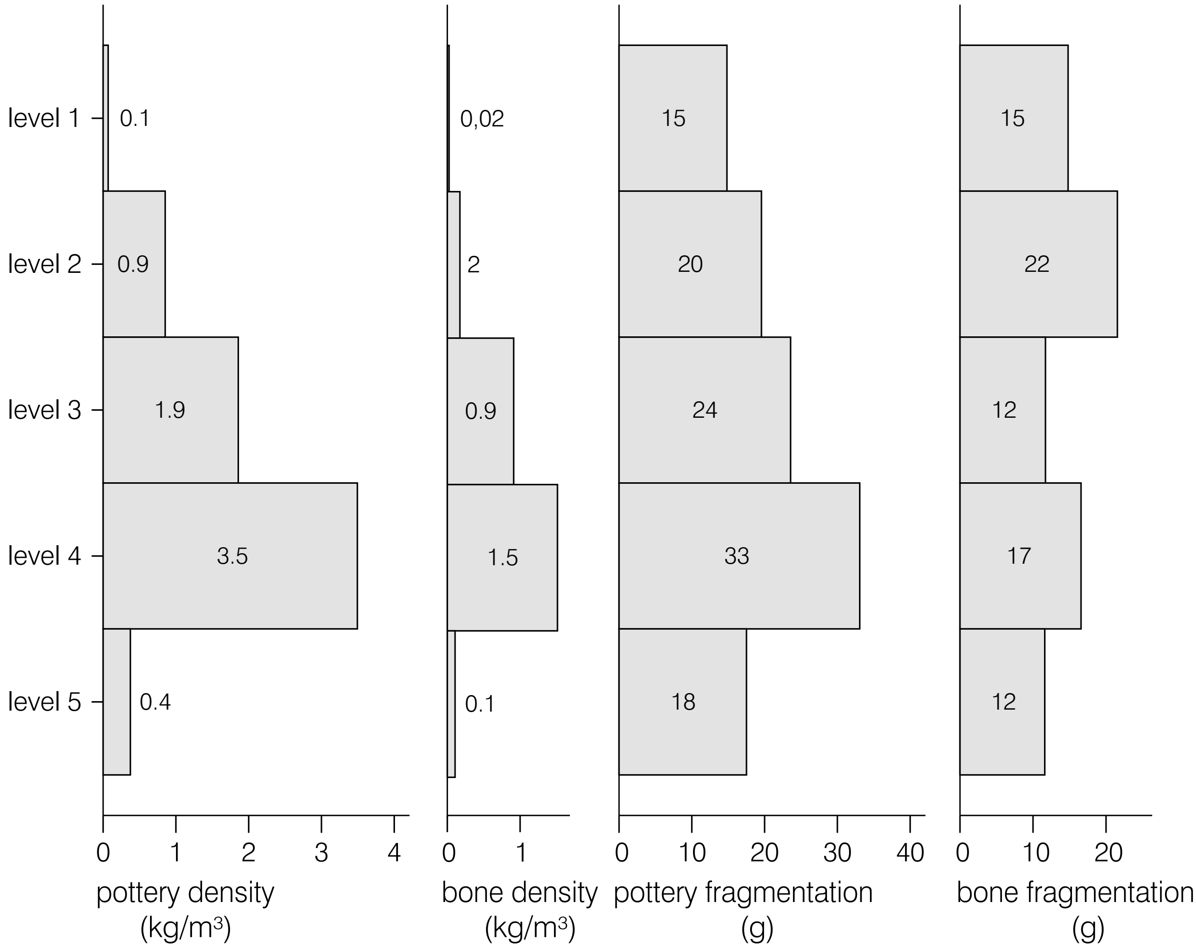


Fig. 36. Pit. 50. The quantity of artefacts (kg/m³) in different levels of the pit. The overall distribution of artefact categories is concentrated in the deposition with the two cattle skulls (level 4).

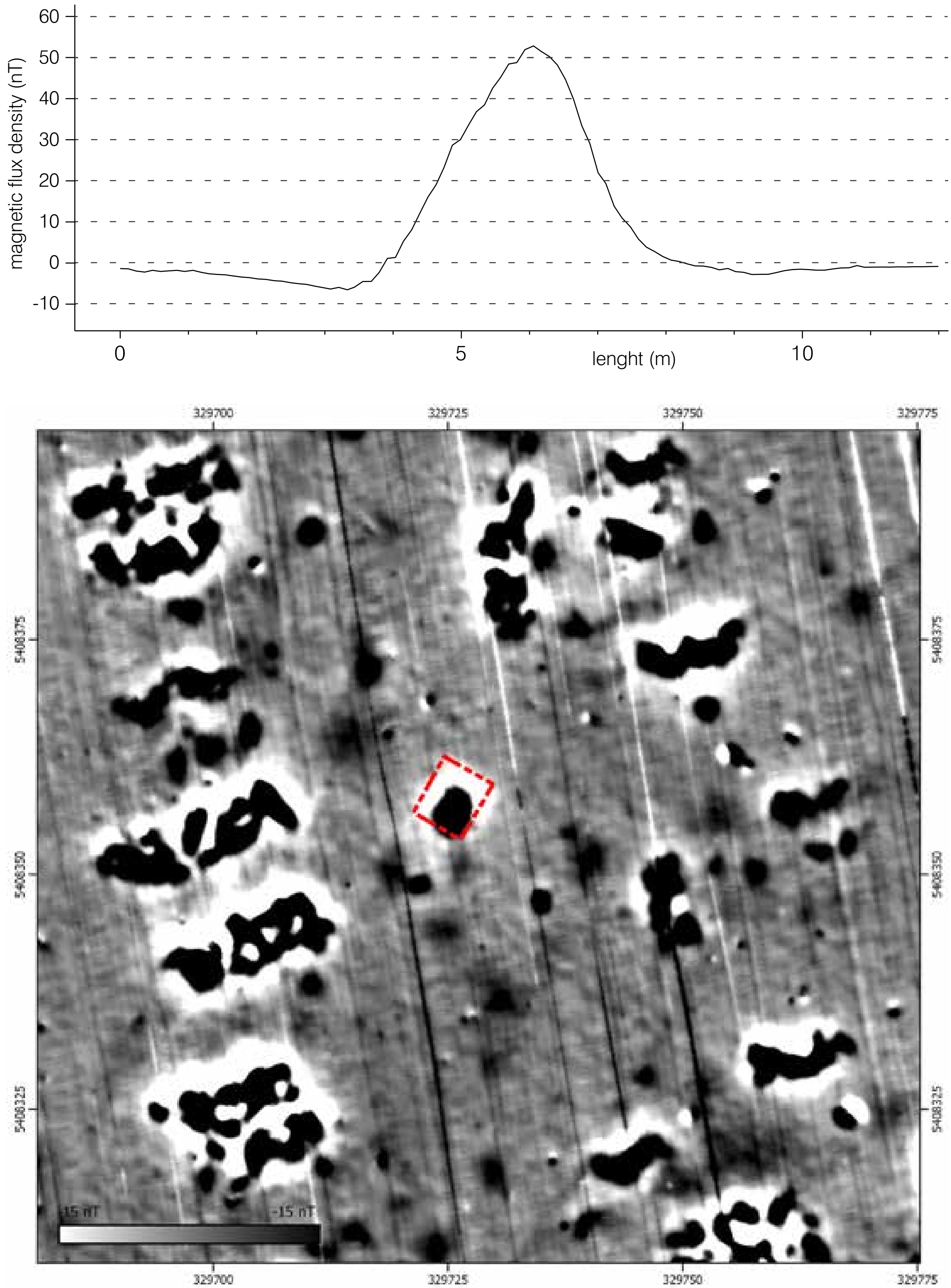


Fig. 37a–b. Pit 60. The geomagnetic flux densities (nT) of the pit.

Fig. 38. Pit 60. The masses of daub depositions were already visible after the topsoil was removed during the excavation. They formed the uppermost fill of an oval pit.

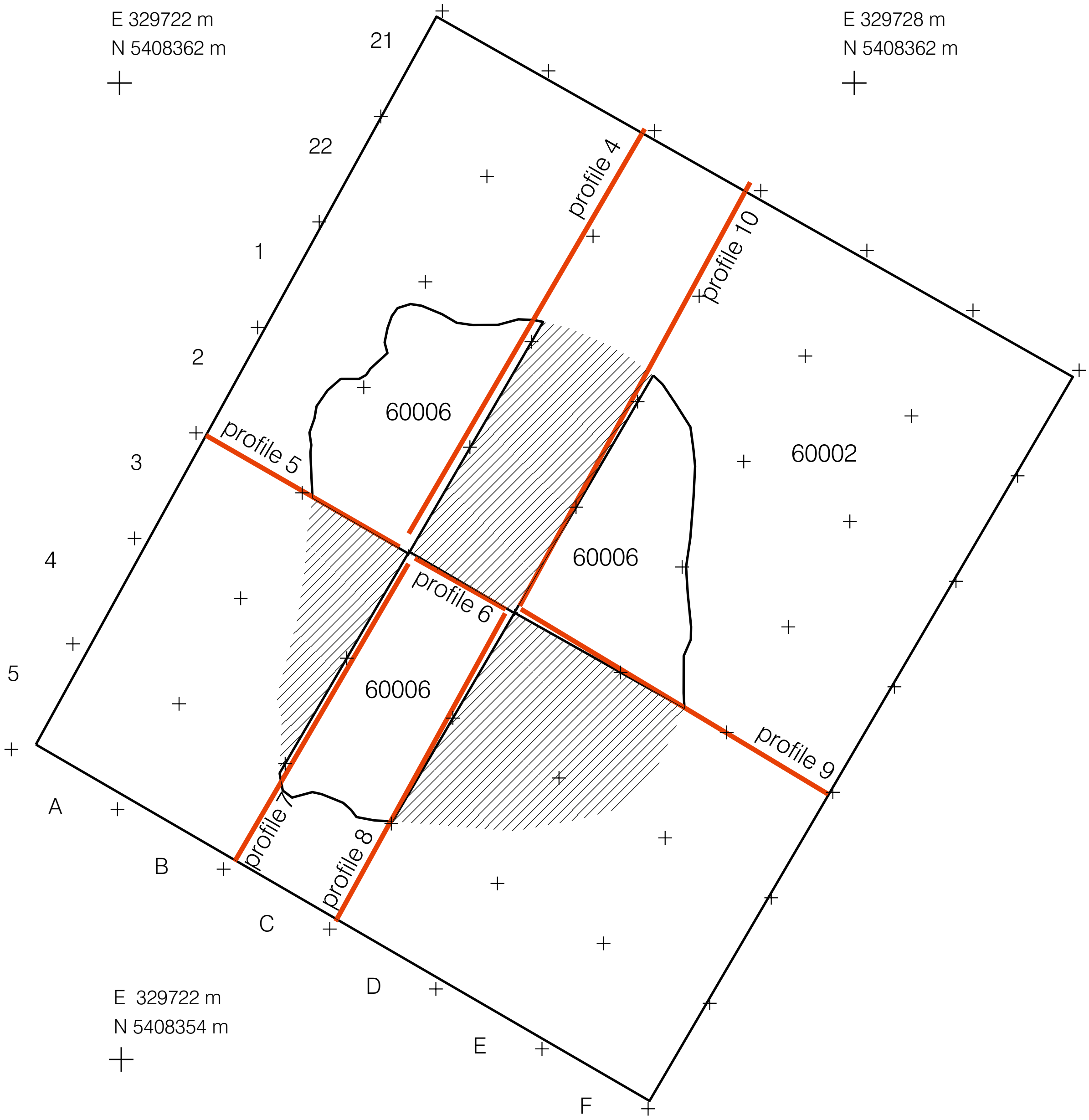


Fig. 39. Pit 60. The 1.5 m deep pit changed in its lower part to a rectangular shape.

