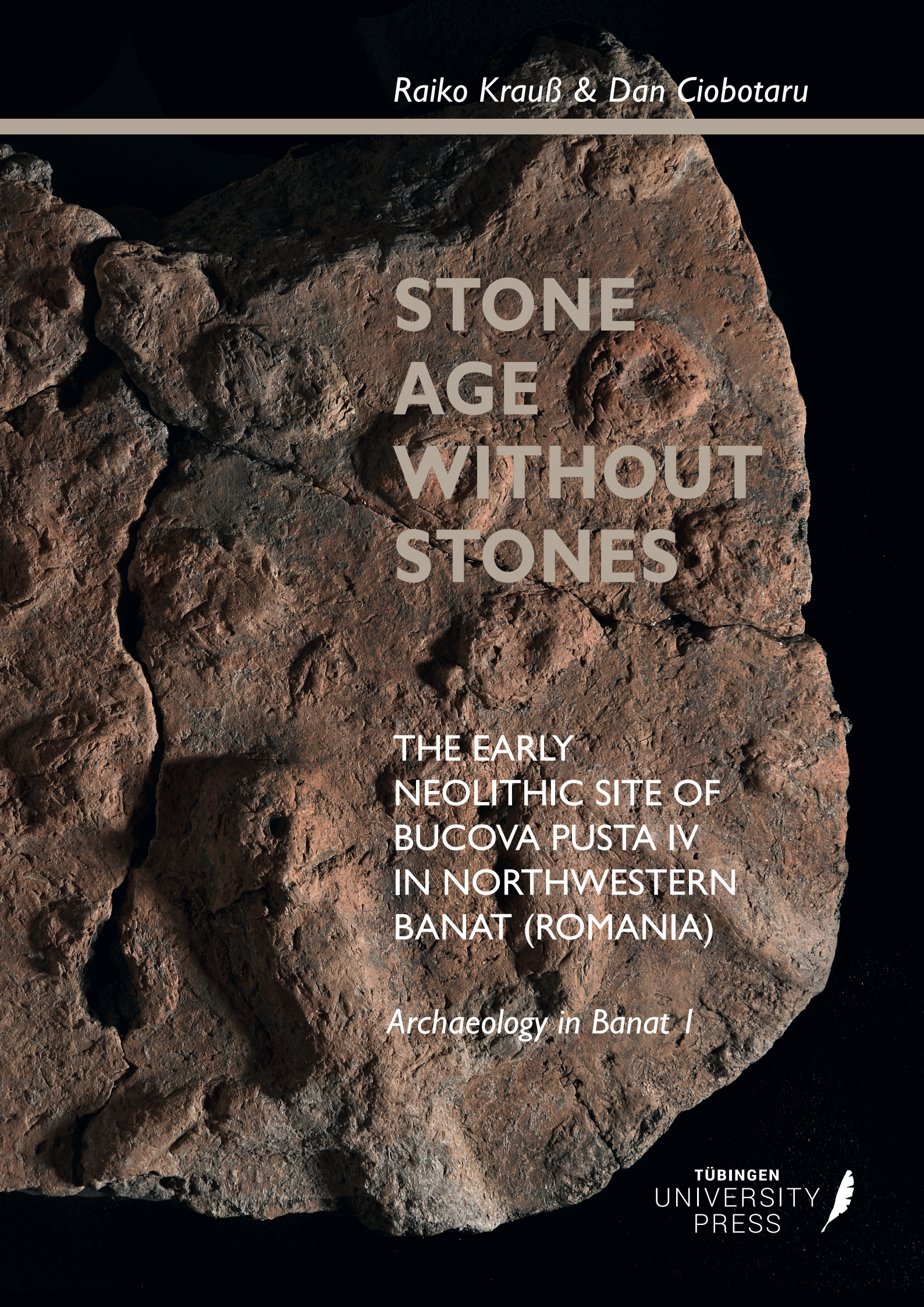
Raiko Krauß & Dan Ciobotaru



STONE AGE WITHOUT STONES

THE EARLY NEOLITHIC SITE OF BUCOVA PUSTA IV IN NORTHWESTERN BANAT (ROMANIA)

Archaeology in Banat 1

TÜBINGEN UNIVERSITY PRESS

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ARCHAEOLOGY IN BANAT I

Edited by
Raiko Krauß & Dan Ciobotaru

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The Early Neolithic site of Bucova Pusta IV in northwestern Banat (Romania)

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in collaboration with

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Preface

This monograph is the first volume in a new book series entitled "Archaeology in Banat". This series is primarily intended for the publication of excavation results in monographic form. Although the trend in archaeology is increasingly shifting towards partial publication in articles in journals or online media, the monograph is still the best method of publishing all aspects of research into an excavation site in a compact and clear manner, with the necessary cross-references between the various contributions. However, this series is also open to various works of monographic scope or conference contributions with a narrower focus on the prehistory and early history of the Banat. At the same time, this series is intended to focus on the cultural history of the historical landscape of the Banat, which today is divided into the three countries of Romania, Serbia, and Hungary, in its entirety, and with reference to neighbouring regions in south-eastern Europe, thus transcending borders. The flat land between the rivers Mureş, Tisza, and Danube, with the Carpathian Mountains to the east, offered good conditions for human settlement, especially from the time of sedentism onwards. Fertile soils and numerous watercourses are the basis of an economy centred on agriculture and livestock farming - these two resources are abundant in Banat. However, the landscape has changed dramatically over the last three centuries due to human involvement. The land, which was once regularly flooded in spring after the snow melted in the Carpathians, was permanently drained as a result of regulatory intervention in the water system from the time of Austrian rule in the 18th century. The presumed vegetation cover of the landscape has also largely disappeared as a result of agricultural use. Many of the former smaller watercourses are still recognisable in satellite images, but are now covered by fields.

The landscape in the northern part of the Banat, where the field of Bucova Pusta is located, is characterised by an absolute lack of stones. Even the rivers in the flat landscape have such a low flow velocity that they can no longer transport pebbles, but rather possess a muddy subsoil. In times when stone artefacts played a major role, this shortage needed to be countered in some way. The stone artefacts from the Early Neolithic settlement of Bucova Pusta IV were made from raw materials hailing from far away, and some of them show traces of extreme use and secondary to tertiary re-use. Other objects, which elsewhere might have been made from simple stones, were moulded from clay and hardened in the fire. However, the lack of stones also confronts archaeological research with the methodological problem of the difficulty

of proving settlement in the times before the Neolithic. Stone artefacts are usually the only surviving evidence of settlement in the Palaeolithic and Mesolithic periods. We have chosen the main title of the book "Stone Age without Stones" to draw the reader's attention to this specific phenomenon of archaeology in Banat.

The archaeology in Banat started in the second half of the 19th century with the foundation of the Society of History and Archaeology in Southern Hungary. Starting in 1893, the association conducted the first archaeological research projects in the Banat. This was also the time when enthusiasts such as Gyula Kisléghi Nagy began their collecting and undertook archaeological excavation in the westernmost part of the Banat. In the south of Banat, the scientific activity of Felix Milleker in collecting and documenting the archaeological heritage of the province had a consistent role in the fostering of interest in its archaeology. In the second part of the 20th century, the main archaeological issues which had preoccupied the founders of the Society almost a century before were still unsolved. Some of the prehistoric archaeological projects undertaken during this time are still not published. This new collection is dedicated to the new generation of researchers who have begun to cooperate internationally over the last decades. Their work and the results which they are generating from projects both old and new form the centrepiece of this new series, and of the present publication.

At this juncture, it is almost impossible to thank all those who have supported our work over the past years. Nevertheless, we would like to mention a few people and institutions without whom the very successful co-operation between the University of Tübingen and the National Museum of the Banat would not have been possible. The German Research Foundation generously supported our work with grants for the research projects "Investigations on the Early Neolithic Settlement on Bucova Pusta, Romanian Banat" (KR 2951/4-1), "Resources and the Formation of Inequality. Raw Materials and Communication Systems in Prehistoric Southeast Europe" (CRC 1070 "Resource Cultures", sub-project A01) and "Chronological Studies on the Neolithisation Process along the Danube" (KR 2951/10-1) as well as through scholarships and personalised funding programmes within the framework of the Heisenberg Programme (KR 2951/8-1; KR 2951/12-1; KR 2951/14-1), and through the provision of vehicles. We greatly appreciated the hospitality of the Dudeştii Vechi community from the very beginning of our work, and have developed close friendships with many community representatives over the years.

First and foremost, the Union of Bulgarians in Banat (UBB), initially represented by its chairman Niculae Mircovici and the then-mayor and current chairman of the Union, Gheorghe Nacov, should be mentioned here. The local heritage museum of the municipality, managed by the UBB, became our excavation base over the years. The building and its grounds offer us accommodation, a leisure area with a sports field and an extensive outdoor area for the preparation of samples and the processing of finds, work rooms, and laboratories and, last but not least, the opportunity to adequately archive the finds and present a selection to a wider public in the exhibition. The polyglot Nacov was able to personally recount the fascinating history of the village and of the Banat Bulgarians in general to generations of students. He was always enthusiastic about our work, and personally contributed to the popularisation of our excavation results. When foreign guests came to visit Dudeştii Vechi, Nacov would show them

round also our excavation house. More than almost anyone else, the current representative of the Bulgarian minority in the Romanian parliament combines his political agenda with the historical roots of his village, in which archaeology occupies a prominent place.

It is thanks to Constantin Kalscov's tireless work that we know the topographical location of the vast majority of archaeological sites in the region. He is a monument conservator in the truest sense of the word, and is always on hand when a site is endangered by encroachment. He has become part of our international team, and has also contributed to this book as an author.

Our general thanks go to the friendly residents of Dudeştii Vechi, with many of whom we have been able to build close relationships over the years and have benefited from their help in a variety of ways. The acting mayor Bono Cucalan should be mentioned here by name, but the sentiment holds for the entire community.

Alexander Edmonds helped with the production of this book by making precise language corrections to the English text. Any remaining spelling mistakes are our own responsibility, as we also needed to make changes to the content ourselves before this text went to print. Anna Koch helped with the technical editing of the texts and took care of compiling the bibliography and implementing the citation rules of the Romano-Germanic Commission (RGK), which were applied there. Jonas Sprißler set the illustration plates and Sophie Anders extracted the plate descriptions from our finds database. Other helpers and contributors to this book are listed by name in the respective chapters. We would like to take this opportunity to thank them all!

In order to make this volume and the planned book series open access immediately after printing, we decided to utilise the possibilities offered by Tübingen University Press (TUP). This necessitated a double anonymised review process, which contributed to the further improvement of the manuscript. We would like to take this opportunity to thank the two anonymous reviewers and the editorial board of TUP. We would particularly like to thank Sandra Binder from TUP, who handled the communication with the printing house and the editorial board and intruduced the final corrections to the manuscript.

Larissa Kurz did a marvellous job, which went far beyond her merely selective involvement in this project. She designed the entire layout of the book and typeset all the texts herself. As if that wasn't enough, most of the content-related work only took place during typesetting, which required numerous correction runs. We think the result is quite impressive and sets the standard for all further volumes which will hopefully appear in this new series.

Tübingen and Timişoara in February 2024,

Raiko Krauß & Dan Ciobotaru

Table of Contents

Introduction

Raiko Krauß, Dan Ciobotaru

The landscape of the northernmost region of the Romanian Banat presents a flat plain divided by pronouncedly meandering rivers, flowing westwards into the Tisza (Tisa) River. The earth is composed of loess or loesslike soils rearranged by the dynamic water system, with a silty to sandy composition and a yellowish to grey colour. The northern limit of the Banat is formed by the Mureş (Maros, Marosch) River, which formed a wide estuarine delta before the construction of embankments in the 18th century, when the area came under the control of the Habsburg Monarchy. Originally, the delta extended from the present mouth of the Mureş into the Tisza at Szeged about 40 km further south. The small present-day river of the Aranka (the Zlatica within Serbia) marks roughly its southern border. On the Aranka's course lie the town of Sânnicolau Mare (Großsanktnikolaus, Nagyszentmiklós) and the villages of Dudeştii Vechi (Óbessenyő, Altbeschenova, Beşenova Veche) and Valcani, before the river on the Serbian side flows into the Tisza River at Padej. Prior to the alterations to the river courses under the Habsburg and Austro-Hungarian regimes, the landscape between the Aranka and today's course of the Mureş was a vast wetland with numerous swamps, forests, and many scarcely distinguishable ponds. Of the once-numerous rivers, only the Ciganska Aranka still carries water in some segments. It flows north of Sânnicolau Mare to Dudeştii Vechi, where the river connects with the actual Aranka. Until the 18th century, the steppe-like landscape which today dominates the entire area up to the Mureş could only be found south of the Aranka River. Thus, there was probably already a marginal area available to the first farmers which offered optimal conditions for arable farming and good grazing land in its southern part, and provided an abundance of aquatic resources and game and sufficient wood for construction and heating in its northern part.

