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The Pottery Kilns at the Copper and Late Roman Age Site Hariachkivka 8 (Ukraine): Magnetic Prospection and Archaeological Verification

***V. Rud** (Institute of Archaeology of the NAS of Ukraine), **R. Hofmann** (Collaborative Research Center 1266, Institute of Prehistoric and Protohistoric Archaeology, Kiel University),
V. Kosakivskyi (Vinnytsia State Pedagogical University named after M. Kotsiubynskyi),
O. Zaitseva (Borys Grinchenko Kyiv University), **J. Mueller** (Collaborative Research Center 1266, Cluster of Excellence ROOTS, Institute of Prehistoric and Protohistoric Archaeology, Kiel University)

SUMMARY

In 2018 and 2019, archaeological field research was conducted at the settlement of Hariachkivka 8 (left bank of the Dnister River). As a result of surface surveys, the existence of two cultural layers, one of the Cucuteni-Trypillia Cultural Complex (CTCC) of the Copper Age and the second of the Cherniakhiv culture of the Late Roman Age, was confirmed. The plan of the CTCC settlement and surrounding ditch was then investigated using magnetic survey. Against the "usual" circular settlement layout, the north-western location of the "megastructure" and two other large objects placed within the ring corridor identified as possible clay extraction pits were unusual. The settlement existed in the period around 4200-4100 BC (Trypillia BI-BII stage). Due to this fact, the kiln-like anomalies identified on the magnetic map of the settlement became the objects of further investigations, since no kilns from this period have yet been found in CTCC contexts. As a result of excavations, it was found that the anomalies are indeed kilns, but of the Cherniakhiv culture. At the same time, the uniqueness of the Copper Age settlement is not lost, as it is one of the earliest settlements in the CTCC with a circular spatial organization.



Introduction

Publications on objects for pottery firing show that kilns have been known in the Cucuteni-Trypillia Cultural Complex (CTCC) area since the end of the last century of the 5th millennium BC; that is since the Trypillia BII stage (*Diachenko and Sobkowiak-Tabaka, 2020; Rud et al., 2019*). On the other hand, evidence for the existence of kilns for pottery firing in the earlier stages of the CTCC is rather uncertain (*Tencariu 2015*), despite the existence of advanced pottery products, in particular during the Trypillia BI-BII stage.

Since 2015, the microregion around the city of Kryzhopil in modern Ukraine has been comprehensively studied over several archaeological field seasons. This area was densely populated during the Trypillia BI-BII stage. Several settlements were surveyed using the magnetic method. As a result, the site of Hariachkivka 8 proved to be the most promising for the study of pottery production.

Site

The Hariachkivka 8 site (48°18'49.1"N 28°45'54.7"E) is located near the Hariachkivka village in Tulchyn Raion, Vinnytsia Oblast, Ukraine (Fig. 1). The site occupies the slightly sloped promontory-like edge of the plateau of the Hariachkivka River (left bank basin of the Dnister River). Parent material within the settlement is loess.

The site was initially discovered by the fieldwalking surveys of V. T. Zahoruiko in 1993 (*Zagoruiko & Shumova, 1997*). Two cultural layers belonging to the Copper Age Trypillia culture and Late Roman Age Cherniakhiv culture were noted. The materials of the Cherniakhiv culture, which are located directly near the water sources (northern part of the site), are spread over a smaller area than the materials of the Trypillia culture.

Methods

Magnetometry was conducted in a 10.9 ha area within the Hariachkivka 8 site. The MAGNETO® MX V3 Survey System of the company SENSYS Sensorik & Systemtechnologie GmbH Bad Saarow (Germany) was used. The device was installed on a hand-pushed wheeled cart with eight sensors at intervals of 0.5 m and a total width of 3.5 m. The geomagnetic device was coupled to a GPS system (Leica, GNSS/GPS systems Viva GS 10), enabling continuous grid measurements (zigzag) in a short amount of time.

The QGIS application was used to collect and process all data from surface surveys and the magnetic survey conducted in 2018, as well as excavations in 2019. The world's coordinate system (reference ellipsoid WGS84, UTM-coordinate system, zone 35 North) was used for the geophysical measurements and excavation documentation.