Fig. 40. Pit 60. The cross section displays a series of different cuts and fills. These separate pits had rounded bottoms and smoothed walls, and were obviously refilled very sudden.

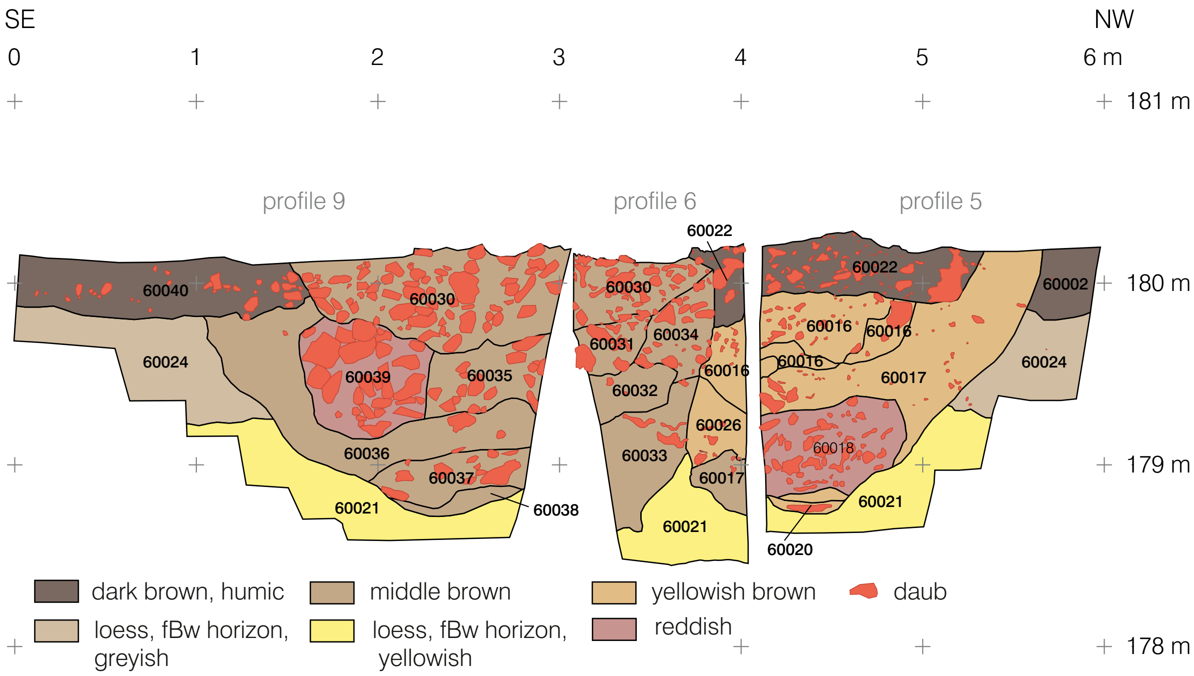


Fig. 41. Pit 60. The cross section, cf. Fig. 39–41.

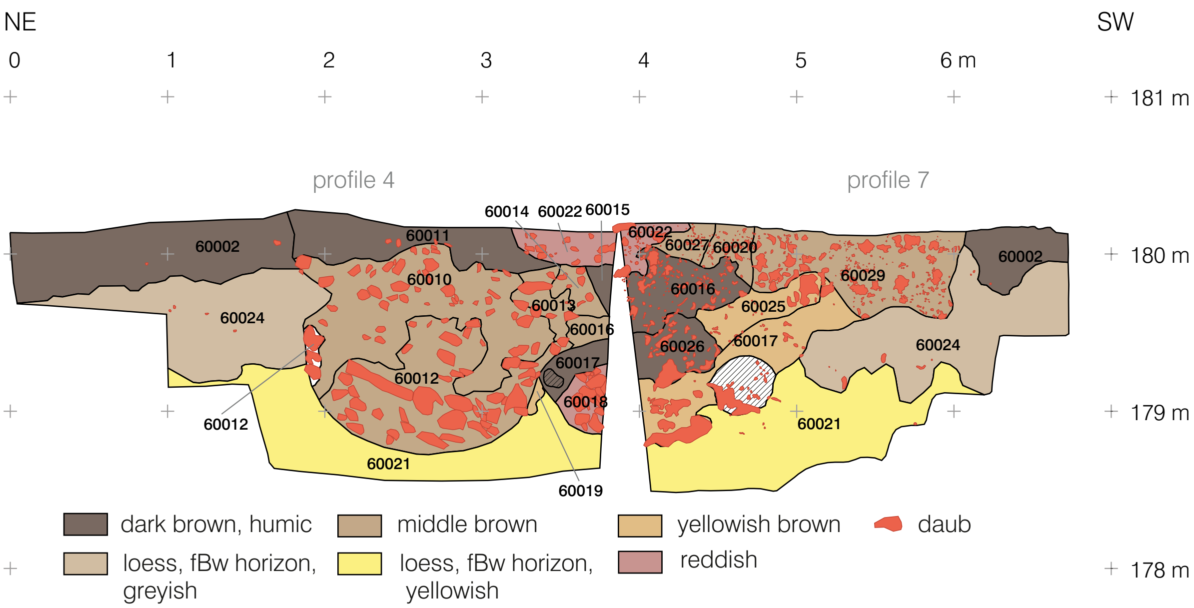


Fig. 42. Pit 60. The cross section, cf. Fig. 39–41.

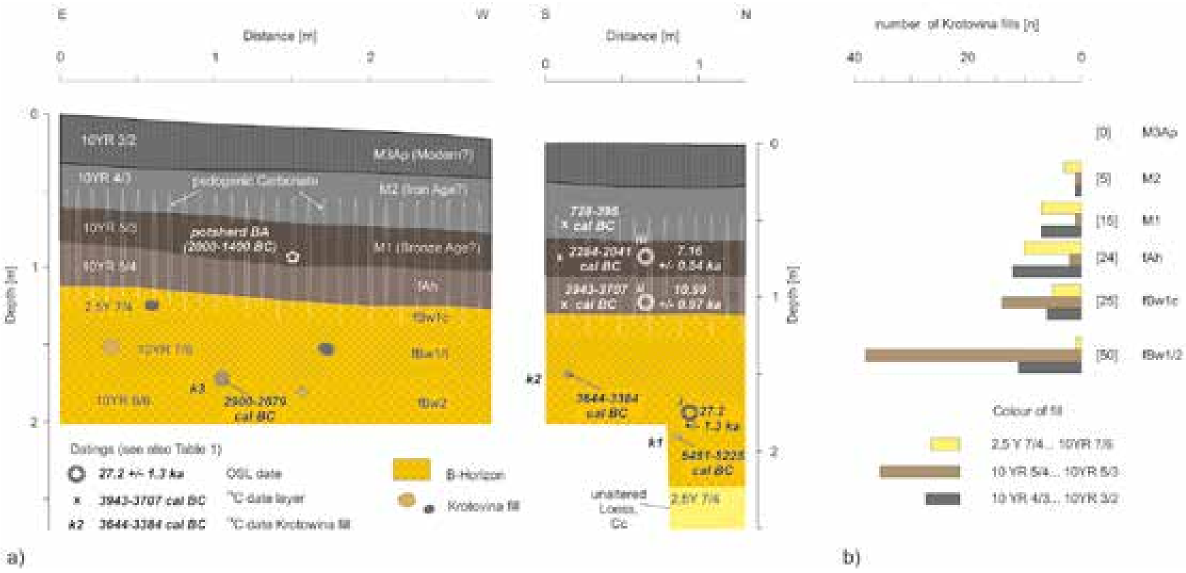


Fig. 43. Trench 70, stratigraphy: a) Scaled drawing with age data. fBw: buried cambic horizon, fAh: buried humus surface horizon, M1–3: colluvial layers (M: lat. migrare). b) Number and colour of krotovina fills from different horizons and layers.

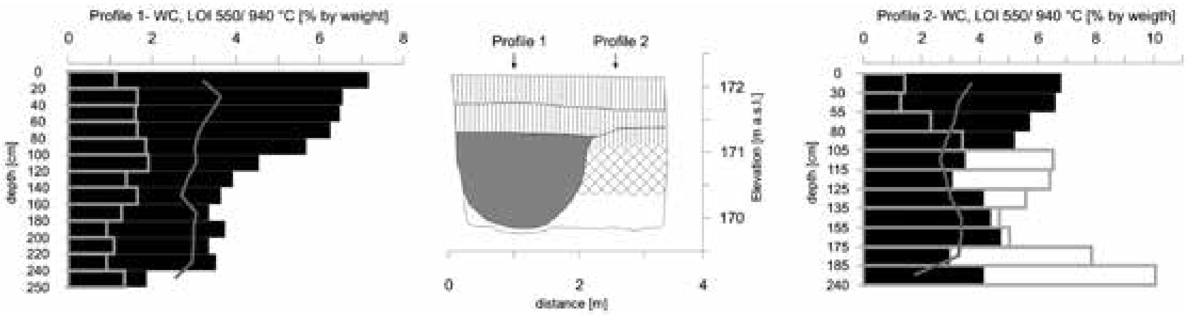


Fig. 44. Trench 52. The sedimentological analyses confirmed a humic-A-horizon at the surface during the Late Trypillia occupation (see text).

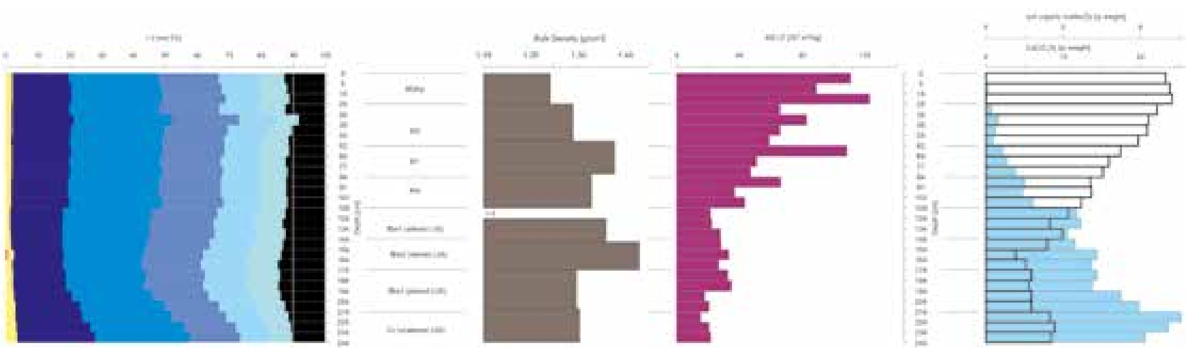


Fig. 45. Trench 70. The grain size distribution, bulk density, magnetic susceptibility, organic matter, and carbonate content of samples from the east-profile.