Historical sources on landscape genesis

This image of the premodern landscape can be established from historical maps. A first map by Johannes Janssonius from 1680 is still quite inaccurate topographically (Fig. 1). Only the large Rivers Danube, Tisza, and the double river system of the Bega and Timiş can be recognised. The latter forms a large lake, in which the town of Becskerek (Zrenjanin) is marked as lying on an island. The map by Thomas Bowles and Robert Sayer is far more precise in terms of proportions and orientation, and is dated between 1710 and 1720 (Fig. 2). It presents the confluence

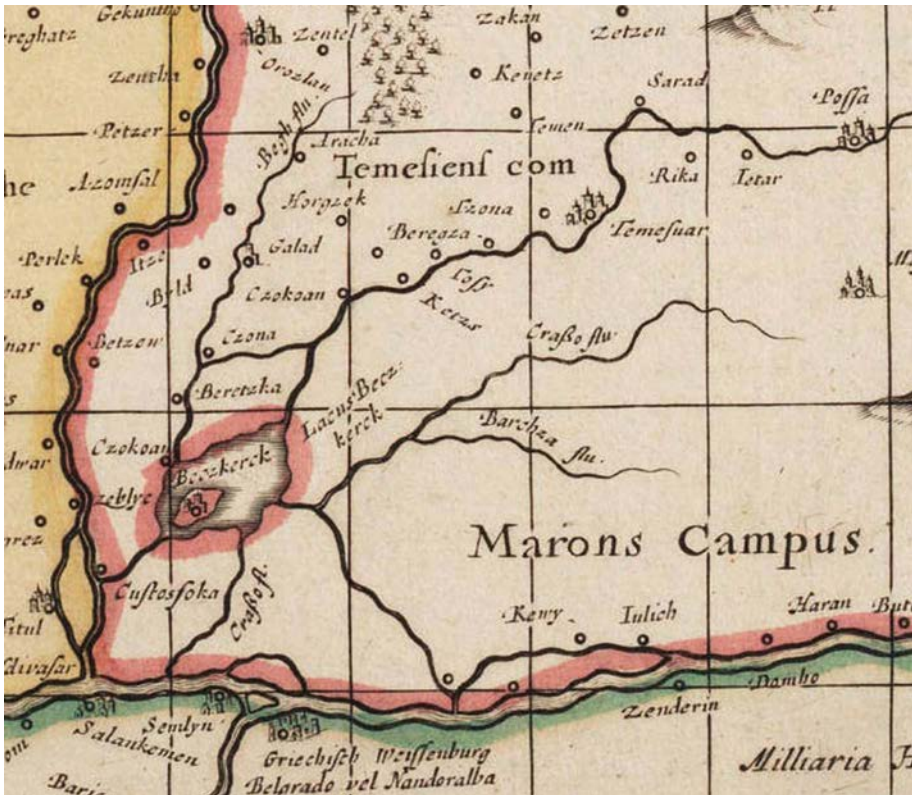


Fig. 1 Detail of the map of Hungary by Johannes Janssonius, Amsterdam 1680.

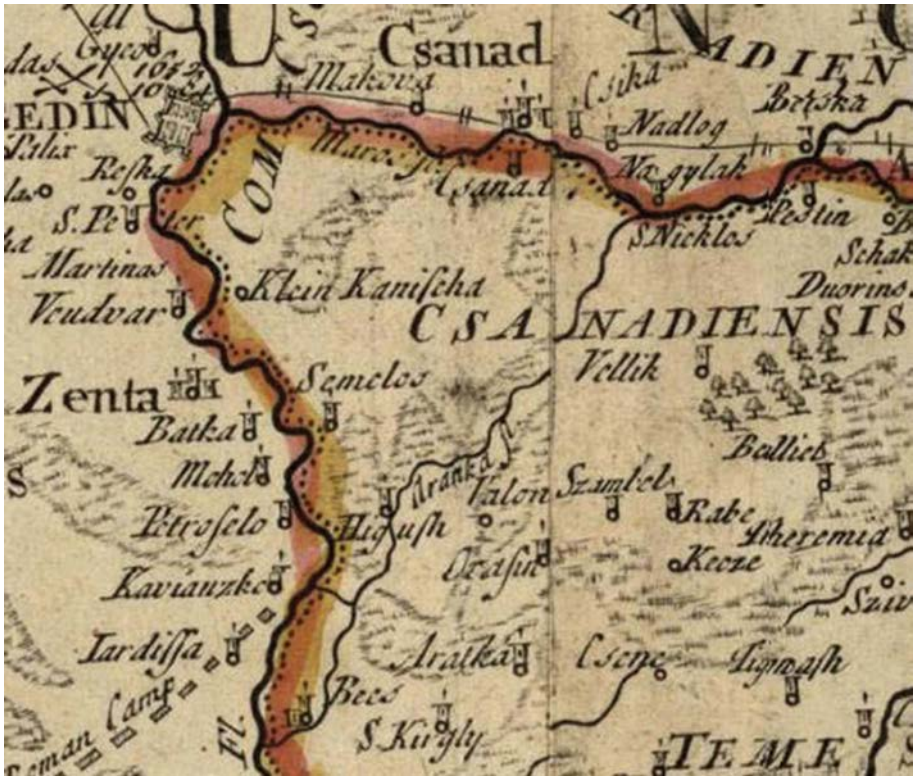


Fig. 2 Detail of the map of Hungary by Thomas Bowles and Robert Sayer, ca. 1710–1720.

of the Maros/Mureș and Tisza Rivers near Szeged. The Aranka rises from the Maros at S. Nicklos (Sânnicolau Mare), and flows into the Tisza at Becs (likely Bečej). Otherwise, only Csanad (Cenad) and Klein Kanischa (Kanjiža) are recorded as settlements in our region. Very informative is the Theatre de la Guerre dans le Bannat de Temeswar by

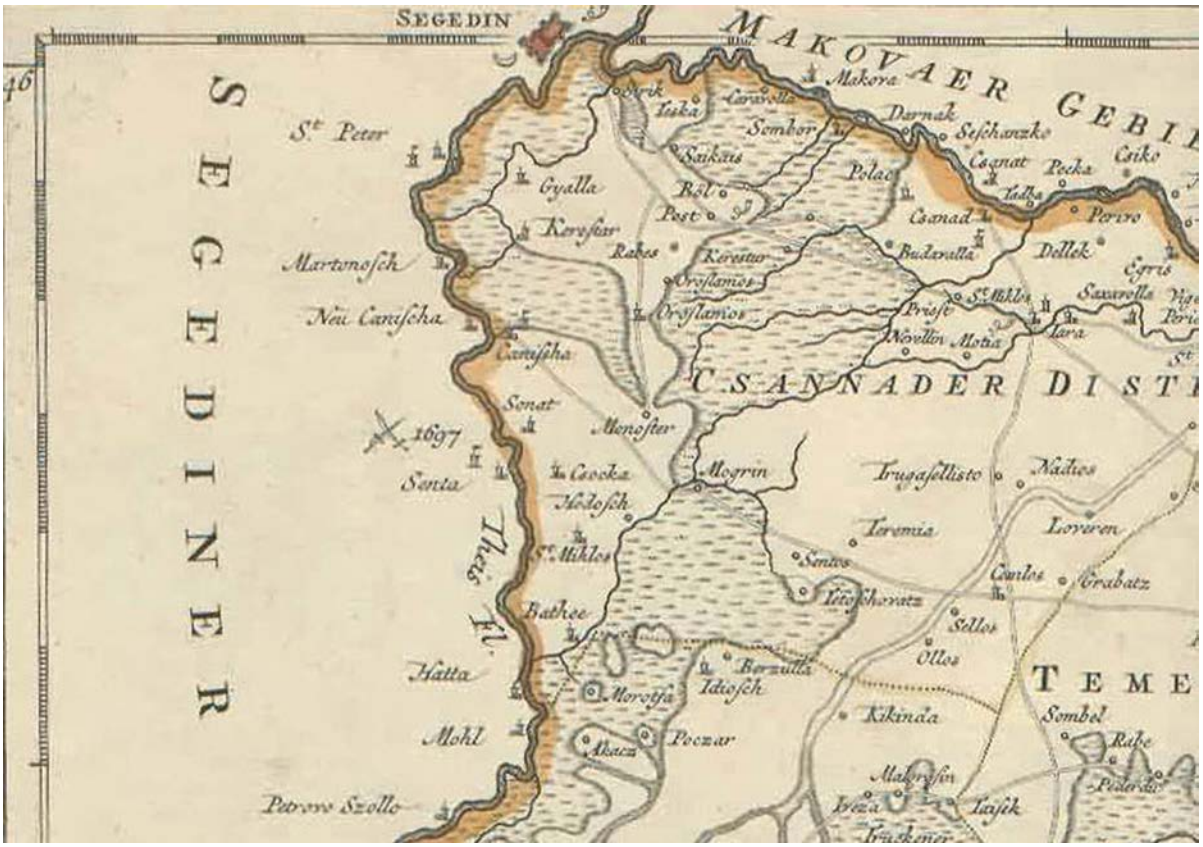


Fig. 3 Detail from the military map of the Timisoara Banat by Reinier and Iasué Ottens, Amsterdam 1740.

Reinier and Iasué Ottens from 1740 (Fig. 3). One can clearly see as to how the Aranka is actually part of a pronounced river delta of the Maros at its confluence with the Tisza. The landscape between the numerous small watercourses is marshy. This characterisation of the landscape by the dense network of waterways can also be seen on the Tabula Bannatus Temesiensis by Franciscus Griselini from 1776, where the settlement areas stand out as small islands between the extensive marshes (Fig. 4). We owe the first precise mapping of the region to the Josephine Land Survey (Josephine Landesaufnahme), edited in the years 1769–1772. This displays the settlement of Beschenova (Dudeştii Vechi) still with an unorganised building plan, before the Austrian engineers intervened to organise it. Forest and meadow areas are recorded between the fields, as well as all the burial mounds still visible at the time, rendering it a valuable source of archaeological information (Fig. 5-6). Statistical data was also collected for all localities. The number of citizens and farmers, gardens and houses, and even the number of horses is recorded. In larger settlements, the families were counted, as well as the yokes and clusters of farmland.