Magnetic map characteristics and Cooper age settlement structure

Several categories of magnetic anomalies were found at the Hariachkivka 8 site (Fig. 1): 96 rectangular anomalies of the burnt ruins of wooden-clay buildings; 39 rectangular anomalies of structures that were either burned with less intensity or eroded; 195 anomalies of pits; two round anomalies identified as kilns; two areas of presumed clay sources; the linear anomaly of the ditch; and the anomalies of two straight linear structures, previously interpreted as traces of modern irrigation systems.

Considering the results of previous geomagnetic studies of CTCC settlements (e.g., *Rassman et al., 2014*), we are confident that most of the above-mentioned magnetic anomalies of the objects surrounded by the linear anomaly of the ditch belong to the Trypillia culture settlement. As a result, we have acquired a complete picture of the Hariachkivka 8 settlement with a 7.5 ha area.

Overall, the Trypillia culture settlement is arranged in two ovals, one within the other, separated by a ring corridor. The center of the settlement is partially built and mostly occupied by the pit anomalies. Outside the outer oval, the buildings are arranged in a long row parallel to the length of the oval (eastern part) or in short radial rows (southern and south-western parts). Within the circle corridor, magnetic anomalies are mostly absent. The exception is the north-western part, which contains several pits and a building. It appears that the presence of these objects is connected to the nearby location of the largest structure in the settlement, probably a megastructure, located in the inner circle. However, it is important to remember that this territory was occupied in the Late Roman Age as well. Surface or sunk structures of the Cherniakhiv culture are often represented by anomalies (*Bondar et*



al., 2022) similar to the pit anomalies of the Trypillia culture. That is, not all anomalies in this part of the site may belong to the Trypillia culture.

The chronology of two massive atypical objects in the south-eastern part of the settlement is clear, since their location within the circle corridor indicates that they belong to the Trypillia culture settlement. We have preliminarily interpreted them as collective sources of clay. Their presence in this part of the settlement may have influenced the location of the megastructure in the north-western part of the settlement instead of the typical eastern or north-eastern placement noted at other sites (*Hofmann et al.*, 2019). Also, the location of these objects seems to have affected the low density of buildings in the eastern part of the outer oval. That is likely why the densely built row to the east from the oval was created.