	Nb	Zr	Y	Sr	Rb	Pb	Zn	Fe	Mn	Ti	Ba	Ca	K	Al	P	Si	S	Mg	org_c	ton
Nb	0	0.00308	0.00158	0.00001	0.00000	0.00646	0.00679	0.00015	0.00002	0.00031	0.00147	0.00001	0.00017	0.00082	0.00107	0.00009	0.08085	0.12955	0.00787	0.81883
Zr	0.55761	0	0.00000	0.00000	0.00000	0.00206	0.16401	0.04196	0.00001	0.00012	0.03033	0.00000	0.00000	0.07454	0.00000	0.00000	0.71771	0.00019	0.00000	0.00396
Y	0.58814	0.80057	0	0.00000	0.00000	0.00043	0.00144	0.00005	0.00000	0.00000	0.01571	0.00000	0.00000	0.00014	0.00000	0.00000	0.02278	0.07974	0.00005	0.43885
Sr	-0.76375	-0.82005	-0.89320	0	0.00000	0.00006	0.00031	0.00000	0.00000	0.00000	0.00327	0.00000	0.00000	0.00003	0.00000	0.00000	0.03861	0.01736	0.00002	0.52047
Rb	0.80603	0.80966	0.86602	-0.98437	0	0.00003	0.00008	0.00000	0.00000	0.00000	0.00148	0.00000	0.00000	0.00004	0.00000	0.00000	0.08089	0.01907	0.00001	0.49214
Pb	0.52011	0.57635	0.63980	-0.70632	0.72284	0	0.00232	0.00012	0.00001	0.00073	0.04922	0.00001	0.00049	0.00127	0.00037	0.00006	0.70117	0.25581	0.00089	0.74300
Zn	0.51737	0.28122	0.59214	-0.65162	0.69651	0.57093	0	0.00000	0.00011	0.00079	0.02447	0.00071	0.00596	0.00002	0.06117	0.00297	0.16833	0.65382	0.10568	0.25069
Fe	0.67633	0.40166	0.71029	-0.81524	0.82490	0.68353	0.84680	0	0.00000	0.00000	0.00249	0.00001	0.00007	0.00000	0.01895	0.00005	0.00689	0.95272	0.07847	0.11628
Mn	0.73664	0.74827	0.84578	-0.95094	0.95332	0.75324	0.68456	0.86178	0	0.00000	0.00073	0.00000	0.00000	0.00002	0.00000	0.00000	0.14421	0.05769	0.00002	0.73577
Ti	0.65149	0.68446	0.83009	-0.88062	0.87727	0.62013	0.61660	0.84591	0.86427	0	0.00486	0.00000	0.00000	0.00000	0.00005	0.00000	0.01403	0.22933	0.00214	0.95804
Ba	0.59121	0.42525	0.46876	-0.55467	0.59084	0.38948	0.44006	0.56763	0.61978	0.53504	0	0.00110	0.03434	0.00300	0.07865	0.00294	0.76142	0.96350	0.04728	0.72809
Ca	-0.74676	-0.87745	-0.89197	0.97707	-0.97719	-0.74627	-0.62094	-0.76581	-0.95334	-0.86655	-0.60353	0	0.00000	0.00022	0.00000	0.00000	0.14991	0.01390	0.00000	0.30136
K	0.67160	0.86293	0.92695	-0.94435	0.91829	0.63533	0.52435	0.69903	0.85612	0.87899	0.41642	-0.93238	0	0.00021	0.00000	0.00000	0.01169	0.01911	0.00002	0.24244
Al	0.61548	0.35568	0.67918	-0.72011	0.71730	0.59735	0.73998	0.90093	0.73521	0.81188	0.55890	-0.66366	0.66563	0	0.03143	0.00005	0.00923	0.32267	0.20804	0.03046
P	0.60476	0.94278	0.80266	-0.84197	0.84035	0.64575	0.37217	0.45689	0.77115	0.70722	0.35108	-0.87579	0.88343	0.42274	0	0.00000	0.70041	0.00018	0.00000	0.01723
Si	0.69289	0.89905	0.92190	-0.94786	0.93806	0.70402	0.55931	0.71053	0.89714	0.88850	0.55976	-0.96346	0.96135	0.70876	0.91265	0	0.13567	0.02686	0.00000	0.25142
S	-0.34869	-0.07446	-0.44484	0.40786	-0.34865	-0.07903	-0.27848	-0.51664	-0.29447	-0.47574	-0.06256	0.29054	-0.48672	-0.50037	-0.07924	-0.30060	0	0.52477	0.47279	0.10092
Mg	-0.30516	-0.66793	-0.34989	0.46252	-0.45650	-0.23119	0.09230	0.01223	-0.37692	-0.24417	0.00944	0.47631	-0.45637	0.20188	-0.67050	-0.43370	-0.13062	0	0.00022	0.00013
org_c	0.50934	0.92612	0.71002	-0.73935	0.75096	0.61218	0.32460	0.35128	0.73111	0.57463	0.39258	-0.82977	0.73902	0.25535	0.89972	0.81061	0.14727	-0.66343	0	0.00220
ton	0.04722	-0.54534	-0.15866	0.13197	-0.14097	0.06755	0.23363	0.31561	-0.06952	-0.01085	0.07162	0.21077	-0.23763	0.42495	-0.46299	-0.23328	-0.32886	0.68009	-0.57327	0

Fig. 46. Trench 70. The total elemental composition is dominated by Si, Ca, Al, and Fe, reflecting the minerals of the parent material (Tab. 15). The correlation matrix reveals some elements clustering together and processes that explain this behaviour.

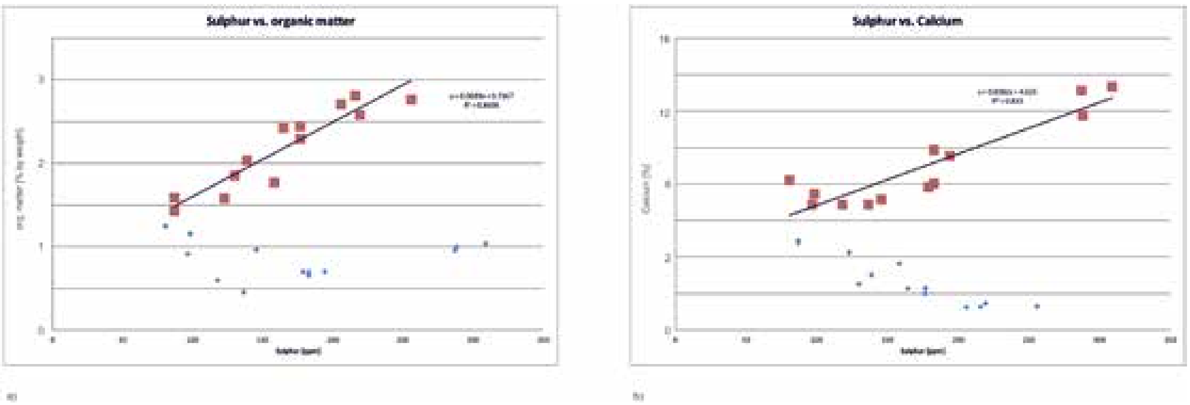


Fig. 47. Trench 70. Sulphur vs. organic matter, sulphur vs. calcium.

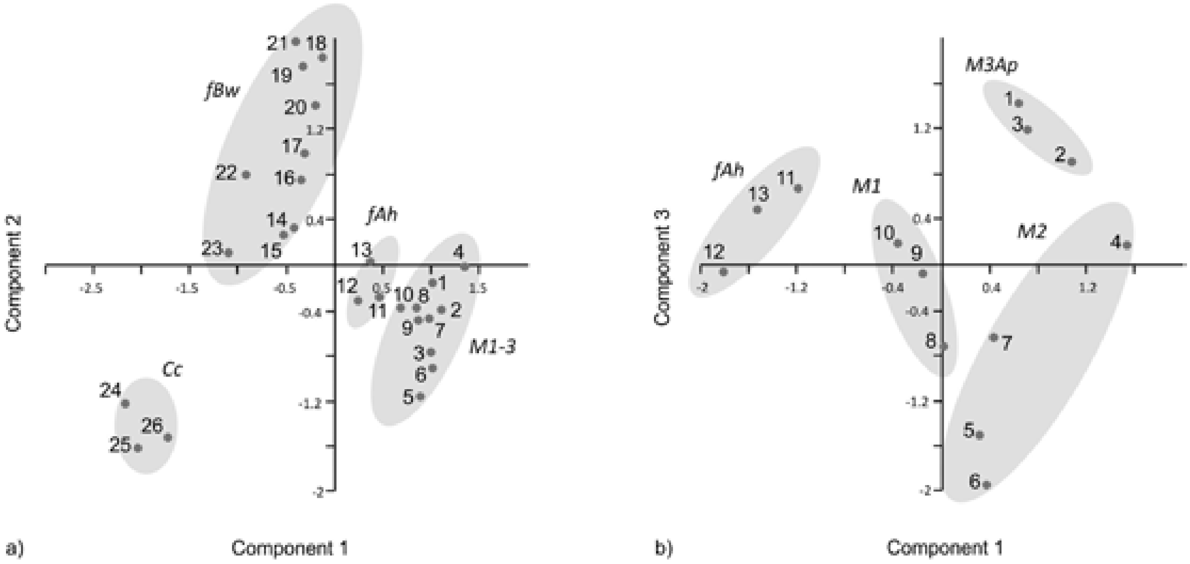


Fig. 48. Trench 70. The PCA scatterplot (1st Component: 64.5%, 2nd Component: 16.6%) shows that the specific properties of the unaltered loess, the buried Bw horizon, and the horizons and layers (colluvial sediments) enriched in soil organic matter cluster clearly in separate groups (a). A separate analysis of the upper part of the sequence (b) results in 4 clusters representing the layers and horizons identified in the field as well (PCA, correlation, 1st component: 46.1%, 2nd component: 17.4%, 3rd component: 11.1%).