Beginning of archaeological research in the region

The marginal area on the southern edge of the mouth of the Mureş delta offered good settlement conditions even in the post-Neolithic period, which is generally expressed in a high density of the archaeological sites along the River Aranka. In particular, numerous burial mounds still prominently protrude from the flat plain. Between 1903 and 1908, the Hungarian history enthusiast and self-taught archaeologist Gyula Kisléghi

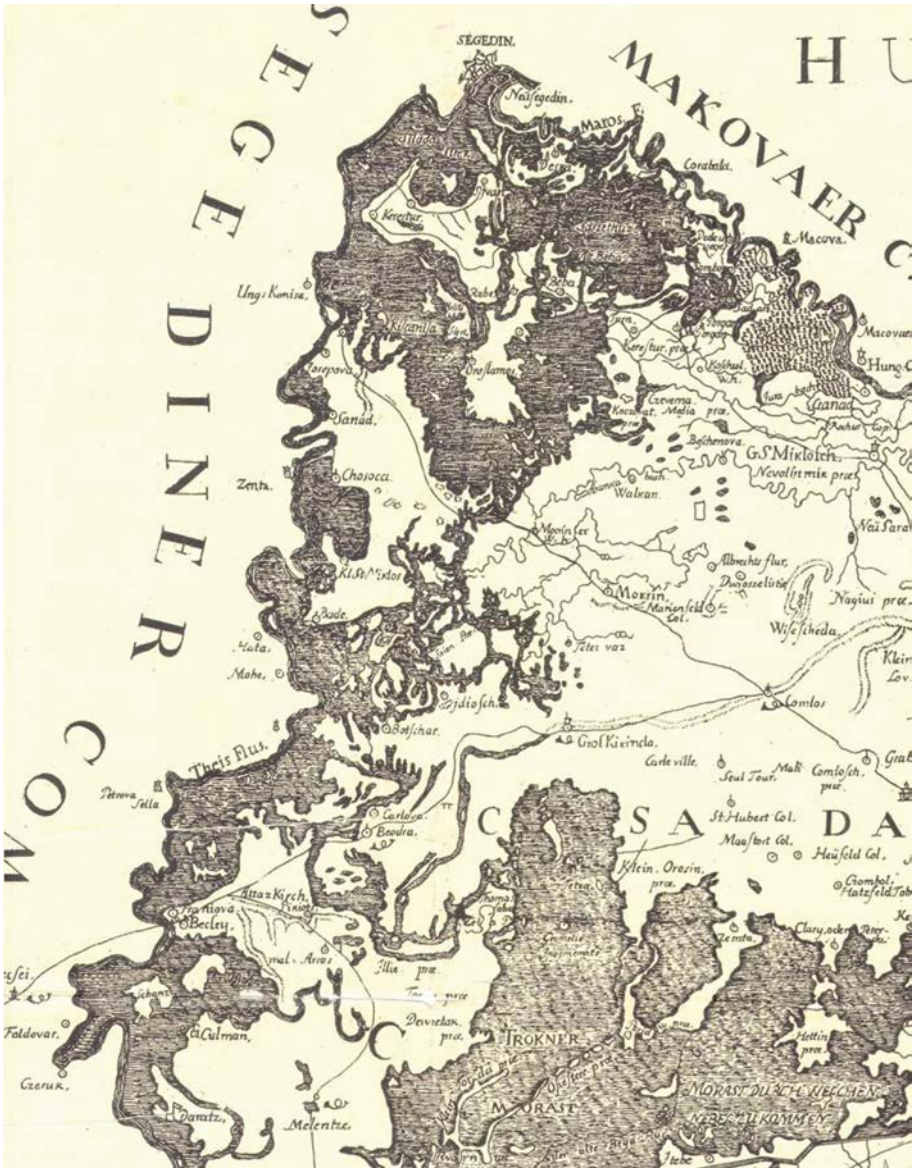


Fig. 4 Map of the Timisoara Banat by Franciscus Griselini, Vienna 1776.

Nagy carried out field surveys and occasional excavations at various sites between Dudeștii Vechi and Sânnicolau Mare (Nagy 1907; id. 1909; id. 1911; id. 1912; id. 2010). The first systematic recording of all archaeological sites in the region superficially visible at the time (especially the burial mounds) originates with him. In the surroundings of Dudeștii Vechi alone, he registered 13 sites, which he designated with Roman numerals (in the order in which they were found) or with toponyms known to him (Nagy 2010, 147 f.; id. 2015, 11). The field name Bucova Pusta (Bukovapuszta, Pusta Bucova) refers to a field of about 300 ha immediately north of the road between Sânnicolau Mare and Dudeștii Vechi, almost exactly half way between the two settlements. There, he registered a total of eleven tumuli visible at the time (Nagy 2010, 145) which he numbered accordingly with Roman numerals (from I to IX). He also identified a deserted village and a flat cemetery from the La Tène period in the vicinity of the mound Bucova Pusta III (according to his scheme).

Sânnicolau Mare is best known for a Medieval hoard of gold vessels found on a property in the south of the town in 1799. The hoard was subsequently stored in Vienna, and formed a foundational collection within

the Kunsthistorisches Museum. The hoard's find-site is located on the property of Erwin Schneider, a Banat Swabian born in Pesac who married into the community of Sânnicolau Mare. The property is located south of the intersection between Strada Comorii (Treasure Street) and Strada Grănicerilor. Perhaps the most famous son of the town is the Hungarian composer Béla Bartók.

Administratively, the Bucova Pusta belongs to Sânnicolau Mare, and forms the westernmost parcel of this municipality. Of the once dense network of waterways, only the Ciganska Aranka still carries some water, at least in places. However, the old river courses are still clearly recognisable in the satellite image and are clearly visible in the LiDAR image (Fig. 7). In the Romanian archives, the sites on Bucova Pusta are often counted as Dudeştii Vechi, formerly Beşenova Veche, probably on account of the research of Gyula Kisléghi Nagy, who undertook archaeological excavations in the region of north-western Banat from 1894 onwards. The records from Kisléghi Nagy's first diary, the only one that is preserved in the National Museum of Banat in Timişoara (inv. nr. MNBT 21008) and is available (Nagy 2010; id. 2015), extend to the year 1909. During this period, his excavations on the Bucova Pusta, which he performed in the years 1902–1907. His research focused on some burial mounds still clearly visible in the terrain at that time. The starting point of his excavations was Dudeştii Vechi, where he lived in the time and from where he recruited his workers.

The German name Altbeschenova, the Hungarian Óbesenyő, and the Romanian Beşenova Veche all refers to the memory of an abandoned settlement of Pechenegs at the same place. In 1738, the village was repopulated by Bulgarian Catholics (Paulicians), who mention in their chronicle (Historia Parochiae Oppidi Ó Bessenyö) the still-visible ruins of a Pecheneg fortress encountered upon their arrival in the Banat. In the local Banat-Bulgarian dialect, the village is called Stár Bišnov, which corresponds to the Romanian Beşenova Veche and the German Altbeschenova – all are literal translations of the Hungarian Óbesenyő, which means something like "the old Pechenegs". In the course of the political conflict with Yugoslavia starting with 1951, members of ethnic minorities and wealthy peasants were deported from the border communities to south-eastern Romania. In 1964, the village was renamed to Dudeştii Vechi, a name presenting no connection to the former toponym.

The background of the Romanian-German research project

Like many archaeological research projects, the beginnings of our fifteen-year collaboration started by establishing personal relationships between specialists who were each looking for a scientific partner. After an initial meeting in Summer 2008, it became clear that the interest of both partners was in identifying an Early Neolithic site which would allow research to focus on recovering the widest possible range of information from excavations, and involving specialists from archaeology-related fields to analyse the results of archaeological fieldwork in the laboratories. This was an approach which was somewhat uncommon in Early Neolithic archaeology, especially in western Romania. The idea was to carry out multi-year research, in which the priority was to recover as much information as possible by accurately documenting the uncovered archaeological structures and inventory. Therefore, in addition to the existence of a research team in the field, it was essential to create a laboratory for the primary processing of archaeological material. This facility was ment to include primary conservation, restoration

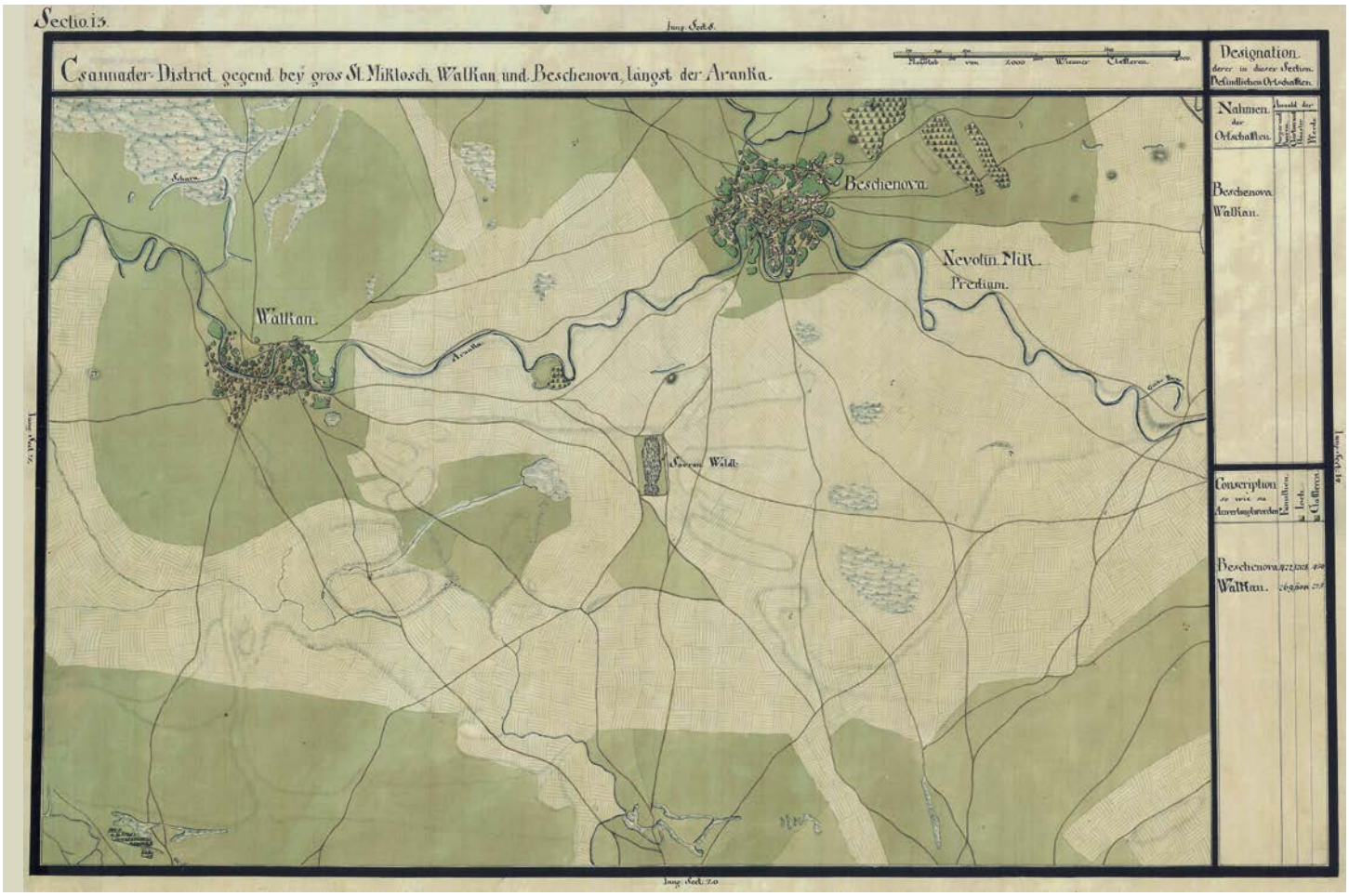


Fig. 5 Map of the Josephine land survey (1769–1772), section 13: The District of Cenad at Sânnicolau Mare, Valcani and Beschenova along the Aranka river.

of archaeological material, drawing, and photography. In the local laboratory, it would be possible to carry out flotation, drying, and primary sorting of samples taken from the structures. The management of all of these activites also depended on the establishment of an integrated digital system to coordinate the significant amount of documentation taken from the field and to communicate via internet.

Our first project was the archaeological research at Foeni-Stația de Gaz, an archaeological site located in Timiș County, close to the border with Serbia. The campaign took place in 2009, and included systematic surveys and a geo-magnetic mapping project on the area. As a result of the analyses, a sector exhibiting a geomagnetic signal of a distinct structure was selected. The excavation allowed the recovery of an Eneolithic structure with an archaeological inventory, as well as an Early Bronze-Age well (Krauß/Ciobotaru 2013). We also recognised that the scattered and small Early Neolithic site at this location does not meet the needs of the intended development of the archaeological project which we were planning.