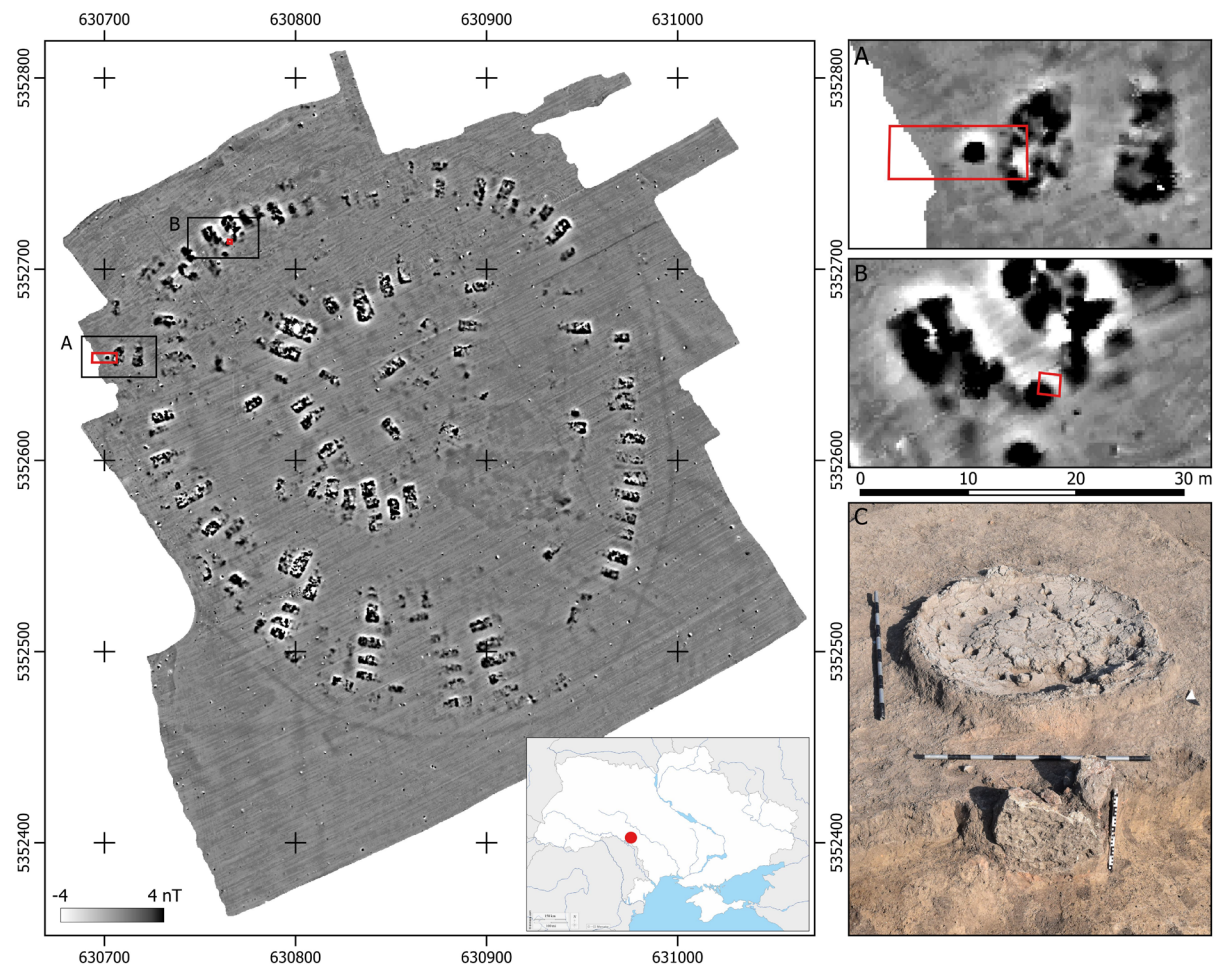


Figure 1 Magnetic plan of the Hariachkivka 8 site (UTM coordinate system, zone 35N) and the site location on the map of Ukraine (map base source - www.d-maps.com). Details of the magnetic map: A – anomaly of Kiln 1 and the location of Trench 1; B – anomaly of Kiln 2 and the location of Trench 4. C - Late Roman Age kiln excavated in the trench 1

Kiln magnetic anomalies and their vicinity

As a working hypothesis, two circular magnetic anomalies identified on the geophysical plan of the Hariachkivka 8 site were interpreted as kilns for pottery firing (Fig. 1). The maximum intensity of these anomalies varies between 20 and 40 nT. Similar objects have been found and excavated in CTCC and Cherniakhiv culture settlements (e. g., *Korvin-Piotrovskiy et al.*, 2016; *Bondar et al.*, 2022).

The first anomaly (Kiln 1; Fig. 1A) measures 2.7 x 2.3 m in size. It was located in the north-west end of the site, 1.4 m to the west of the farthest building of the settlement outside the outer oval. The anomaly of ditch was located at least 1.5 m to the west of the kiln.



The second magnetic anomaly (Kiln 2; Fig. 1B) is 3.1 x 3.0 m in size. It was identified in the northern part of the site. It is located between the anomalies of buildings in the outer oval. Importantly, the simultaneous use of all three objects is impossible due to the risk of fire.

Excavations of kiln anomalies

The kiln anomalies were investigated by the excavation of two trenches.

Trench 1 measured 13 x 5 m and included the entirety of the Kiln 1 anomaly, whereas the building and the ditch were partly examined (Fig. 1A). The latter two objects belong to the Trypillia culture. The pottery kiln (Fig. 1C) and a pit in front of it were identified as objects of the Cherniakhiv culture. The complex is oriented along a northwest-southeast axis; that is, along a slope towards the valley. The kiln consists of two vertical chambers divided by a 0.14 m thickness perforated grill. In plan view, the upper chamber of the kiln is round with a diameter of 1.3 m. The vertical walls of the upper chamber were preserved only to 0.14 m in height. In the center of the lower chamber, there was a circle stand that supported the grill. The lower chamber was connected to the pit near the kiln by a 0.55 m long channel. The opening of the firing channel was closed with an oval shelly limestone. The pit anomaly was not noted during the interpretation of the magnetic plan of the site.

Test Trench 4 (Fig. 1B) had an area of 2 x 2 m and was located above the north-eastern quarter of the second kiln-like anomaly. Only the upper part of the walls of the upper chamber of this object was excavated and so the level of the grill was not encountered. The inner space of the upper chamber was filled with Cherniakhiv culture artifacts, which indicates the Late Roman Age chronology of the object. Further excavations were not conducted and the object is currently sealed.