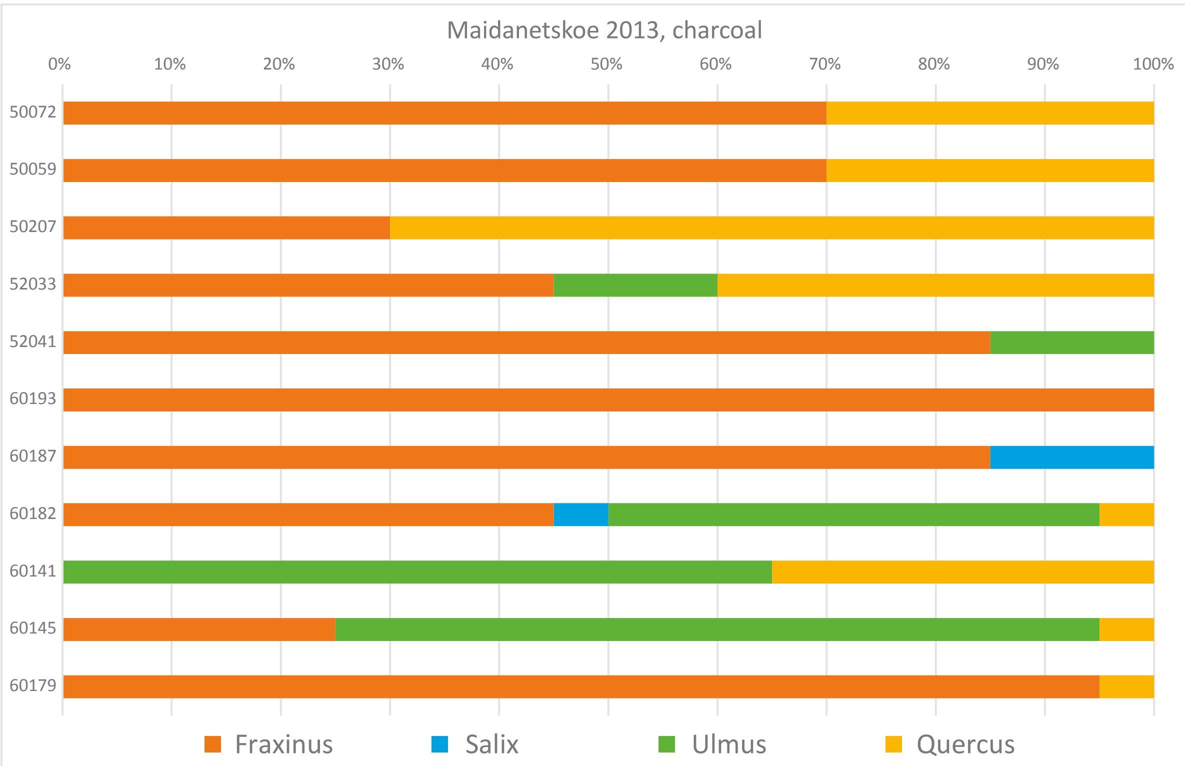


Fig. 49. The charcoal assemblage from pit fills (trenches 50, 52 and 60), excavation campaign Maidanetske 2013.

Forest steppes (deciduous broadleaved forests or xerotryphic shrubs alternating with meadow steppes or dry grassland)
Herb-grass steppes/Grass steppes and desert steppes
Beech and mixed beech forests
Mixed oak-hornbeam forests
Lowland to submontane acidophilous oak and mixed oak forests, poor in species
Caucasian mixed hornbeam-oak forests

Fig. 50. Natural vegetation: The distribution of forest, forest steppe and true bunch grass steppe in the west Pontic plant region (after Bundesamt für Naturschutz 2004).

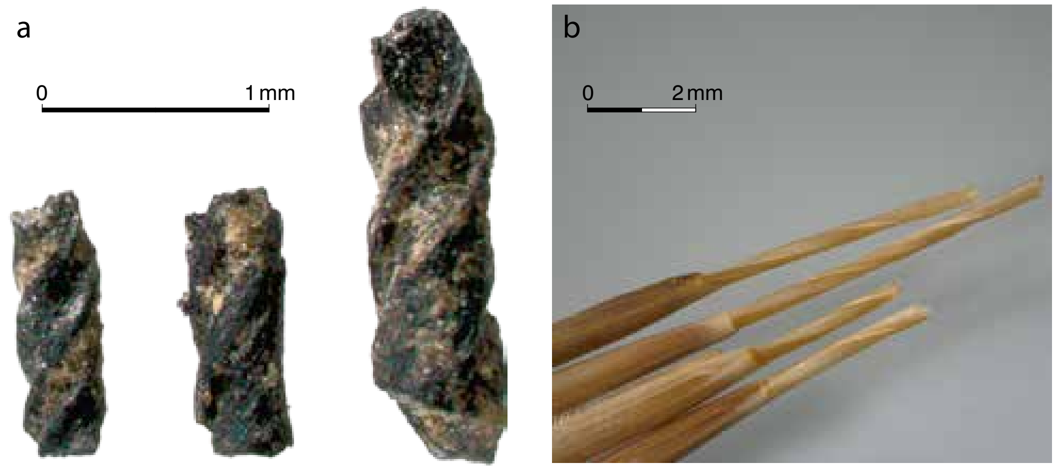


Fig. 51. a) cf. Stipa (feathergrass), charred awn fragments, sample 51182_12; b) Modern Stipa ucrainica, Botanical Garden, Halle University, Germany.

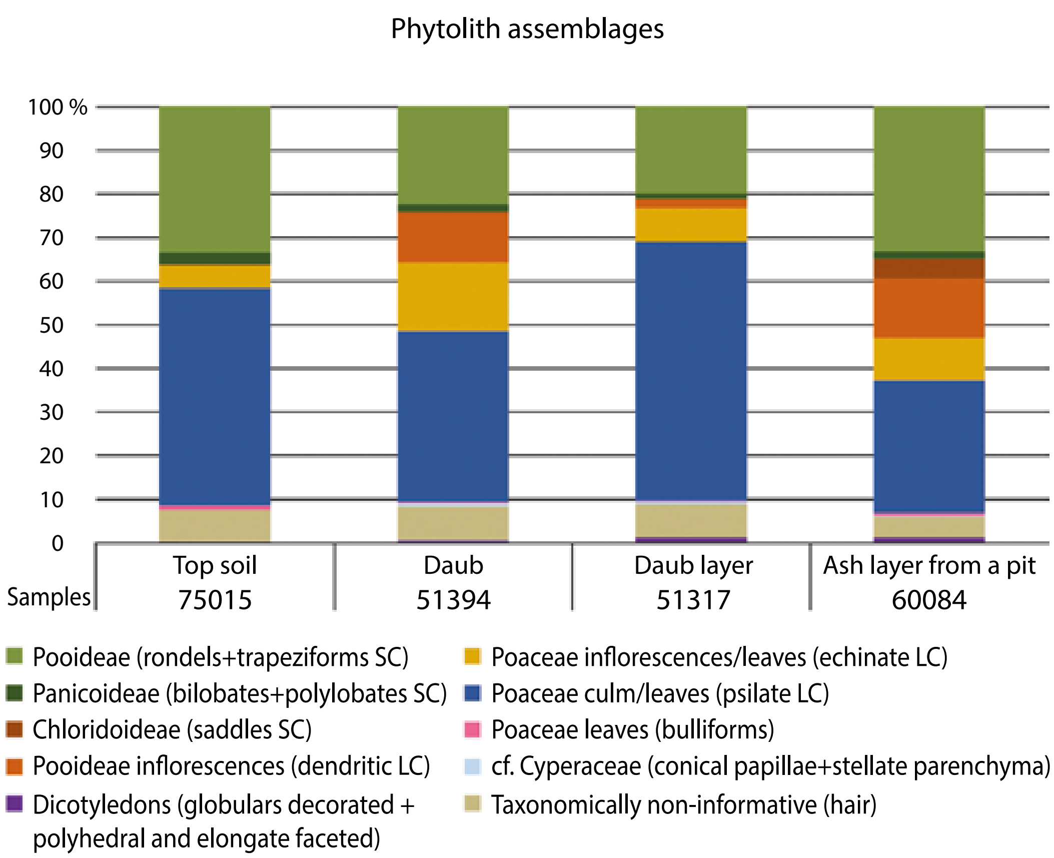


Fig. 52. The phytolith assemblage from Maidanetske 2013. Percentage values of the plant taxonomic groups and the grass plant parts identified on the basis of the phytolith morphotypes (specified in brackets). For silica skeletons the percentage values have been obtained on the sum of phytoliths from identifiable morphotypes plus silica skeletons (Jenkins et al. 2011). Abbreviations: SC = short cell; LC = long cell.

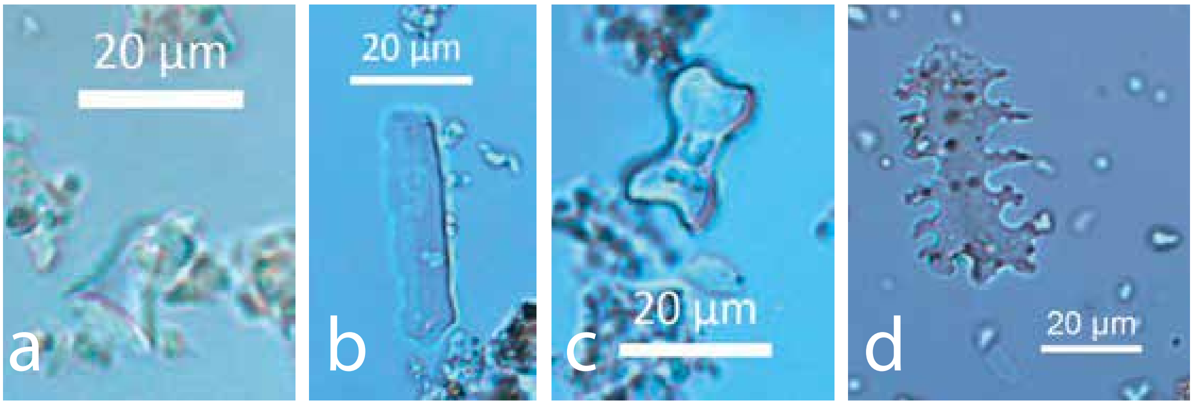


Fig. 53. The main phytolith morphotypes in the assemblages from Maidanetske 2013 give indications of Pooideae (a. rondel, b. trapeziform), Panicoideae (c. bilobate), and pooid cereal chaff (d. dendritic long cell) (photographs M. Dal Corso).

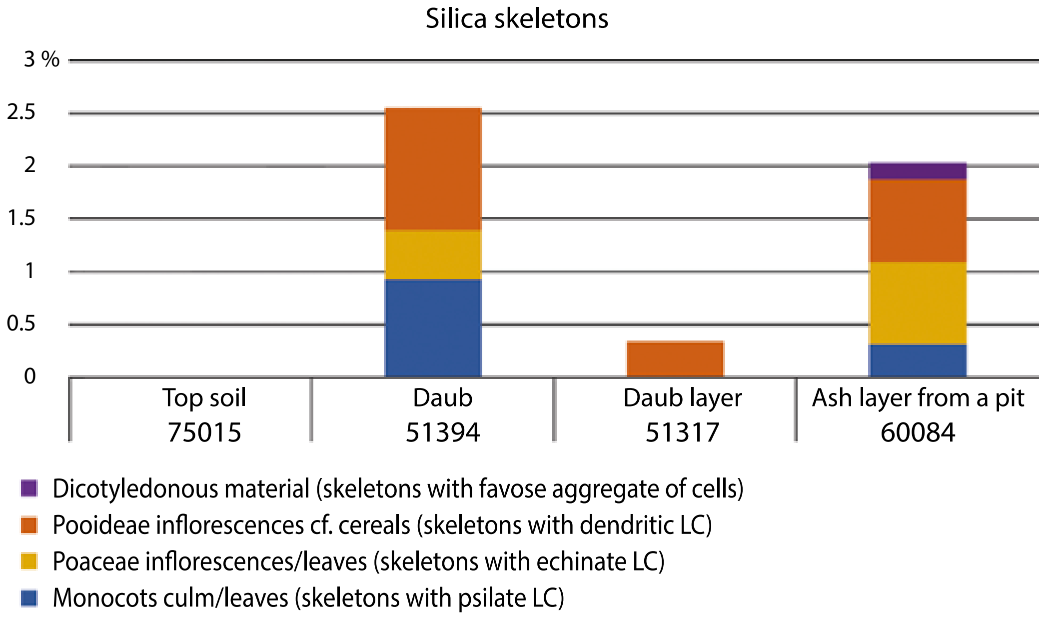


Fig. 54. The silica skeleton assemblage from the 2013 excavation campaign in Maidanetske according to archaeological context. LC = long cells.