An area very rich in Early Neolithic sites is located in the north-west of Timiș County, in the region where the Mureș River and the present-day Aranka Canal constituted a large drainage basin, with numerous clogged branches and meanders, where Early Neolithic communities would have found favourable

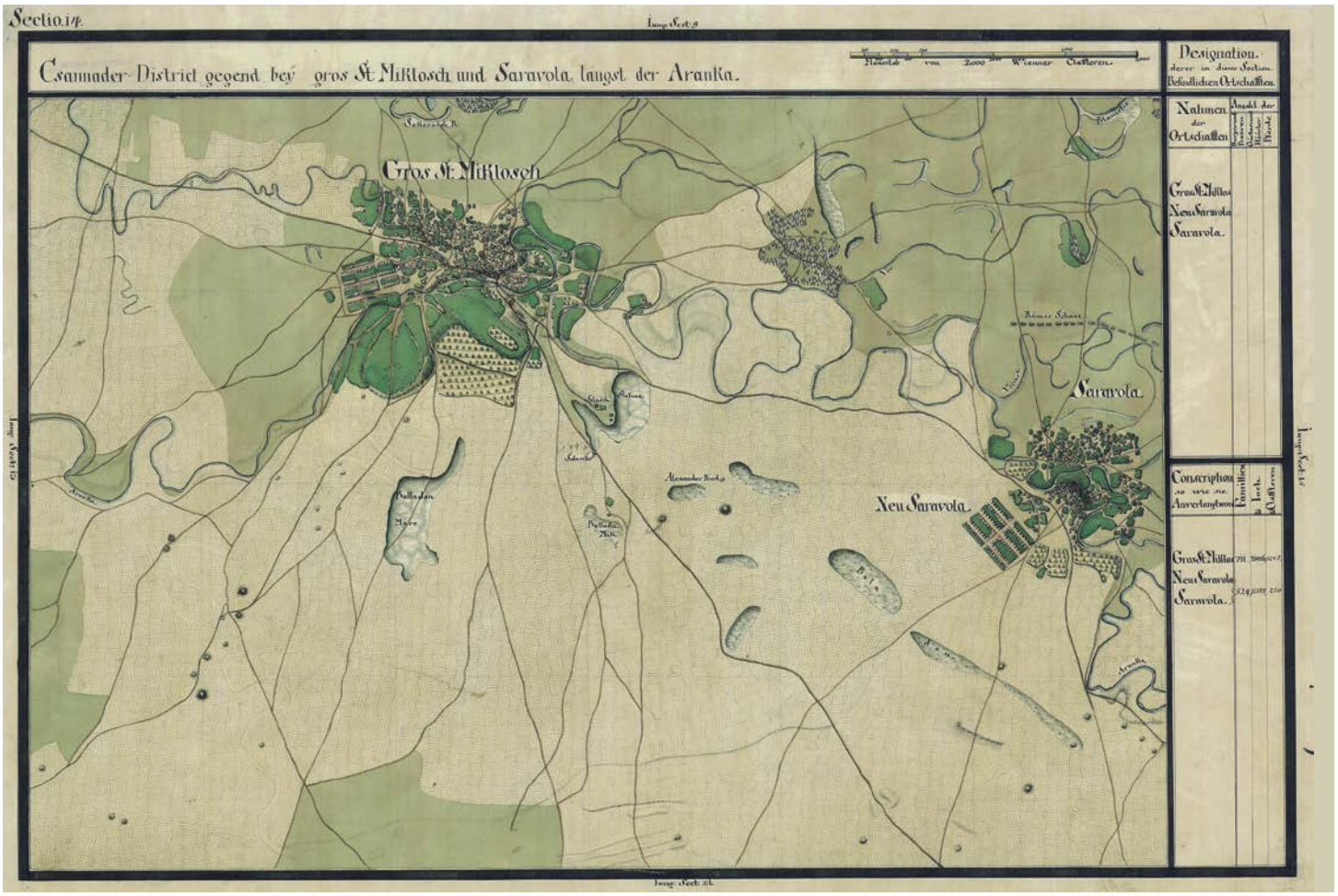


Fig. 6 Map of the Josephine land survey (1769–1772), section 14: The District of Cenad at Sânnicolau Mare and Saravale along the Aranka river.

conditions for subsistence. As mentioned above, the sites in the area were already known at the end of the 19th Century through the archaeological identification and prospecting work organised by Gyula Kisléghi Nagy. The articles published by him received widespread academic reception by way of Ida Kutzián in her monograph on Körös (Kutzián 1947), and were then reused in publications for a long time without the sites having been revisited. Gheorghe Lazarovici included the collection kept at the National Museum of Banat in his monograph dedicated to the Neolithic of Banat (Lazarovici 1979).

Research in the Dudeştii Vechi area was resumed for several campaigns by Dan Ciobotaru in the 2000's at the site of Dudeştii Vechi-Movila lui Deciov. On this occasion, together with his partner Josif Moravetz and the geophysicist Jean-Michel Maillol, a geomagnetic resonance prospecting project was carried out on the sites in the area of Dudeştii Vechi and Bucova Pusta (Moravetz 2003; Maillol et al. 2004).

During our first joint visit to Dudeştii Vechi, we noticed the willingness of the local authorities to support a project in this area. Moreover, the museum which the Bulgarian community owned in one of the large houses in the central area of the village met the necessary conditions for the organisation of the primary research laboratory of which we had conceived. There were also the necessary premises to house a large team in very good conditions.

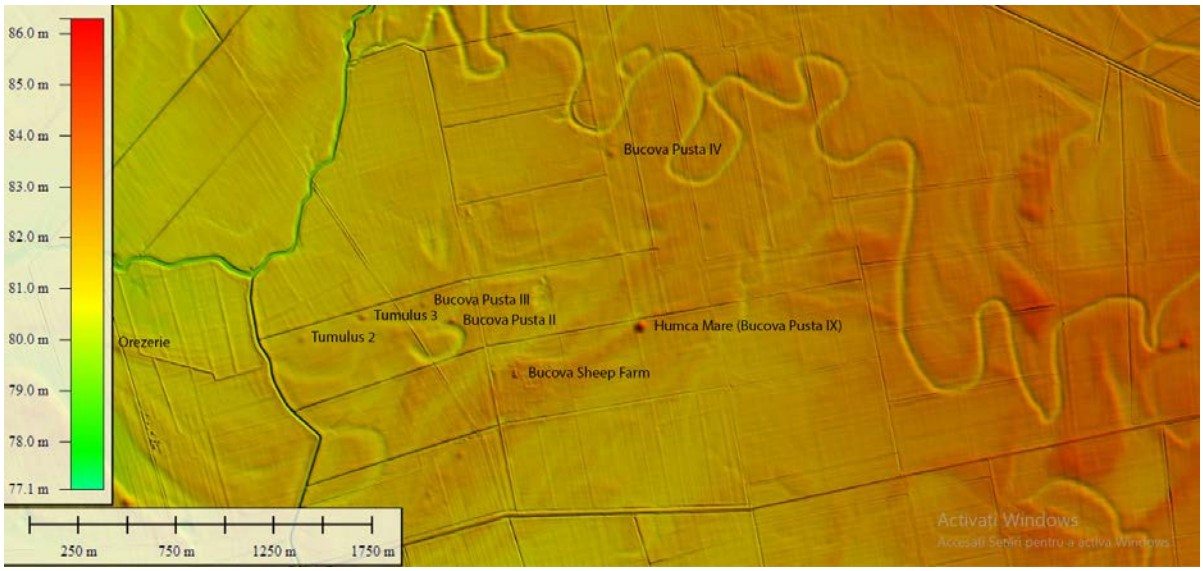


Fig. 7 LiDAR-Scann of the Bucova Pusta and neighbouring fields north of the road between Dudeștii Vechi and Sânnicolau Mare with marked archaeological sites. Provided by the Banat Water Administration (Administrația Bazinală de Apă Banat, ABAB).

The site chosen for the research was Sânnicolau Mare-Bucova Pusta IV. This site had been investigated by Gyula Kisléghi Nagy in the early 20th century, but the documentation was extremely elusive. The archaeological inventory was partially preserved in the National Museum of Banat Timișoara, but without stratigraphic context. The site had not been investigated in the meantime, and the results of geomagnetic measurements were promising.

The Municipality of Dudeștii Vechi then offered us the museum as base for the excavations and as laboratories for find processing. At this time, the collection of the museum of the Banat Bulgarians contained mainly ethnographical objects and text documents written in the Paulician dialect, as well as maps and documents on the history of this ethnic minority, albeit also a small pre-existing collection of archaeological finds. In addition to the exhibition area, the building also houses a large hall with smaller adjoining rooms which could be used as a laboratory. Moreover, there are bedrooms and sanitary facilities upstairs for 22 people, which can be used for accommodation. The museum is part of a larger complex with a sports field, a building with dressing rooms and bathrooms, and an area for outdoor celebrations and public facilities, all frequently used by the local population. Other communal facilities include two cultural institutes, one with a library, and a sports hall. In the village, there is a kindergarten, a primary school, and the high school "Sv. Sv. Cyril and Methodius", which is of superregional importance. Its catchment area extends far beyond the villages belonging to Dudeștii Vechi, as students from Sânnicolau Mare also attend this secondary school. The special features of the grammar school include tuition in the Bulgarian language. However, the official language used in Bulgaria today is taught, and the Banat-Bulgarian dialect (Paulician) is taught only by the parish priest within the framework of the catechism school.

Our archaeological work has been greatly supported by the municipality of Dudeștii Vechi from the very beginning. Not only were we able to use many of the public facilities as a find processing laboratory, as

excavation housing, and as a dining room, but were also always logistically supported by employees of the mayor's office and their fleet of vehicles (bulldozer, fire truck, transport vehicle, building materials, cleaning staff). Through our work on site, the archaeological collection was significantly expanded, and the ethnographic-historical parts of the museum gradually renewed. Today, the archaeological collection accounts for a good half of the total stock of the museum. In consultation with the National Museum of Banat in Timişoara, the entire archaeological archive of our excavations was able to remain in the museum of the Banat Bulgarians in Dudeştii Vechi. The collection is now also officially enrolled in the register of Romanian museums thanks to the support of the National Museum of Banat in Timişoara.

Participants in our research

In 2010 and from 2012 to 2013, work on the Bucova Pusta IV was carried out as an excavation of the Banat Museum (headed by Dan Ciobotaru), with the participation of the University of Tübingen (Raiko Krauß). The excavation permit for the years 2014 and 2015 was assigned to Raiko Krauß, while Dragoş Diaconescu led the excavation for the National Museum of Banat, and Dan Ciobotaru was assigned as a specialist.

Additional scientists involved were Mario Gavranović (FU-Berlin, 2013 and 2016), Bernhard Weninger (Köln University, 2013 and 2015), Zoltan Iustin (Museum of the Banat, Timişoara, 2014), Stephan Blum (University of Tübingen, 2014), Cynthian Debono Spyteri (University of Tübingen, 2015) and Matthias Lang (E-Science Center of the University of Tübingen, 2015). Steve Zäuner (University of Tübingen, 2012) worked on a part of the Medieval skeletal remains. Bea de Cupere (Museum of Natural Science, Brussels, 2014 and 2015) investigated the animal bones from the excavation. Elena Marinova (KU Leuven, Belgium, 2014) sorted the botanical remains, supported by Ivanka Hristova (Sofia University, 2015) and Hristo Hristov (2015). Bastiaan Notebeart (KU Leuven, 2014) and György Siposi (Szeged University, 2015 and 2021) performed geomorphological studies. The geophysical measurements of the Eastern Atlas Team lead by Cornelius Meyer was supported by Henning Zöllner (2009), Dana Pilz (2012), and Miriam Locker (2013). Cornelius Meyer also took part in the 2016 reprocessing campaign. Luca Valcov and Petru Ciocani from Dudeştii Vechi were involved in all excavation campaigns on the Bucova Pusta IV, and also looked after the finds in the museum outside of the excavation season and supported the preparations and follow-up of the individual excavation campaigns on site; Ciocani did this first as an archaeology student of the Veliko Tărnovo University, and from 2014 onwards as a doctoral student at the University of Tübingen. In turn, the doctorand from the Sibiu University, Andreea Iosza (2010 and 2012–2014) was involved in the excavations. Numerous students took part in the five excavation campaigns and the subsequent documentation campaign, especially from the University of Tübingen, the West University Timişoara, and the New Bulgarian University in Sofia. Their names are listed here in alphabetical order: Jonas Abele (Tübingen, 2010 und 2012–2014), Adrian Ardelean (Timişoara, 2013 and 2015), Constanze Arndt (Tübingen, 2013), Stephanie Bealek (Tübingen, 2012), Dominik Bochatz (Vienna, 2015), Bogdana Bogdanova (Sofia, 2015), Steven Bosch (Tübingen, 2012–2013), Sonja Boschert (Tübingen, 2013), Annika Condit (Tübingen, 2013), Boia Constantin (Timişoara, 2014–2015), Bogdan Craiovan (Timişoara, 2014), Marion Etzel (Tübingen, 2010 and 2013), Franziska Faupel (Tübingen, 2010), Cristi Floca (Timişoara, 2014–2015), Antonia Flontaş (Munich, 2014), Alexandra Gath

(Tübingen, 2012), Kalina Gemkova (Sofia, 2014–2015), Joscha Gretzinger (Tübingen, 2014–2015), Michael Held (Tübingen, 2013), Alexandru Ionescu (Timişoara, 2013 and 2015), Rémy Jeannot (Besançon 2014), David Kirschenheuter (Tübingen, 2013), Anna-Katharina Loy (Tübingen, 2014–2015), Mathias Macher (Tübingen, 2010), Franziska Mandt (Tübingen, 2014–2015), David Matzig (Tübingen, 2015–2016), Silvia Mircheva (Sofia, 2014–2015), Niklas Neumeyer (2016), Cristian Oprean (Timişoara, 2014), Dimităr Patšev (Sofia, 2015), Pavel Popov (Sofia 2015), Martin Riesenberg (Tübingen, 2010), Clemens Schmid (Tübingen, 2013–2015), David Schwarz (Tübingen, 2013–2014), Nicole Tußler (Tübingen, 2012), and Ljubomir Vangelov (Sofia, 2015).