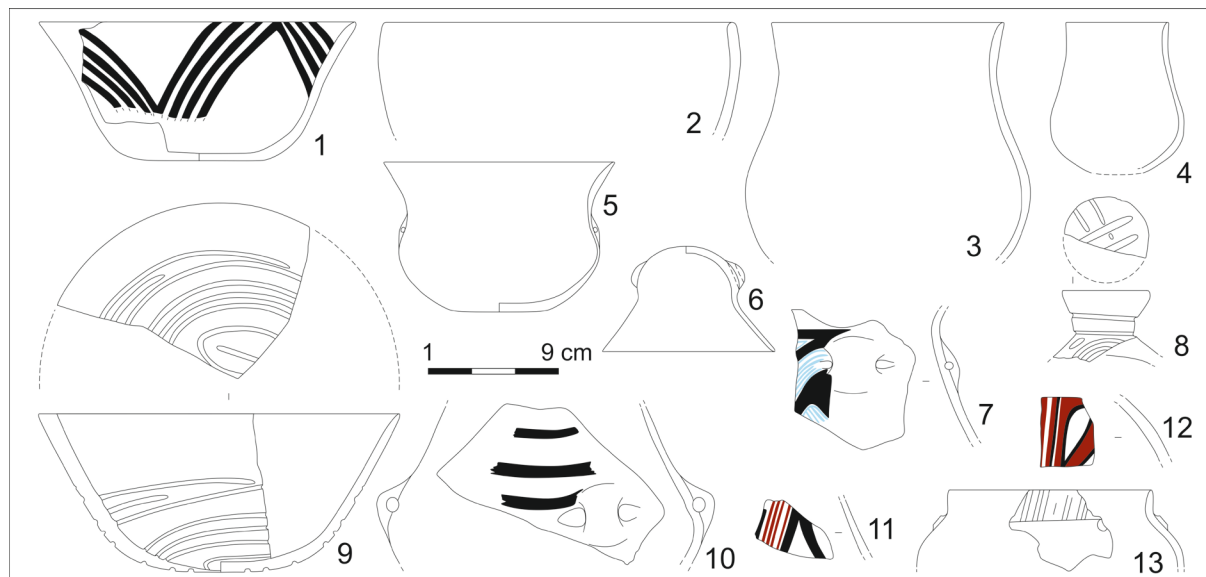


Figure 2 Trypillia culture pottery of the Hariachkivka 8 settlement

Discussion of the results

The magnetometry surveys have led to the development of a plan of the multi-component site of Hariachkivka 8. Comparison with existing examples allowed most of the objects on the magnetic image to be associated with the Trypillia culture. Thus, we have obtained important information about the structure of the Eneolithic component of the site. It has a circular structure with a ring corridor and was surrounded by a ditch. In this case, the time of its existence is very important.

The ceramic complex of the site has common features with the synchronous neighboring CTCC cultural units – the Klishchiv, Polyvaniv Yar II, and Bilykivtsi types. Nevertheless, Hariachkivka 8 shares the most common features with the settlements of the Soloncheny group (Vinogradova, 1981), but, it seems, with local features. The collection of pottery includes categories of vessels with painted (monochrome and bichrome; Fig. 2: 1-7, 10-12) and incised (Fig. 2: 8-9) ornaments, as well as a group of so-called «kitchen» ceramics made of clay tempered with powdered shell (Fig. 2: 13). The mentioned cultural units cease to exist theoretically around 4100 BC (Harper et al., 2021). So, the



Hariachkivka 8 site represents one of the oldest examples of the circular internal settlement structure within the CTCC area. The internal structure of such settlements, which is based on the ring corridor, forms the core of the structure of subsequent Trypillia culture mega-sites (*Hofmann et al., accepted*). However, the question of the CTCC kilns of the Trypillia BI-BII stage is still opened. We assume that kilns of the mentioned stage could consist of movable elements, which could have been demounted after the last use. An example of such action has been documented at the subsequent settlement of Trostianchyk (*Rud et al., 2019*). Of course not excluded the presence of other reasons (economical or ritual) that affected the absence of kilns in the settlements of the Trypillia BI-BII and earlier stages.

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