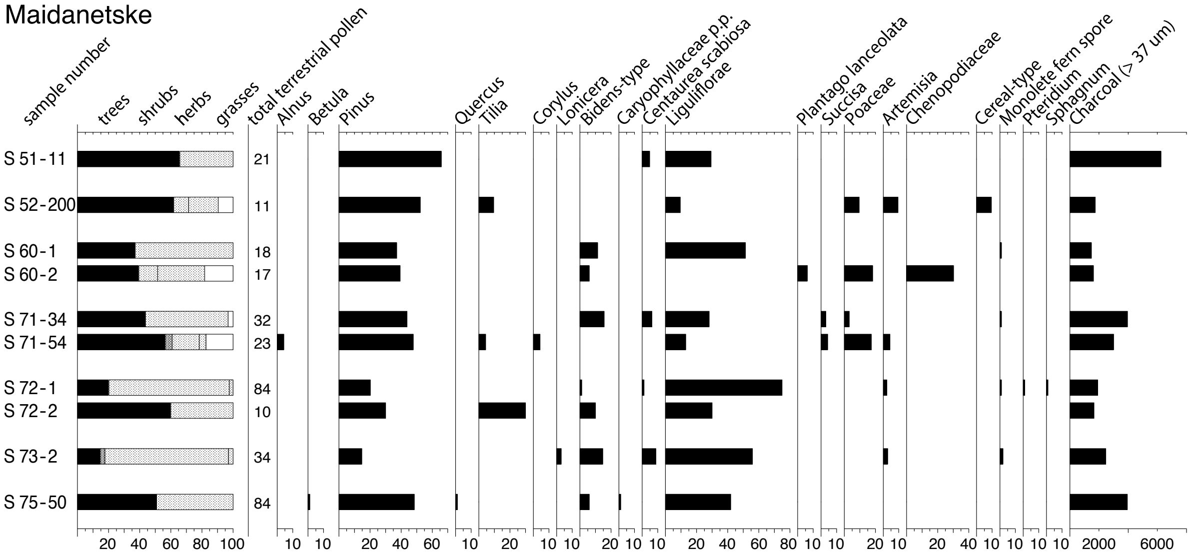


Fig. 55. On-site pollen spectra (Trenches 51, 52, 60, 71, 72, 73, 75), excavation campaign Maidanetske 2013. Percentage values based on the terrestrial pollen sum (analyses: Carola Floors/Walter Dörfler).

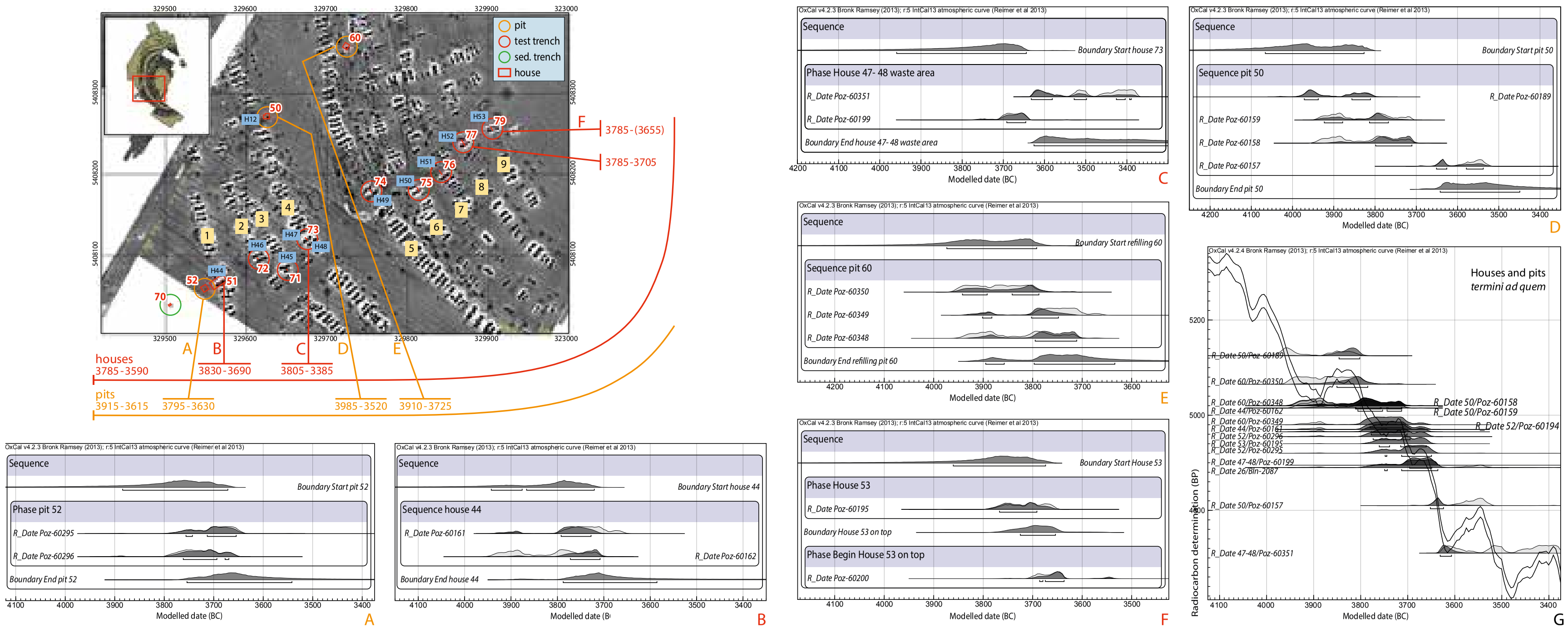


Fig. 56. Model of ^{14}C-dates from Maidanetske. The sequential calibration of 6 groups of dates, which are related to different houses and pits, indicates the most probable chronological timeframe for the features. While for house 44, pit 50, and pit 60 the stratigraphic order of the samples could be integrated in the calculation, in all other cases phases were indicated by ^{14}C-dates of non-stratigraphic order. The median of each boundary calculation was used to display the most probable range for the dates in relation to their spatial order (cf. Müller, 2014 et al.; Bronk Ramsey, 2009; Reimer, et al. 2013).

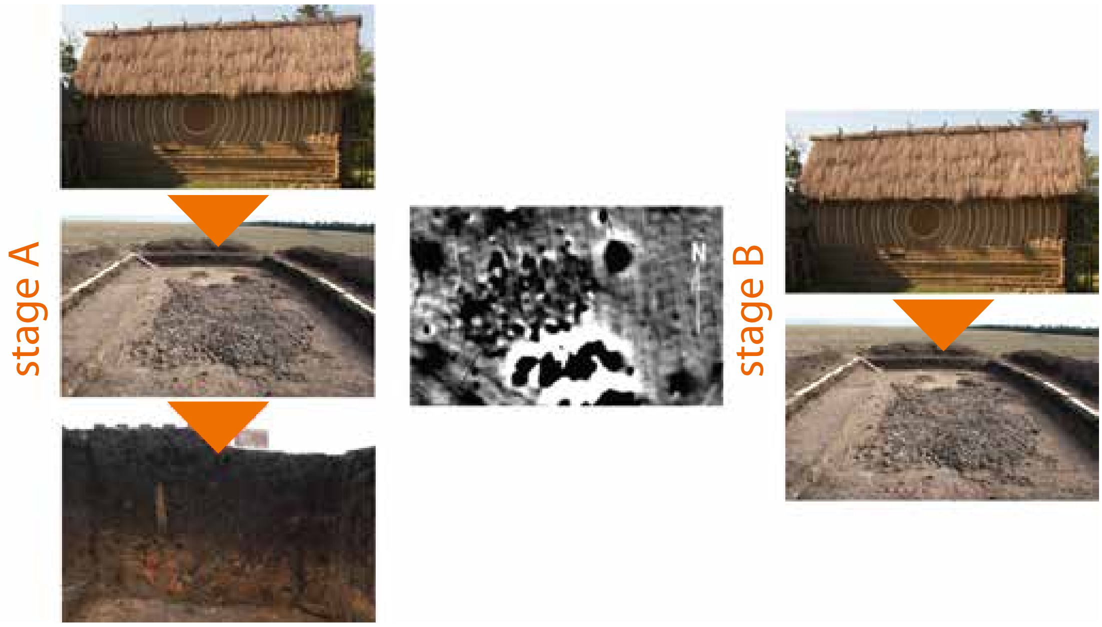


Fig. 57. Model of depositional activities related to pit 60. Judging by the ^{14}C-dates, part of a house was deposited in the pit in the 39th century BCE.

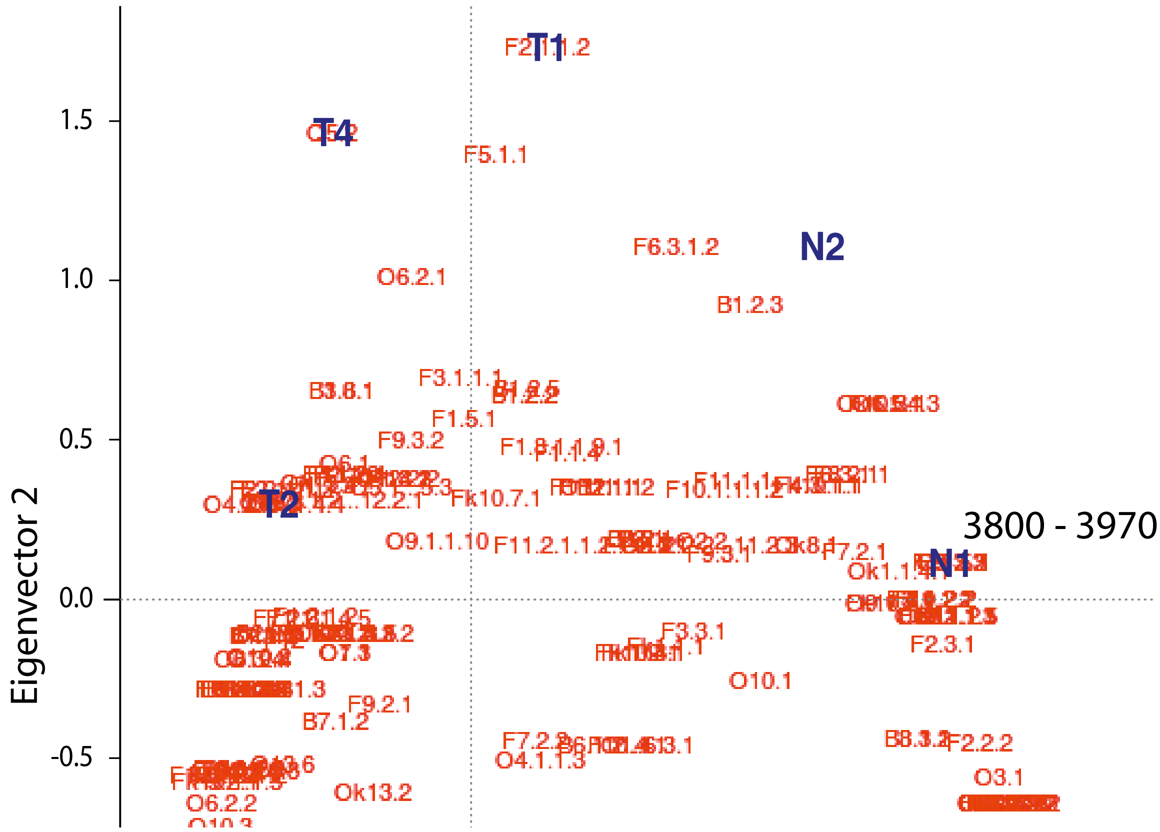


Fig. 58. Comparison of the ^{14}C dates from Maidanetske, Taljanky etc.