Restoration work was carried out by Gavan Razvan (Timişoara, 2012), Măria Mîţu (Timişoara, 2013–2014), Akin Aksoy (2013–2014), and Andrea Pană (Timişoara, 2015). Moni Möck (Tübingen, 2013 and 2015) and Achim Frey (Tübingen, 2014–2016) produced find drawings, while Mircea Jar (Timişoara, 2013) and Liviu Tulbure (Timişoara, 2015) photographed finds. Ottilie Blum (Berlin) later inked most of the find drawings. The carpenter Petru Şerban made showcases and vitrines for the exhibition according to individual needs and prepared frames for the numerous in situ up-liftings of finds.

The excavation workers comprised Cristian Augustinov (2015), Eugen Barbura (2015), Nicolae Boboiciov (2015), Luca Calnacov (2014), Gheorghe Caradjov (2015), Josif "Joszi" Castiov (2014–2015), Gabriel Ciobancan (2015), Petru "Jesus" Ciocani (2014–2015), Raul Ciocani (2015), Andrei "Piticu" Damianov (2015), Benyo Ioan (2014–2015), Catalin Mehno (2014), Gheorghe Petcov (2015), Vasile Rad (2015), Ion Sachelaru (2013), Nicu Smecaiuc (2014–2015), Nicolae Tranculov (2015), Georgi Tatov (2014), Antonio "Andres" Velciov (2014), Ioan "Iani" Uzun (2014), and Dragoi Velciov (2012). Elisabeta Uzun (2012 and 2014–2015) washed the finds.

Palaeogeographical analysis of the Bucova Pusta field

György Sipos, Bastiaan Notebaert, Raiko Krauß, Tímea Kiss, Elena Marinova, Dávid Filyó, Tamás Bartyik, Cristian Floca, Petru Urdea

Introduction

The Mureş (Maros) River is the fourth-largest river of the Carpathian Basin; the total area of its alluvial fan is nearly 10,000 km^2, making it the second largest alluvial fan in the basin. The almost perfect alluvial cone has been continuously formed by the river for several millions of years since the Pliocene as a result of the continuous subsidence of the area (Borsy 1990). Although subsidence is general within the region, the neighbouring floodplains of the Tisza (Tisa) and Criş (Körös) Rivers subside at a faster rate (Joó 1992), which had heavily influenced the course of the river in the past. At present, the fan's territory is also dissected by several fault lines (Andó 2002), and therefore some areas sink at a slower rate and form thereby relative uplifts (such as the Battonya Height and Vinga Plateau), also affecting directions of flow. The large volume of sediments and the relatively steep slope of the alluvial fan are further factors determining the course and style of the river (Sipos 2012).

In examining the environs of the archaeological site of Bucova Pusta IV, the Late Pleistocene and Holocene development of the river must first be considered. The reconstruction of fluvial development can be made on the basis of the 18 identifiable palaeo-channel generations (Sümeghy et al. 2013), and their age determined by numerical dating methods (Sipos 2012; Kiss et al. 2015). The planform of identifiable channel generations often greatly differs, and the size of channels also demonstrates much variety (Fig. 1). Sometimes, more than a kilometre-wide, multiple thread, braided channels resemble extreme channel forming discharges and a very high amount of sediment load, whereas meandering, single and anabranching channel generations refer to less dynamic fluvial activity (Sipos 2012). These differences indicate considerable variations in climate and sediment availability on the catchment throughout the Late Pleistocene and Holocene.

The largest, at some locations 2 km wide, braided channels are related to three major channel generations situated on the Nagykamarás–Pusztaottlaka–Csanádapáca–Orosháza line, the Kunágota–Pitvaros–Kövegy–Apátfalva line (both in Hungary), and the Periam–Lovrin–Comloşu Mare corridor (in Romania) (Fig. 8). These channels are characterised by enormous islands and natural levees, rising above the plain of the alluvial fan by 1.5–2 m, thus providing safe settlement sites for

earlier cultures inhabiting the region. The largest cross-sections were identified at the braided channels of Orosháza and Kövegy (Fig. 1), referring to a 2000–2500 m^3/s bankfull discharge during its formation. By means of comparison, the present day bankfull discharge of the river at Makó is 600–700 m^3/s, while its peak discharge was 2420 m^3/s during the record-breaking flood of 1970 (Sipos et al. 2008).

However, most of the channel zones identifiable on the alluvial fan present a meandering, anastomosing channel pattern (Kiss et al. 2015). Surveyed by drilling and geophysical methods, the original cross-sectional parameters of these channels imply lower bankfull discharges, similar to the present-day values (Katona et al. 2012). Based on slope conditions, the alluvial fan can be divided into three zones (Sipos 2012). The first, upper zone extends to the Orosháza–Battonya–Lovrin line, has a slope of 20–25 cm/km, and is characterised mostly by braided channels. The second, middle zone is a narrow stripe with a 25–30 cm/km slope where most of the past riverflows (even the braided examples) developed large meanders. In the third, lower zone slope decreases to 22–27 cm/km, certain channels return to their upper zone pattern, but in most of the cases meandering becomes dominant. The steep middle zone can be regarded as the border of intensive sediment accumulation (Sümeghy et al. 2013).

The oldest channels on the surface of the alluvial fan can be dated as far back as 19 ka (Sipos 2012), and flowed around the Battonya Heights from the north. Until around 9–10 thousand years ago, the river mainly wandered through the northern part of its alluvial fan (Kiss et al. 2015), and drained towards the northwest (Fig. 1). In this period, the discharge of the river varied significantly as a matter of the alternating climatic conditions during the Pleistocene-Holocene transition. It must also be underlined that according to the numerical ages of sediments, there could be a temporal overlap of the activity of certain channel zones, implying an extensive fluvial activity, especially during the climatic transition to the Bölling-Alleröd interstadial approximately 15 thousand years ago.

A dramatic change in the direction of flow occurred between 9.6 and 8.5 ka, when the river turned sharply southwest near Sanpaul at the apex of the alluvial fan, and passed by the Battonya Heights from the south (Fig. 1). The sudden channel shift (termed an avulsion) was probably caused by the intensive sediment deposition of the previous period, and thus occurred for primarily geomorphological reasons (Sipos 2012). The translation of flow direction is indicated by 8.5 ka-old meandering channels near Horia–Zimandcuz–Arad, and a robust braided channel lying on the Periam–Lovrin line (Fig. 1). Consequently, from the onset of the humid and warm Atlantic Phase of the Holocene, which is coincides with the start of the Neolithic period in the region (Sava 2015), the river flowed in the area of the present day Mureş–Aranka system. In the beginning of the period, it occupied an 800–900 m-wide braided channel with a reconstructed bankfull discharge of 2000 m^3/s (Katona et al. 2012). Subsequent to an intensive aggradation phase, the river shifted to the north around six thousand years ago. Since then, its primary flow direction coincides with its present-day course with anabranches draining water through the Aranka, being especially active 1900-1600 years ago (Fig. 1).

On the strength of this review, the development of the alluvial fan has a complex history with frequent changes in the flow direction and the style of the

Fig. 1 Reconstructed palaeo-flow directions of the Mureş River on its alluvial fan (Sipos 2012). Ages were determined by the means of OSL. Red points mark the sampling sites of Kiss et al. (2014), the yellow point marks the site investigated in the present study.

river, this suggesting that the environs of the archaeological site of Dudeştii Vechi had also undergone a dynamic geomorphic evolution. Considering this, the primary aim of the present study was to reconstruct the fluvial development of the area, and to assess the origins of the bend-like depression partly surrounding the excavated Neolithic archaeological features.

Study site and methods

Mapping

In order to evaluate the wider surroundings and hydrography of the area before the large scale water regulation works in the 19th and 20th centuries, the 1:28000 scale map series of the Second (or Franciscan) Military

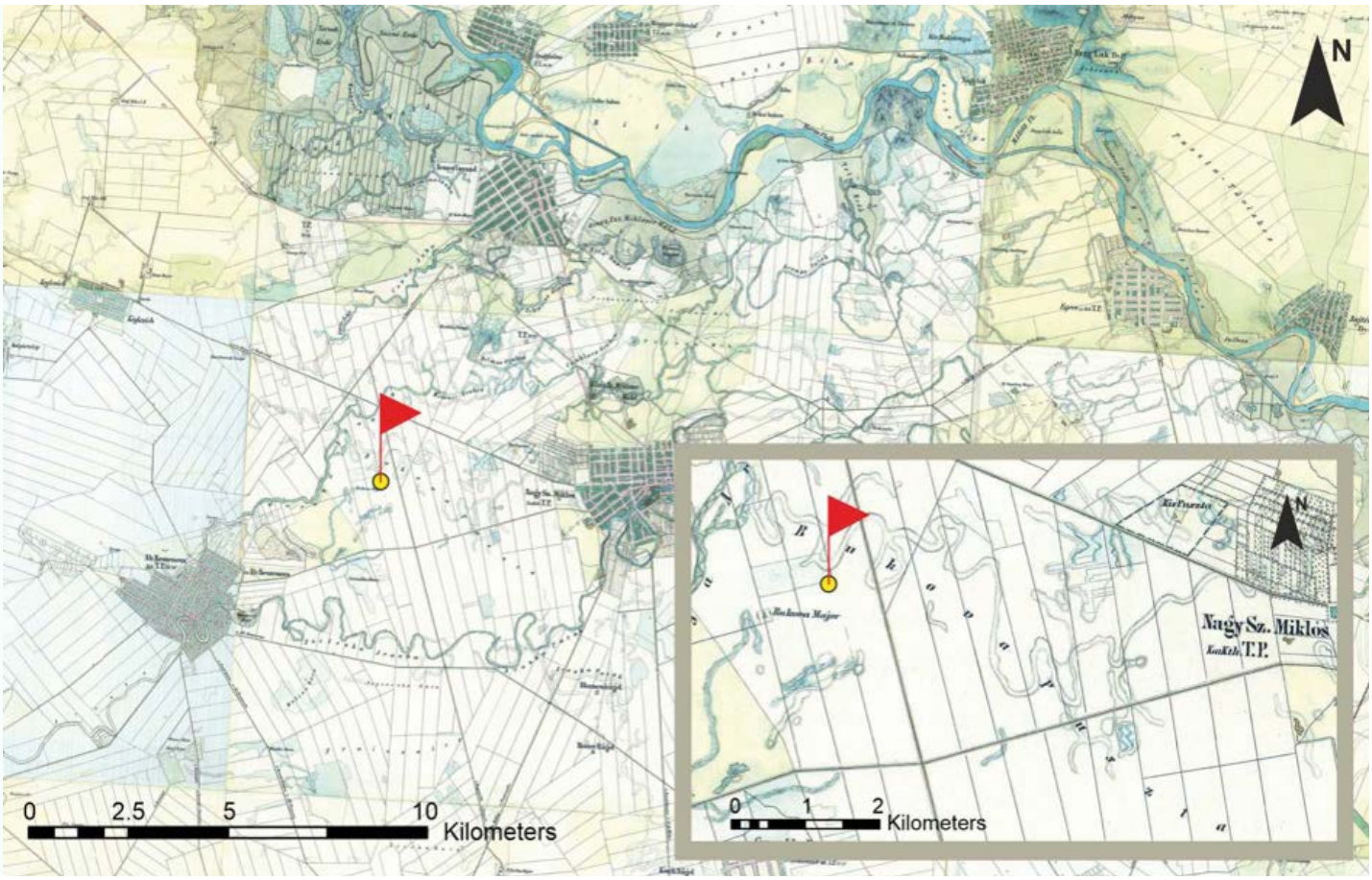


Fig. 2 Hydrographic situation in the area at the mid of the 19th century (Franciscan Military Survey). The yellow circle and flag show the location of the study site.