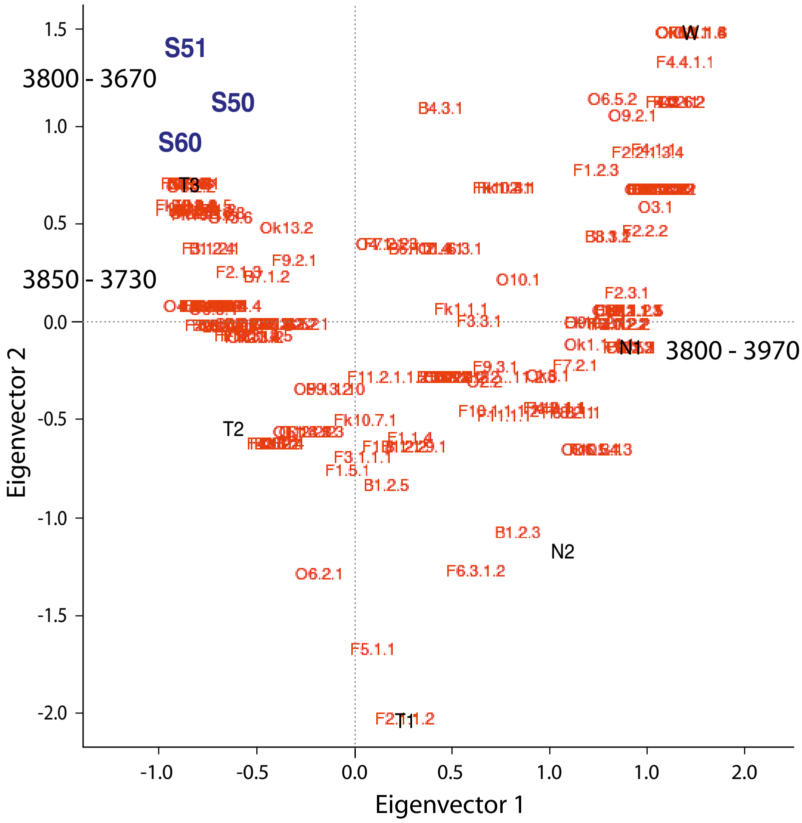


Fig. 59. Correspondence analyses of ceramic shapes and ornamentation types of the Volodymyrivska-Nebelivska-Tomashivska local group sub-phases (BII/CI T 1–3) that were developed by Ryzhov (1999). In addition, inventories of the 2013 Maidanetske excavation are added. The ^{14}C-dates indicate chronological tendencies (Graphic: Lennart Brandtstätter/Johannes Müller, UFG Kiel).

References

Albert et al., 2008
Albert, R. M./ Shahack-Gross, R./ Cabanes, D./ Gilboa, A./ Lev-Yadun, S./ Portillo, M./ Sharon, I./ Boaretto, E./ Weiner, S., 2008. Phytolith-rich layers from the Late Bronze and Iron Ages at Tel Dor (Israel): mode of formation and archaeological significance. Journal of Archaeological Science 35: 57–75.

Alexandrovskiy/Chichagova, 1998
Alexandrovskiy, A.L./ Chichagova, O.A., 1998. Radiocarbon age of Holocene palaeosols of the East European forest-steppe zone. Catena, 34: 197–207.

Ball et al., 2009
Ball, T.B./ Ehlers, R./ Standing, M.D., 2009. Review of typologic and morphometric analysis of phytoliths produced by wheat and barley. Breeding Sciences 59: 505–512.

Bieniek/Pokorny 2005
Bieniek, A. and Pokorny, P., 2005. A new find of macrofossils of feather grass (*Stipa*) in an Early Bronze Age storage pit at Vlineves, Czech Republic: local implications and possible interpretation in a Central European context. Vegetation History and Archaeobotany 14: 295–302.

Boden 2005
Boden, A.G., 2005. Bodenkundliche Kartieranleitung, 5th edn. AG Boden; Hannover.
Bogaard/Jones 2007
Bogaard, A./ Jones, G., 2007. Neolithic farming in Britain and central Europe: contrast or continuity? In: Whittle, A./ Cummings, V. (eds.), Going over: the Mesolithic-Neolithic transition in north-west Europe. Oxford University Press, Oxford, 357–375.

Bond et al., 1997
Bond, G./ Showers, W./ Cheseby, M./ Lotti, R./ Almasi, P./ Demenocal, P./ Priore, P./ Cullen, H./ Hajdas, I./ Bonani, G., 1997. A Pervasive Millennial-Scale Cycle in North Atlantic Holocene and Glacial Climates. Science, 278: 1257–1266.

Borisov et al., 2005
Borisov, A.V./ El'tsov, M.V./ Shishlina, N.I./ Demkina, T.S./ Demkin, V.A., 2005. Paleosol studies of kurgans of the Catacomb Culture second half of the third Millennium B.C. in Kalmykia. Eurasian Soil Science, 38: 123–131.

Brandtstätter, in print
Brandtstätter, L., in print. Die Keramik aus Maidanetske im Tripolje-Zusammenhang. Journal of Neolithic Archaeology.

Bronk Ramsey, 2009
Bronk Ramsey, C., 2009. Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1): 337–360.

Brown, 1987
Brown, B.M., 1987. Population Estimation from Floor Area. A Restudy of "Naroll's Constant". Cross-Cultural Research, 21: 1–49.

Bundesamt für Naturschutz (BfN)/ Federal Agency for Nature Conservation (2004) Karte der natürlichen Vegetation Europas/ Map of the Natural Vegetation of Europe, Maßstab/ Scale 1 : 2,500,000.

Erläuterungstext, Legende, Karten/ Explanatory Text, Legend, Maps. Münster: Landwirtschaftsverlag. Interactive CD-rom/ Interactive CD-rom. http://www.floraweb.de/vegetation/dnld_eurovegmap.html , latest access date: 24.05.2015

Butler, 1959
Butler, B.E., 1959. Periodic phenomena in landscapes as a basic for soil studies. CSIRO, Soil Publ. 14, Canberra, Australia.

Campbell et al., 1967
Campbell, C.A./ Paul, E.A./ Rennie, D.A., 1967. Factors affecting the accuracy of the carbon-dating method of soil humus studies. Soil Science, 104: 81–85.

Casselberry, 1974
Casselberry, S.E., 1974. Further refinement of formulae for determining population from floor area. World Archaeology, 6: 117–124.

Chapman et al., 2014a
Chapman, J./ Videiko, M.Y./ Gaydarska, B./ Burdo, N./ Hale, D., 2014. Architectural differentiation on a Trypillia mega-site: preliminary report on the excavation of a mega-structure at Nebelivka, Ukraine. Journal of Neolithic Archaeology, 16: 135–157.

Chapman et al. 2014b
Chapman, J./ Videiko, M.Y./ Hale, D./ Gaydarska, B./ Burdo, N./ Rassmann, K./ Mischka, C./ Müller, J./ Korvin-Piotrovskiy, A.G./ Kruts, V., 2014. The Second Phase of the Trypillia Mega-Site Methodological Revolution: A New Research Agenda. Journal of European Archaeology, 17: 369–406.

Chernovol 2008
Chernovol, D., 2008. Interioir of the Tripolian house. In: Korvin-Piotrovskiy, A.G./ Menotti, F. (eds.), Tripolye Culture Culture in Unkraine: The Giant Settlement of Talianki, Kiew, 177–191.

Chernovol 2012
Chernovol, D., 2012. Houses of the Tomashovskaya local group. In: Menotti, F./ Korvin-Piotrovskiy, A.G. (eds.), The Tripolye Culture Giant-Settlements in Ukraine, 182–209.

Ciuk, 2008
Ciuk, K. (eds.), 2008. Mysteries of Ancient Ukraine: The Remarkable Trypilian Culture, 5400–2700 BC, Toronto.

Dalfes et al., 1997
Dalfes, H.N./ Kukla, G./ Weiss, H., 1997. Third Millenium BC Climate Change and Old World Collapse. Springer, Berlin.

Demkin et al. 2004
Demkin, V.A., El'tsov, M.V., Alekseev, A.O., Demkina, T.S., Alekseeva, T.V., Borisov, A.V., 2004. Soil development in the lower Volga area during the historical period. Eurasian Soil Science, 37: 1324–1333.

Diachenko 2012
Diachenko, A., 2012. Settlement System of West Tripolye Culture in the Southern Bug and Dnieper Interfluve. Formation Problems. In: Menotti, F./Korvin-Piotrovskiy, A. (eds.), The Tripolye Culture Giant-Settlements in Ukraine, 116–138.

Diachenko/Menotti 2012
Diachenko, A./Menotti, F., 2012. The gravity model: monitoring the formation and development of the Tripolye culture giant-settlements in Ukraine. Journal of Archaeological Science, 39: 2810–2817.

Doniţă/Karamyševa, 2003
Doniţă, N./ Karamyševa, Z.V., with contributions by Attila Borhidi and Udo Bohn, 2004. Forest Steppes (Meadow Steppes Alternating with Nemoral Deciduous Forests) and Dry Grasslands Alternating with Dry Scrub. In: Bundesamt für Naturschutz (BfN) (eds.) U. Bohn/ R. Neuhäusl & G. unter Mitarbeit von Gollub et al.. (2000/2003): Karte der natürlichen Vegetation Europas/Map of the Natural Vegetation of Europe. Maßstab/Scale 1:2.500.000. Teil 1: Erläuterungstext mit CD-ROM; Teil 2: Legende; Teil 3: Karten. Münster: Landwirtschaftsverlag, pp. 375–89.

Dreibrodt et al., 2009
Dreibrodt, S./ Nelle, O./ Lütjens, I./ Mitusov. A./ Clausen, I./ Bork, H-R., 2009. Investigations on buried soils and colluvial layers around Bronze Age burial mounds at Bornhöved (northern Germany): an approach to test the hypothesis of ‘landscape openness’ by the incidence of colluviation. The Holocene, 19,3: 487–497.

Dreibrodt et al., 2010
Dreibrodt, S./ Lubos, C./ Terhorst, B./ Damm, B. Bork, H-R., 2010. Historical soil erosion by water in Germany: scales and archives, chronology, research perspectives. Quaternary International, 222: 80–95.

Dreibrodt et al., 2013
Dreibrodt, S./ Jarecki, H./ Lubos, C./ Khamnueva, V.S./ Klamm, M./ Bork, H.-R., 2013. Holocene soil formation and erosion at a slope beneath the Neolithic earthwork Salzmünde (Saxony-Anhalt, Germany). Catena 107: 1–14.

Dudkin 1978
Dudkin, V.P., 1978. Geofizicheskaya razvedka krupnih tripol’skih poselenii. In: Genining, V.F. (eds.), Ispol’zovanie metodov estestvennih nauk v arheologii, Kyiv, 35–45.

Fullagar/Field, 1997
Fullagar, R./ Field, J., 1997. Pleistocene seed-grinding implements from the Australian arid zone. Anitquity 71: 300–307.

Fuller/McClatchie, 2014
Fuller, D.Q./ Stevens, C. / McClatchie, M., 2014. Routine activities, tertiary refuse, and labor organization: social inferences from everyday archaeobotany. In: Madella, M./ Lancelotti, C./ Savard, M. (eds), Ancient Plants and People. Contemporary Trends in Archaeobotany, Tuscon Press, Arizona, 174–217.

Gerasimenko, 1997
Gerasimenko, N., 1997. Environmental and Climatic Changes between 3 and 5 ka BP in southeastern Ukraine. In: Dalfes, H.N./ Kukla, G./ Weiss, H. (eds.), Third Millennium BC Climate Collapse and Old World Change, Springer, Berlin, 371–399.

Gluza, 2013
Gluza, I. (2013) Plant impressions on the ceramics. In: Kadrow, Sławomir (ed.): Tripolye culture from the Werteba and the Ogród sites. TOM V, Biblioteka Muzeum Archeologicznego w Krakowie. Krakow.

Harvey/Fuller 2005
Harvey, E.L./ Fuller, D.Q., 2005. Investigating crop processing using phytoliths analysis: the example of rice and millets. Journal of Archaeological Science, 32: 739–752.

Hilgers et al., 2001
Hilgers, A./ Gehrt, E./ Janotta, A./ Radtke, U., 2001. A contribution to the dating of the northern boundary of the Weichselian Loess Belt in Northern Germany by luminescence dating and pedological analysis. Quaternary International, 76/77: 191–200. http://boplan.pereplut.net/index.html abgerufen am 17.01.2015. http://de.climate-data.org/ abgerufen am 31.12.2014.

James, 2014
James, L.A., 2014. Legacy sediment: Definitions and processes of episodically produced anthropogenic sediment. Anthropocene, 2: 16–26.

Kadrow, 2013
Kadrow, S., 2013. Werteba site in Bilcze Zlote: recent research and analyses. In: Kadrow, S. (ed.), Bilce Zlote. Materials from the Werteba and the Ogród sites, Karków, 13-21.

Kay, 1998
Kay, B.D., 1998. Soil Structure and Organic Carbon: a Review. In: Lal, R./ Kimble, J.M./ Follett, R.F./ Stewart, B.A. (eds.), Soil Processes And The Carbon Cycle, CRC Press Boston, 169–199.

Kirleis/Dal Corso 2015
Kirleis, W./ Dal Corso, M., 2015. Trypillian subsistence economy: Animal and plant exploitation. In: Müller, J., Rassmann, K. Videiko, M. (eds.), Tripolye-Megasites and European Prehistory 4100–3400 BCE. EAA – *Themes in contemporary archaeology*, Maney Publishing, London. In print.

Kirleis/Dreibrodt, 2015
Kirleis, W./ Dreibrodt, S., 2015. The natural background: Forest, forest steppe or steppe environment. In: Müller, J./ Rassmann, K./ Videiko, M. (eds.), Tripolye-Megasites and European Prehistory 4100–3400 BCE. EAA - *Themes in contemporary archaeology*, Maney Publishing, London. In print.

Kirleis et al., 2012
Kirleis, W./ Klooß, S./ Kroll, H./ Müller, J., 2012. Crop growing and gathering in the northern German Neolithic: a review supplemented by new results. Vegetation History and Archaeobotany, 21: 221–242. DOI: 10.1007/s00334-011-0328-9

Körber-Grohne, 1996
Körber-Grohne, U., 1996. Pflaumen, Kirschpflaumen, Schlehen.Heutige Pflanzen und ihre Geschichte seit der Frühzeit. Theiss, Stuttgart

Korvin-Piotrovskij et al., 2015
Korvin-Piotrovskij, A.G./ Hofmann, R./ Rassmann, K./ Videiko, M./ Brandtstätter L., 2015. Pottery Kilns in Trypillian settlements. Tracing the division of labour and the social organization of Copper Age communities) In: Müller, J./ Rassmann, K./ Videiko, M. (eds.), Tripolye-Megasites and European Prehistory 4100–3400 BCE. EAA – *Themes in contemporary archaeology*, Maney Publishing, London. In print.
Krementski, 1997

Krementski, C.V., 1997. The Late Holocene Environmental and Climate Shift in Russia and Surroundings Lands. In: Dalfes, H.N./ Kukla, G./ Weiss, H. (eds.), Third Millennium BC Climate Collapse and Old World Change, Springer, Berlin, 351–370.

Kruts et al., 2001
Kruts, V.A./ Korvin-Piotrovskiy, A.G./ Rizhov, S.N., 2001. Talianki – settelemnt-giant of the Tripolian culture. Investigations in 2001, Intstitute of archaeology of NASU.
Kruts, 2008
Kruts, V.A., 2008. Giant-Settlement of Talianki. In: Korvin-Piotrovkiy, A.G./Menotti, F. (eds.), Tripolye Culture in Ukraine: The Giant-Settlement of Talianki. Kiev: Institute of Archaeology of the NASU, 57–70.

Kruts 2012
Kruts, V.A., 2012. Giant-settlements of Tripolye culture. In: Menotti, F./ Korvin-Piotrovskiy, A.G. (eds.), The Tripolye Culture Giant-Settlements in Ukraine 2012, 70–78.

Kruts et al. 2013
Kruts, V.A., Korvin-Piotrovskiy, A.G./ Chabanyuk, V.V./ Shatilo, L. A., 2013. Talianki – settlement-giant of the tripolian culture. Investigations in 2012, Kiev.

Kruts et al. 2001
Kruts, V.A., Korvin-Piotrovskiy, A.G./ Rizhov, S.N., 2001. Talianki – settlement-giant of the Tripolian culture. Investigations in 2001.

Kruts et al. 2008
Kruts, V.A./ Korvin-Piotrovskiy, A.G./ Ryzhov, S.N./ Chernovol, D., 2008. The 2005–2006 research in Talianki. In: Korvin-Piotrovskiy, A.G./ Menotti, F. (eds.), Tripolye Culture Culture in Ukraine: The Giant Settlement of Talianki, Kiev, 82–108.

Kuzminova, 1991
Kuzminova, N.N., 1991. Crops and weeds in the Tripolye culture sites in Moldavia. In: Palaeoethnobotany and Archaeology. International Workgroup for Palaeoethnobotany, 8th symposium, Nitra-Nové Vozokany 1989. Acta Interdisciplinaria Archaeologica Tomus VII. Nitra 1991, 199–201.

Lu et al., 2009
Lu, H./ Zhang, J./ Wu, N./ Liu, K./ Xu, D./ Li, Q., 2009. Phytoliths Analysis for the Discrimination of Foxtail Millet (Setaria italica) and Common Millet (Panicum miliaceum). PLoS ONE 4(2): e4448.

Madella et al., 1998
Madella, M./ Powers-Jones, A.H./ Jones, M.K., 1998. A simple method of extraction of opal phytoliths from sediments using a non-toxic heavy liquid. Journal of Archaeological Sciences, 25(8): 801–803.

Menotti, 2012
Menotti, F.,2012. Introduction. In: Menotti F./ Korvin-Piotrovskiy A.G. (eds.), The Tripolye Culture Giant-Settlements in Ukraine, 1–5.

Menotti/Korvin-Piotrovskiy, 2012
Menotti F./ Korvin-Piotrovskiy, A.G. (eds.), 2012. The Tripolye Culture Giant-Settlements in Ukraine, Oxford.

Mitusov et al., 2009
Mitusov, A./ Mitusova, O.E./ Pusovoytov, K./ Lubos, C.C.-M./ Dreibrodt, S./ Bork, H.-R., 2009. Palaeoclimatic indicators in soils buried under archaeological monuments in the Eurasian steppe: a review. The Holocene, 19 (8): 1153–1160.

Müller et al. 2014
Müller, J./ Hofmann, R./ Rassmann, K./ Mischka, C./ Videyko, M.Y./ Burdo, N.B., 2014. Maydanetskoe: Investigations, Based on Updated Plan (Майданецкое: исследования по обновленному плану поселения). Stratum Plus, 2: 285-302.

Müller et al. 2015
Müller J./ Hofmann, R./ Ohlrau, R., From Domestic Households to Mega-Structures: Proto-Urbanism? In: J. Müller, K. Rassmann, M. Videiko, M. (Hrsg.), Trypillia Mega-sites and European Prehistory: 4100–3400 BCE. Themes in Contemporary Archaeology 2 (Leeds 2015) 253–268.
Munsell Soil Color Charts. 1992. Macbeth, Division of Kollmorgen Instruments, Corp., New York.

Naroll, 1962
Naroll, R. 1962. Floor Area and Settlement Population. American Antiquity, 27: 587–589.

Nocete 2014
Nocete, F., 2014. Southern Iberia in the 4th and 3rd Millennia Cal. BC. In: M. Almagro-Gorbea ed. Iberia. Protohistory of the far West of Europe: from Neolithic to Roman conquest. Universidad de Burgos: Burgos, 83–94.

Ohlrau, 2014
Ohlrau, R., 2014. Tripolje Großsiedlungen. Geomagnetische Prospektion und architektursoziologische Perspektiven (Christian-Albrechts-Universität zu Kiel 2014).

Pashkevich, 2014
Pashkevich, G., 2014. Data of the Trypillian Agriculture: New Palaeobotanical Evidence. In: Dumitroaia, G., Preoteasa, C. and Nicola, C.-D. (eds). Cucuteni Culture within the European Neo-Eneolithic Context. International Colloquium, Cucuteni 130, Abstracts. Piatra-Neamt, 24–27.

Pashkevich, 2011
Pashkevich, G., 2011. Value Bernašivka-1 for palaeoethnobotanical characteristics of early Tripolje. In: Korvin-Piotrovskiy, A. (ed.) Earliest farmers of southeastern Europe. Abstracts of International scientific conference. Kiev, 67–68.

Pashkevich/Videiko, 2006
Pashkevich, G./ Videiko, M., 2006. Ril'nictro plemen Tripìl'skoï kul'turi (Arable farming in the Tripillian culture). Kiev, 145.

Passek 1949
Passek, T.j.S., 1949. Periodization of Tripolian settlements. Materials and Studies in the Archaeology of the USSR 10, Moskau.

Paul et al., 1964
Paul, E.A./ Campbell, C.A./ Rennie, D.A./ McCallum, K.J., 1964. Investigations on the dynamics of soil humus utilizing carbon dating techniques. Int. congr. Soil Sci. Transact.8th, 201-208.