Survey of the Austro-Hungarian empire was applied. The surveying within this region for the maps occurred in 1865, and they clearly demonstrate not only the branches of the Mureş–Aranka system active at the time, but also some of the palaeo-channels (Fig. 2). The geomorphology of the area was assessed using the EU-DEM v.1.1. digital elevation model (with a 25 m horizontal resolution and 2.9 m vertical accuracy), and satellite images from Google Earth. The DEM was used to identify the main geomorphological units in the wider vicinity of the investigated archaeological site, and to evaluate slope conditions. Palaeo-channels and other elements of fluvial geomorphology (point bars, terraces) were mapped by applying satellite images.

The surroundings of the archaeological site

The site under investigation is located on a small mound NE of the village of Dudeştii Vechi. Right next to the mound, at its western edge, a bend-like depression of unknown origin was identified during archaeological excavations. Based on shallow geophysical surveys, the bend joins to the remnants of a wider, braided channel (see Chapter 4). In the field, topographic differences were almost invisible, and the braided form could hardly be recognised. The buried braided channel cannot be identified on satellite images either. Nevertheless, a clearly visible east-westerly meandering palaeo-channel is located a few hundred metres to the north of the site.

Fig. 3 The surroundings of the sampling site and the position of drilling and sampling points.

Drilling and sampling near the site

The stratigraphy of fluvial features was investigated with two coring transects using hand drills. The first transect (Transect 1) mapped the meandering palaeo-channel located just north of the site, while the other (Transect 2) was focused on the bend-like depression right next to the excavation (Fig. 3). In all, 23 corings were made and macroscopically described, focusing on sediment texture, colour, and other secondary features. Based on this information, various different sedimentary units were identified.

Three additional drillings were made near the Neolithic site. The first (Coring DV) was at the bottom of the excavation trench, exposing the depression (Fig. 3). The second (Coring DB) targeted a potential braid bar at the buried braided channel to the south. The third (Coring DM) was made on the youngest point bar of the meandering palaeo-channel in the north (Fig. 3). In order to reconstruct the geomorphological development of the area, sedimentary analyses (macroscopic description and grain size measurements) were made along with dating the age of sedimentary units using OSL dating. Grain size samples were collected from every 10 cm of borehole DV. Finally, a total of 10 undisturbed samples were taken for OSL dating at the 3 sampling points (Fig. 3).

Grain size analysis

The grain size analysis of samples collected at the OSL sampling site was carried out on a Fritsch Analysette 22 MicroTec laser diffraction grain-sizer at the Department of Geoinformatics, Physical and Environmental Geography, University of Szeged. The device is equipped with a green (λ=532 nm, P=7 mW) and an infrared (λ=940 nm, P=9 mW) laser, and has a measurement range of 0.08–2000 μm. Sample preparation followed the procedures detailed in Kun et al. (2013) and Serban et al. (2015).

No chemical dispersion was applied to avoid the modifying effect of the dispersant on the measurements; a longer, 180s ultrasonic pretreatment (f=36 kHz, P=60 W) was applied instead (Kun et al. 2013). To generate grain size distribution curves, the laser diffraction data were processed according to the Mie optical theory, using the following parameters: refraction index of 1.52 and absorption index of 0.1 for the dispersed sample, and refraction index of 1.33 for water (Makó et al. 2017).

Optically stimulated luminescence

Optically stimulated luminescence (OSL) is a so-called trapped charge dating method which can be applied to determine the last time of sunlight exposure (i.e. the time of deposition) in terms of almost any kind of sediments. The method utilises the accumulation of electrons (charges) in the crystal lattice defects (traps) of mineral grains as a matter of environmental radioactivity after the burial of the sediment. By means of the optical stimulation in the laboratory, charges can be freed, and a faint luminescence intensity can be measured. The higher the intensity, the more charges were trapped, the higher the radioactive dose was absorbed, and the more time had passed since sediment formation when traps were naturally zeroed under sunlight. Age is given by the ratio of the absorbed total dose (palaeo-dose or its laboratory equivalent) and dose rate, the annual amount of radioactive dose reaching the mineral grains.

Samples collected for dating were mostly silty floodplain sediments; however, representative channel sediments were also taken from the bottom of the drillings. Consequently, both the so-called fine grain (silt) and coarse grain (sand) techniques were applied during the dating process, and the quartz fraction of the sediment was subjected to the analyses in both cases.

The preparation of samples followed the usual laboratory techniques (as explained in Sipos et al. 2016, and Tóth et al. 2017). For fine and coarse grain dating, 4–11 μm and 90–150 μm fractions were used respectively. The separation of fractions was made by sieving and settling. The carbonate and organic material content was removed by repeated treatment in 10 % HCl and 10 % H_2O_2. The abundance of quartz in fine grain samples was enhanced by a 7-day etching in H_2SiF_6 acid. In the case of coarse grains, a heavy liquid separation was applied for the separation of the quartz fraction. This step was followed by a 50 min etching in 40 % HF.

To determine the value of the absorbed total dose (equivalent dose – De), a RISOE DA-15 TL/OSL type luminescence reader was applied (Bøtter-Jensen et al. 2010) and the so-called single aliquot regeneration (SAR) protocol was used (Wintle/Murray 2006). Stimulation was carried out using blue (470 nm) LEDs, and detection of luminescence was made through a U-340 filter. To determine optimal measurement parameters, combined preheat and dose recovery tests were made. In the case of fine grain and coarse grain samples, a 200°C/160°C and a 240°C/160°C preheat/cutheat treatment respectively proved to be adequate. SAR measurements were performed

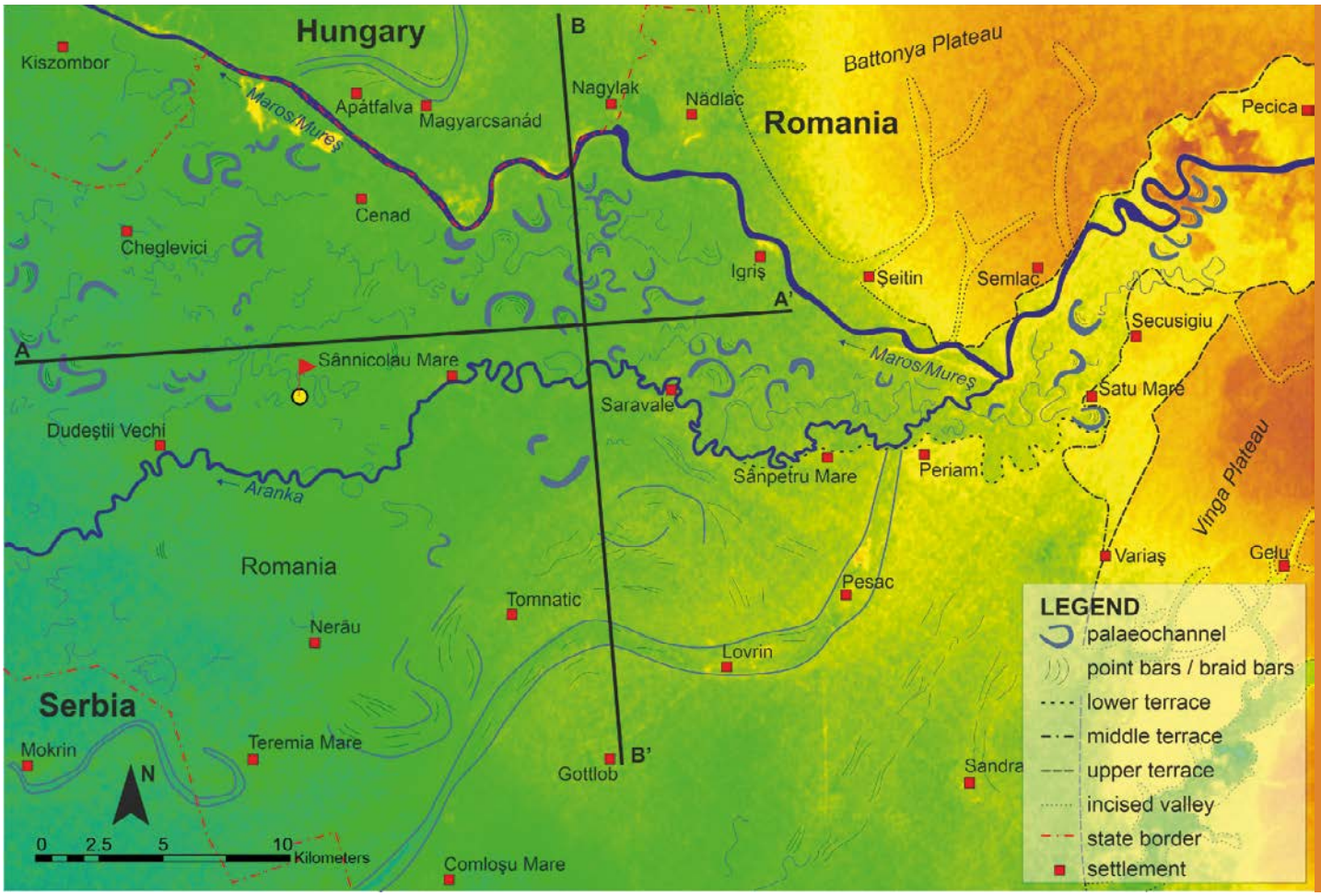


Fig. 4 Fluvial landforms of the Mureş-Aranka system. Transects A-A' and B-B' are shown in Fig. 5.

on 12 and 48 aliquots per sample. Standard rejection criteria were used to select aliquots performing well during the measurements (Murray/Wintle 2000). In the case of fine grain samples, De values were given as the mean and standard error of single aliquot De values, whereas the central age model (Galbraith et al. 1999) was applied in the case of coarse grain samples.

Environmental dose rate (D*) was determined by using high-resolution, extended range gamma spectrometry (Canberra XtRa Coaxial Ge detector), using 500 cm^3 marinelli beakers. Dry dose rates were calculated using the conversion factors of Adamiec and Aitken (1998). Wet dose rates were assessed on the basis of in situ water contents. The rate of cosmic radiation was determined on the basis of burial depth, following the method of Prescott and Hutton (1994).