Pietsch, 2013
Pietsch, D., 2013. Krotovinas – soil archives of steppe landscape history. Catena, 104: 257–264.

Pietsch et al. 2014
Pietsch, D./ Kühn, P./ Lisitsyn, S./ Markova, A./ Sinitsyn, A., 2014. Krotovinas, pedogenic processes and stratigraphical ambiguities of the Upper Palaeolithic sites Kostenki and Borshchevo (Russia). Quaternary International, 324: 172-179.

Porčic, 2012
Porčic, M., 2012. Effects of Residential Mobility on the Ratio of Average House Floor Area to Average Household Size. Implications for Demographic Reconstructions in Archaeology. Cross Cultural Research, 46(1): 72–86.

Rassamakin/Menotti 2011
Rassamakin, J.J./ Menotti, F., 2011. Chronological development of the Tripolye Culture giant-settlement of Talianki (Ukraine): C14 dating vs. pottery typology. Radiocarbon, 53 (4): 645–657.

Rassmann et al. 2014
Rassmann, K./ Ohlrau, R./ Hofmann, R./ Mischka, C./ Burdo, N./ Videiko, M.Y./ Müller, J., 2014. High precision Tripolye settlement plans, demographic estimations and settlement organization. Journal of Neolithic Archaeology, 16: 96–134.

Rassmann et al. forthcoming
Rassmann K./ Scholz R./ Mertl, P./ Radloff, K./ Pendic, J./ Jablankovic, A., Belovode. Geomagnetic data as a proxy for the reconstruction of house numbers, population size and the internal spatial structure of Copper Age settlements.

Reimer et al., 2013
Reimer, P.J./ Bard, E./ Bayliss, A./ Beck, J.W./ Blackwell, P.G./ Bronk Ramsey, C./ Grootes, P.M./ Guilderson, T.P./ Haflidason, H./ Hajdas, I./ Hatt, C./ Heaton, T.J./ Hoffmann, D.L./ Hogg, A.G./ Hughen, K.A./ Kaiser, K.F./ Kromer, B./ Manning, S.W./ Niu, M./ Reimer, R.W./ Richards, D.A./ Scott, E.M./ Southon, J.R./ Staff, R.A./ Turney, C.S.M./ van der Plicht, J., 2013. IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. Radiocarbon, 55(4): 1869–87.

Ryzhov, 1990
Ryzhov, S.N., 1990. Mikrochronologiya tripoloskogo poseleniya u s. Taljanki. In: Zbenovich, V.G., (ed.) Rannezemledelcheskie poseleniya-giganty tripolskoj kultury na Ukraine. Tezisy dokladov pervogo polevogo seminara. Taljanki: Institute of Archaeology of the AS of the USSR, 83–90. Рыжов, С.Н. Микрохронология трипольского поселения у с. Тальянки. В сб.: В.Г. Збенович, ред. Раннеземледельческие поселения-гиганты трипольской культуры на Украине. Тезисы докладов первого полевого семинара. Тальянки: ИА АН УССР, с. 83–90.

Ryzhov, 1999
Ryzhov, S.N., 1999. Keramika poselen trypilskoi kultury Bugo-Dniprovskogo mezhyrichcha yak istorychne dzerelo (unpublished PhD Thesis). Kiev: Institute of Archaeology of the NASU. Рижов, С.М. 1999. Кераміка поселень трипільської культури Буго-Дніпровського межиріччя як історичне джерело (рукопис дисертації канд. істор. наук). Київ: Інститут археології НАНУ.

Ryzhov, 2012a
Ryzhov, S.N., 2012. Relative chronology of the giant-settlement period BII–CI. In: F. Menotti/ A. Korvin-Piotrovskiy (eds.), The Tripolye Culture Giant-Settlements in Ukraine, Oxford, 139–168.

Ryzhov, 2012b
Ryzhov, S.N., 2012. Tripolian pottery of the giant-settlements: characteristics and typology. In: F. Menotti/A. Korvin-Piotrovskiy (eds.), The Tripolye Culture Giant-Settlements in Ukraine, Oxford, 139–168.

Schön/Holter, 1988
Schön, W./ Holter, U., 1988. Zum Gebrauch von Mahl- und Schleifsteinen in der Ostsahara. Archäologische Informationen, 11: 156–60.

Shishkin, 1973
Shishkin, K.V., 1973. Z praktiki deshifruvannya aero-fotoznimkiv u arheologichnih tsiliyah. Arheologiya, 10: 32–41.

Shishkin, 1985
Shishkin, K.V., 1985. Planuvannya tripilskih poselen za danimi aerofotoziomki. Arheologiya, 52: 72–77.

Shmaglij/Videiko, 2003
Shmaglij, N.M./ Videiko, M.Yu.,   Maidanetskoe – Tripolskij protogorod (Kiev 2005). Н.М. Шмаглий, М.Ю. Видейко Майданецкое – трипольскийпро тогород (Киев 2005).

Sycheva, 2006
Sycheva, S.A., 2006. Long-term pedolithogenic rhythms in the Holocene. Quaternary International 152–153: 181–191.

Tan et al., 1986
Tan, K.H., Hajek, B.F./ Barshad, I., 1986. Thermal Analysis Techniques. In: Klute, A. (ed.), Methods of Soil Analysis. Soil Science Society of America, Madison, 151–183.

Videiko, 2003
Videiko, M.Y., 2003. Radiocarbon chronology of settlements of BII and CI stages of the Tripolye culture at the Middle Dnieper. In: Balitic-Pontic Studies. The foundations of radiocarbon chronology of cultures between the Vistula and Dnieper: 4000–1000 BC. Poznań, 7–21.

Videiko, 2012
Videiko, M.Y., 2012. Comprehensive Study of the Large Settlements of the Tripolye Culture: 1971–2011. Stratum Plus, 225–63.
Videiko, 2002
Videiko, M.Y., 2002. Trypil’ski protomista : istorija doslidžen’, Kiev.

Videiko, 2008
Videiko, M.Y., 2008. Trypil‘s‘ka cyvilizacija, Kiev.

Walter/Breckle, 1986
Walter, H./ Breckle, S.-W., 1986. Ökologie der Erde, Geo-Biosphäre. Band 3: Spezielle Ökologie der gemäßigten und arktischen Zonen Euro-Nordasiens. Zonobiom VI–IX. Fischer Verlag, Stuttgart.

Walter/Breckle, 1997
Walter, H./ Breckle, S.-W., 1997. Vegetation und Klimazonen. 7. Auflage, Ulmer, Stuttgart.

Wechler, 1994
Wechler, K.-P., 1994. Zur Chronologie der Tripolje - Cucuteni - Kultur aufgrund von 14C - Datierungen. Zeitschrift für Archäologie, 28: 7–21.

Yanushevich, 1978
Yanushevich, Z.V. (1978) Prehistoric Food Plants in the south-west of the Soviet-Union. Berichte der Deutschen Botanischen Gesellschaft 91 (1), Special Issue: Behre, K.-E., Lorenzen, H., Willerding, U. (eds.): Beiträge zur Paläo-Ethnobotanik von Europa. Stuttgart, 59–66.

Yanushevich, 1975
Yanushevich, Z.V. (1975) Fossil remains of cultivated plants in the south-west of the Soviet Union. Folia Quaternaria 46, 23–30.

Yanushevich, 1980
Yanushevich, Z.V., Zemledelie v rannem Tripolje (po dannym palaeobotaniki). In: Artemenko, I., (ed.). Pervobytnaya archeologiya:– poiski i nakhodki, Kiev: Naukova Dumka, 225–34. Янушевич, З.В. 1980. Земледелие в раннем Триполье (по данным палеобо таники). В сб.: И.И. Артеменко, ред. Первобытная археология: поиски и находки. Киев: Наукова думка, с. 225–34.

Acknowledgements

The authors would like to thank Javier Ruiz-Pérez of the IMF-CSIC laboratory in Barcelona, for processing the phytolith samples and Gwendolyn Peters and Heike Uhlworm, Kiel, for sorting the botanical macro remains. We are grateful for helpful advice to Helmut Kroll, Kiel.

Figure sources

Fig. 1 Knut Rassmann/Karin Winter

Fig. 2 Rassmann et al. 2014, 101 Fig. 5

Fig. 3 Rassmann et al. 2014, 111 Fig. 18

Fig. 4 Rassmann et al. 2014, 113 Fig. 21

Fig. 5 Stefan Dreibrodt

Fig. 6 René Ohlrau

Fig. 7 Johannes Müller/Karin Winter

Fig. 8 Rassmann et al. 2014, 117 Fig. 25

Fig. 9 Rassmann et al. 2014, 117 Fig. 26

Fig. 10 Rassmann et al. 2014, 119 Fig. 29

Fig. 11 Robert Hofmann/Karin Winter

Fig. 12 Photograph UFG

Fig. 13 Robert Hofmann/Johannes Müller/Karin Winter

Fig. 14 Robert Hofmann

Fig. 15 Robert Hofmann

Fig. 16 Photograph Mykhailo Videiko

Fig. 17 Photograph Mykhailo Videiko

Fig. 18 Photograph Mykhailo Videiko

Fig. 19 Photograph Mykhailo Videiko

Fig. 20 Photograph Mykhailo Videiko

Fig. 21 Robert Hofmann/Karin Winter

Fig. 22 Robert Hofmann/Johannes Müller/Karin Winter

Fig. 23 Photograph Mykhailo Videiko

Fig. 24 Photograph UFG

Fig. 25 Robert Hofmann

Fig. 26 Robert Hofmann

Fig. 27 Robert Hofmann

Fig. 28 Robert Hofmann

Fig. 29 Robert Hofmann

Fig. 30 Robert Hofmann

Fig. 31 Robert Hofmann

Fig. 32 Robert Hofmann

Fig. 33 Photograph UFG

Fig. 34 Robert Hofmann/Johannes Müller

Fig. 35 Photograph UFG

Fig. 36 Robert Hofmann

Fig. 36 Robert Hofmann

Fig. 37 Robert Hofmann

Fig. 38 Photograph UFG

Fig. 39 Robert Hofmann

Fig. 40 Photograph UFG

Fig. 41 Robert Hofmann

Fig. 42 Robert Hofmann

Fig. 43 Stefan Dreibrodt

Fig. 44 Stefan Dreibrodt

Fig. 45 Stefan Dreibrodt

Fig. 46 Stefan Dreibrodt

Fig. 47 Stefan Dreibrodt

Fig. 48 Stefan Dreibrodt

Fig. 49 Wiebke Kirleis/Karin Winter

Fig. 50 Marta Dal Corso

Fig. 51 Photographs Sara Jagiolla/Wiebke Kirleis

Fig. 52 Marta Dal Corso/Karin Winter

Fig. 53 Marta Dal Corso/Karin Winter

Fig. 54 Marta Dal Corso/Karin Winter

Fig. 55 Karola Floors/Walter Dörfler

Fig. 56 Karin Winter

Fig. 57 Mykhailo Videiko/Karin Winter

Fig. 58 Johannes Müller/Karin Winter

Fig. 59 Lennart Brandtstätter/Karin Winter