Results

Geomorphology

The investigated area is situated between the present-day Mureş River and its anabranch the Aranka, close to the frontal edge of the Mureş Alluvial Fan (Fig. 4). The south-eastern part of the alluvial fan has a complex morphology, as the river occasionally raised its floodplain and then incised and formed terraces. The temporally changing intensity of fluvial activity is also demonstrated by the variable dimension and pattern (meandering,

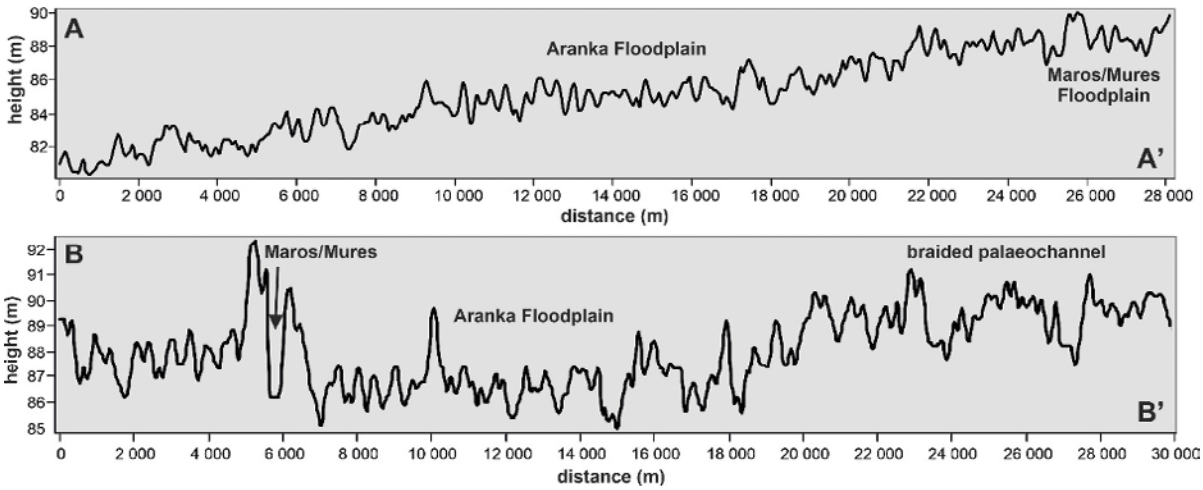


Fig. 5 West to east (A-A') and north to south (B-B') transects along the Aranka Floodplain.

braided, anabranching) of identifiable palaeo-channels on the surface (Fig. 4).

Based on a west-east radial transect (Transect A-A'), the surroundings of the archaeological site have a relatively low slope (13 cm/km) (Fig. 5), referring to low energy fluvial processes and limited alluvial fan development in the near past. This is also reinforced by the palaeo-geographical setting revealed by the Franciscan Military Survey from the middle of the 19th century (Fig. 2). At that time, the land between Sânnicolau Mare and Dudeştii Vechi was characterised by a network of anabrancing secondary channels related both to the Mureş and Aranka, but possibly only active during high flow events. The site itself is located next to a clearly identifiable inactive anabranch (Fig. 3).

The relatively deep position of the study area is also confirmed by Transect B-B', stretching from north to south (Fig. 4 and 5). Although this transect was not taken alongside the investigated archaeological site, but rather further to the east, it is obvious that the floodplain between Sânnicolau Mare and Dudeştii Vechi is situated by around 2–3 m below the fluvial surface of the wide and braided Periam–Lovrin palaeo-channel, and north of the present Mureş River another step-like elevation increase (1–2 m) can be noted (Fig. 5). Consequently, the deep-lying Mureş–Aranka floodplain is well separated from the surrounding areas.

Based on previous age data and the fluvial landforms identified, the river first flowed along the Periam–Lovrin line and built an extensive secondary alluvial fan, and then occupied the Periam–Cenad corridor following an avulsion event, and started to erode previous deposits (Fig. 4). Later, a northward lateral shift occurred, and the Aranka simultaneously came to occupy its present flow direction. As no large palaeo-channels can be identified in the area investigated, it is presumed that the main flow of the Palaeo-Mureş did not pass the Sânnicolau Mare–Dudeştii Vechi area during the timeframe of around 8 ka until present. Consequently, the territory probably functioned as a low energy floodplain throughout the period.

The archaeological site is located near a meandering palaeo-channel, well visible on the Franciscan Military Survey (Fig. 2). The meanders of the channel are congested, again

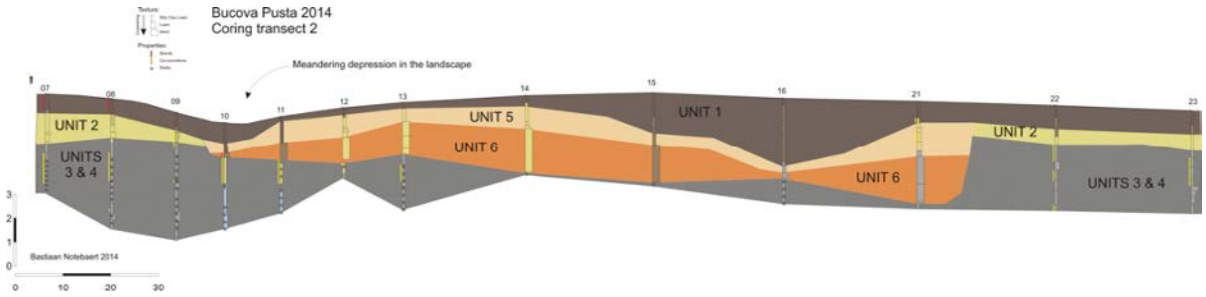


Fig. 6 Sedimentary units identified in Transect 1, made across the meandering palaeo-channel, north of the site.

relating to a very low slope. The mean radius of meanders is 125 m, whereas the same parameter for the Aranka is 190 m, meaning that the channel forming discharge was lower than that of the Aranka. By considering this and the track of the channel (still visible on satellite images), it was most likely an anabranch of the Aranka, and therefore presumably developed approximately 2 ka ago, during the primary formation period of the main channel (Kiss et al. 2015).

Stratigraphy and sediments in coring transects

In Transect 1, recovering the typical stratigraphy of the anabranch north of the site, six alluvial sedimentary units could be identified (Fig. 6). At the northern and southern parts of the transect, the top of the cores always consisted of dark brown silty clay loam (Unit 1). This was followed by brown and eventually yellowish-brown compact clay loam and loam (Unit 2). This slightly coarser material is then followed by silty clay loam (Unit 3), occasionally with some thin coarser sections (Unit 4). Between Corings 10 and 21, the stratigraphy is totally different (Fig. 6). Unit 1 is followed by a fining-up sequence from sandy to clayey sediments (Unit 5), under which channel deposits of medium to coarse sand with some gravel at the bottom could be identified (Unit 6). In Corings 15 and especially 16, Unit 1 is much thicker. Below Unit 6, Units 3 and 4 appear again.

Below the A-horizon of variable thickness (Unit 1), therefore levelling the surface, two main sedimentary features can be identified. In the middle of the transect, Units 5 and 6 represent the channel-forming phase of the meander studied (Fig. 6). Point bar formation and southward growth of the meander is made clear by the undulating surface of channel deposits (Unit 6) and the typical upward-fining sedimentary sequence (Unit 5). The second main feature is an almost uniform overbank deposit into which the studied channel incised, thus being older than the channel recovered. The top of the floodplain sequence is represented by a thin layer with subordinate soil formation (Unit 2). Below 2 m, however, only minor variations can be identified in sediments (Units 3 and 4) (Fig. 6). The minor alternation of texture refers to the differences in the energy of the depositional system, i.e. the changing distance of the Mureș and Aranka from the site. The presence of shells, mostly in Unit 3, indicates a marshy environment, typical for backswamps. Unfortunately, no channel deposits related to this older fluvial activity could be identified in the transect. All these findings reinforce that until the appearance of the anabranch in the area, the surroundings of the site exhibited a predominantly marshy, floodplain environment.

Transect 2, situated next to the Neolithic archaeological site, was made across the channel-like feature identified during the

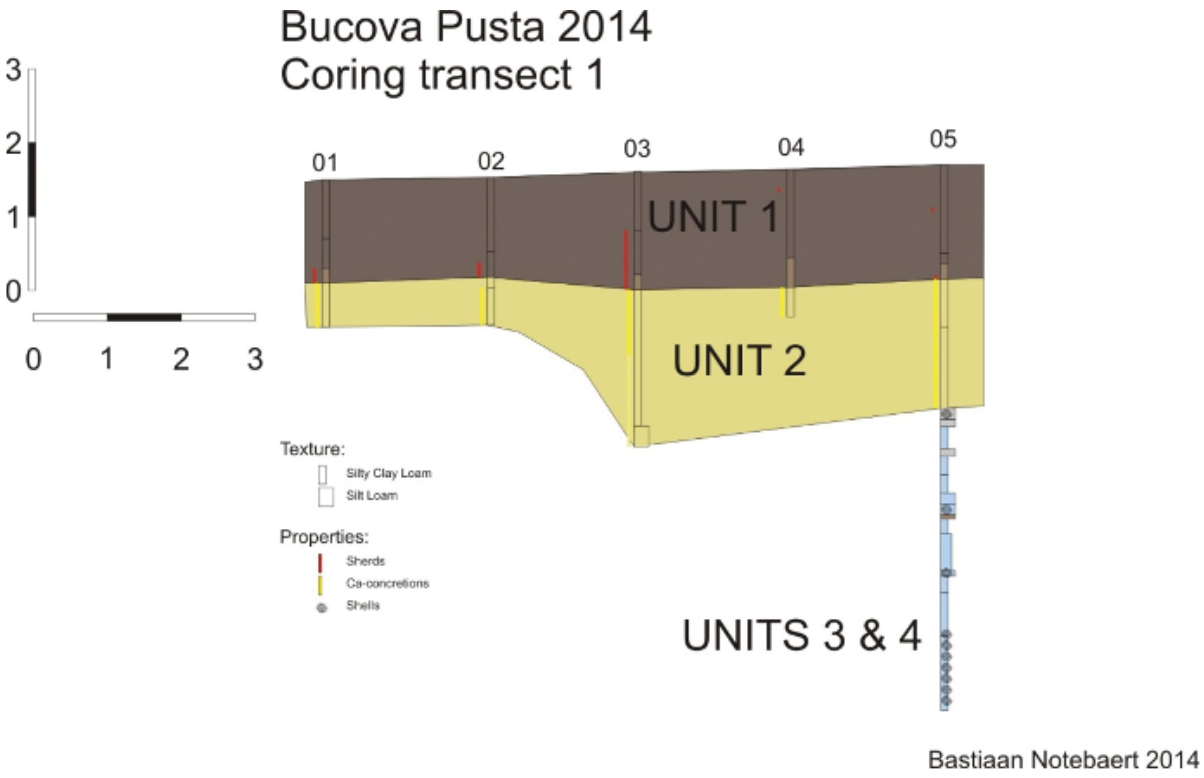


Fig. 7 Sedimentary units identified in Transect 2, made across the depression next to the Neolithic site.

excavations and geomagnetic mapping. The five drillings exposed a very similar floodplain sequence to that seen in Transect 1 (Fig. 7). The upper layer (Unit 1) with a thickness of 1 to 1.5 m is a dark brown silty clay loam. The lower part of this layer is sometimes less dark (Unit 1B). In Corings 1–3 and 5, the bottom of this layer contained some sherds. Under the dark brown layer, yellowish-brown silty clay loam appears (Unit 2). The transition between the two is generally gradual. This layer is dominated by oxidation marks (Fe and Mn oxidation), and contains numerous carbonate concretions. At the bottom of Coring 3, this layer grades into a yellowish-brown silty loam (Unit 2B). In terms of Transect 2, Coring 5 was the only deep coring (7.5 m). Here also, silty loam is observed beneath Unit 2A, but this time it has a grey colour as a result of the reduction of iron oxides (Unit 2B). The layer also contains some shell remains. Below Unit 2B, smaller layers of silty clay loam (Unit 3) and silty loam to sometimes loam (Unit 4) alternate. They have a grey colour, and both can contain shell fragments. As the horizontal relationship between the units remain unclear, it is difficult to separate them.

In general, the corings exposed overbank deposits with a structure similar to the stratigraphy seen on the two ends of Transect 1 (Fig. 6). The width of the excavated ditch was less than the width of the anabranch studied north of the site. If the feature is assumed to be natural and formed prior or contemporaneously to the settlement of Neolithic people, then, on the convex side whereupon the settlement is situated, point bar deposits similar to those identified in Transect 1 should be found. Still assuming that the feature is natural, but formed after the abandonment of the settlement, then the growing bend should have eroded the Neolithic mound on account to meander development, which is not the case.

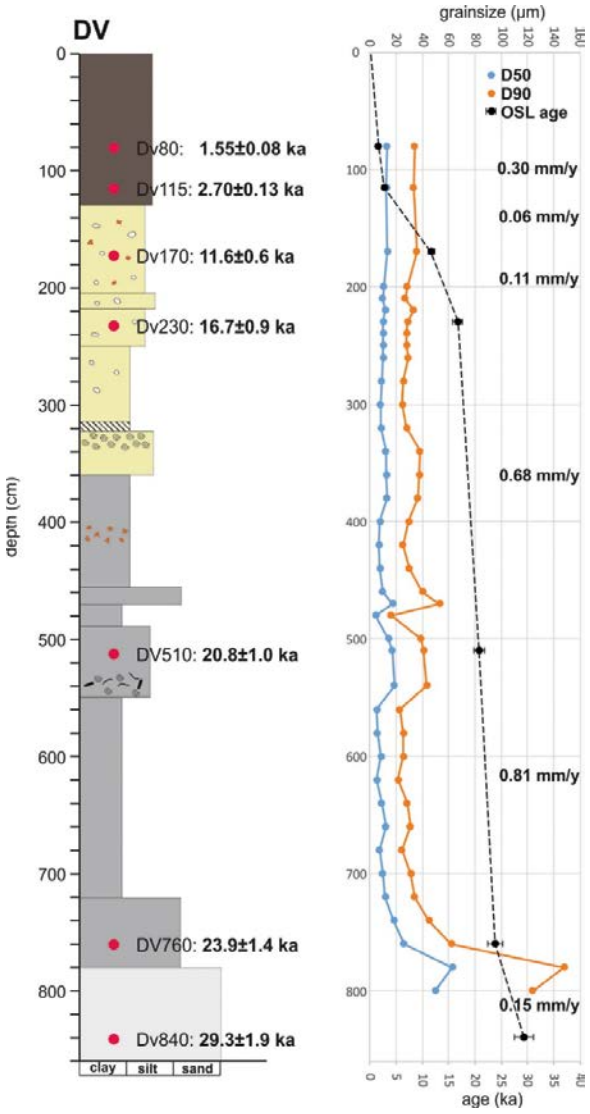


Fig. 8 Stratigraphy, ages and sedimentation rates at Coring DV, drilled at the bend-like depression next to the Neolithic site.

OSL ages and reconstruction of local geomorphic development

The drilling made at Transect 2 (Coring DV) in order to sample sediments for dating and grain size measurements clearly had a stratigraphy similar to that described before (Fig. 8). The only exception is that sandy deposits were reached at 8 m, demonstrating a higher energy fluvial environment. The mean grain size (D50) of this deposit is around 60 µm, which is the upper limit of coarse silt on the Wentworth grain size scale; however, it also contains a considerable amount of very fine and fine sand on the basis of D90 values. Based on this, it can be interpreted as an upward fining point bar deposit if the stratigraphy of Transect 1 is taken as an analogy (Fig. 6 and 8). Point bar deposits relate to active channel formation, taking place at 29.3±1.9 ka BP, i.e., during the beginning of the Last Glacial Maximum (LGM). Above the presumable point bar deposits, sediments start to get finer, starting from medium silt (D50=25 µm at 760 cm) and ending in very fine silt (D50=7 µm at 680 cm) (Fig. 8). Based on the age obtained from this unit (23.9±1.4 ka BP), the sedimentation rate was 0.15 mm/year during the first half of the LGM (Fig. 8).

Subsequently, a 1.5 m thick layer of very fine silt and clay (D50=5.2 µm at 580 cm) accumulated which finally ended up in medium silt at 20.8±1.0 ka BP. This upper layer also contains some vegetal remains and shell fragments (Fig. 8). Accumulation rate is the highest at this part of the entire section (0.81 mm/year); consequently, the area could be a depression in this period. A similar environment can be assumed up until around 350 cm, the upper limit of Units 3 and 4 (see Transect 1 and 2). The variation in grain size indicates the changing distance of the river, or more likely an anabranch of it, from the site (Fig. 8).

In respect to the layers of Unit 2 (see Transect 2), grain size does not significantly alter, but it still gets slightly coarser (D50=11.9 µm at 340 cm). However, the major difference is not this, but rather the presence of carbonate concretions all over the sedimentary unit, and a carbonate pan at 320 cm (Fig. 8). Although the bottom of Unit 2 was not sampled for OSL, ages from the middle (16.7±0.9 ka BP) and the top (11.6±0.6 ka BP) indicate a decreasing accumulation rate, being only 0.11 mm/year between 230 and 170 cm. Based on the above, the unit can mostly be interpreted as a low-

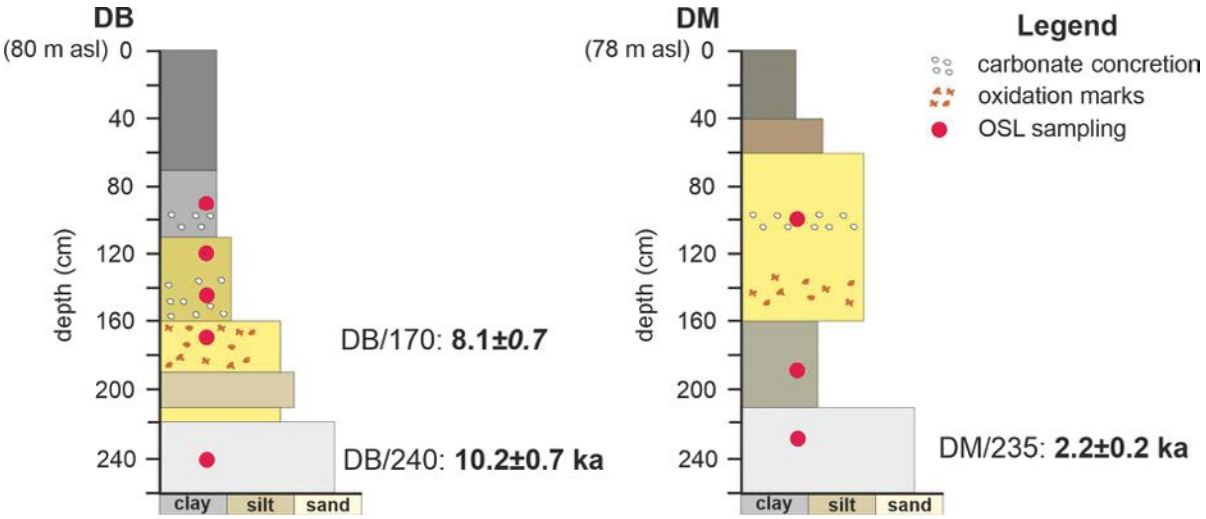


Fig. 9 Stratigraphy of Coring DB and Coring DM exposing a buried braid bar and a point bar, respectively.

energy floodplain sequence, accumulating in an environment when fluvial fine sediments were mixed with aeolian dust, since the main river was far from the site. This is essentially true, since the palaeo-Mureş was flowing in a north-westerly direction on its alluvial fan at this time (Fig. 1).

A remarkable change in both sediment characteristics and accumulation rate occurs at 130 cm (Fig. 8). The very uniform layer (fine silt, D50=13.7 μm at 80 cm) on the top of the sequence started to accumulate around 2.7±0.1 ka BP, meaning that there was either a severe drop in sedimentation rate or an erosional event at some time between 10 ka and 3 ka BP (Fig. 8). The first option can presumably be ruled out, as the palaeo-Mureş appeared on the southern part of its alluvial fan along the Periam–Lovrin–Comlosu Mare corridor after an avulsion event at around 8 ka BP. This means that although the river was braided, it should have deposited some overbank fine sediments in the area, being well below the alluvial surface of the high discharge main channel. Moreover, by incising and shifting in the direction of Periam–Cenad, it came closer to the site, but overbank sediments are seemingly also missing from this period.

The development of the surroundings of the Neolithic site can be understood better by considering the ages obtained from Coring DB and Coring DM (Fig. 9). Based on macroscopic features, Coring DB already exposed coarse channel sediments from a depth of 220 cm, reinforcing the notion that the braid bar of a very shallow channel, buried later by floodplain deposits, was hit possibly by the coring. Based on the obtained OSL ages, the channel was formed actively until 10.2±0.7 ka BP. Subsequently it was filled up by fine grain overbank sediments, though sedimentation rates cannot be calculated at this coring. However, the 8.1±0.7 ka BP age obtained from a silty layer between 160 and 190 cm, similar to that seen in Coring DV (Fig. 8), does indicate that overbank sedimentation existed in the area during the activity time of the Periam–Lovrin–Comlosu Mare braided channel, but is simply not preserved in the depression near the archaeological site. Based on the OSL ages at Coring DB and Coring DV and the similarity of deposits, the buried braided channel and the bend-like depression could have developed simultaneously until around 10 ka BP.

The coring on the youngest point bar of the meandering channel exposed a typical

point bar sequence (Fig. 9). The age of the sandy deposit, reached at a depth of 210 cm, was 2.2±0.2 ka BP, which fits well to the period identified for the formation of the Aranka main channel (Kiss et al. 2015). This reinforces our previous assumption that the palaeo-channel could be an anabranch of the Aranka. The age obtained might also indicate that the depression next to the mound could have been reactivated in this period as a result of rejuvenating fluvial activity in the area. This could explain the hiatus of sedimentation at Coring DV between 12 and 3 ka. However, deposits filling up the bend-like depression and the anabranch are very different, moreover, such a reactivation should have introduced sand to the depression.

Conclusions

Morphologically, the area under investigation is situated at the edge of the Mureş Alluvial Fan on a low slope, relatively deep-lying floodplain. The age of major palaeo-channel systems near the surface suggests that the main flow of the Mureş certainly avoided the region for at least the past 8–10,000 thousand years. Therefore, mostly overbank sediments accumulated, which is also supported by the transects made in the vicinity of the Neolithic archaeological site. There are unambiguous signs of intense fluvial activity at 10 ka (Coring DB) and at around 2–3 ka (Coring DM).

Sedimentation rates display great differences in the sedimentary sequence related to the depression embracing the Neolithic archaeological site (Coring DV). During the period of the Late Glacial Maximum, it almost reached 1 mm/year, then it decreased by the Late Glacial. The reasons behind this can be complex: both partly geomorphic, as we know at this period the palaeo-Mureş was mainly flowing on the northern part of the alluvial fan (Fig. 1), and partly climatic, as climate amelioration could change sediment dynamics. However, an even more dramatic drop can be seen at around 10 ka, at the interface of overbank silt and the topmost deposit interpreted as the fill material of the depression. This must certainly demonstrate either an erosive natural process, or human agency, as both could result in a hiatus of this type in the sequence, although, in the case of fluvial activity, channel sediments should also have accumulated in the depression.

Based on the OSL ages, the depression was filled up by unstratified sediments from 3–2.5 ka BP. Deposits may originate from the continuous erosion of the nearby mound, the overbank sediments of the Mureş shifting to the flow direction of Periam–Cenad, and the anabranch nearby the site.

Based on the geomorphological and sedimentological information gathered in the framework of the present research, a wet, marshy plain can be reconstructed for the area during the Neolithic period, with stands of floodplain forests and recurring floods, resulting in shallow water coverage from time to time. This also explains the necessity of constructing a mound to settle and exploit this rich, but possibly harsh environment.

History of research

Dan Ciobotaru, Constantin Kalcsov

3.1. The sites investigated by Gyula Kisléghi Nagy at Bucova Pusta

(Dan Ciobotaru, Constantin Kalcsov)

As Gyula Kisléghi Nagy frequently noted, Bucova Pusta (Bukovapuszta, Pusta Bukova) was a farm belonging to the larger farm of Pusta Budovala in his own time. Both were part of the Comloşu Mare estate belonging to Princess Milleva de San Marco, née Nako (Nagy 2015, 52, 78). Bucova Pusta was located on the right side of the road Sânnicolau Mare-Dudeştii Vechi, towards Cenad and south of Pusta Budovala. Access was by way of a dirt road starting from the aforementioned main road and cutting across the farm. The old farm buildings are no longer preserved, and the modern farm is located a few metres to the south. During the communist period, a very large sheep farm was built on the right side of the road leading to the old farm. The land is barely agriculturally productive, being suitable mainly for sheep grazing. In many archaeological publications, the location Bucova Pusta-Dudeştii Vechi appears erroneously attributed to Dudeştii Vechi (it never belonged to the commune of Dudeştii Vechi). Today, this belongs to the territory of the town of Sânnicolau Mare (formerly Gross Sankt Nikolaus, Nagyszentmiklós).

The River Aranka flows from south-west of the town of Arad to Sânnicolau Mare, and then the villages Dudeştii Vechi and Valcani before passing into Serbia. In the area of Sânnicolau Mare, it splits into the main course of the Aranka to the south, and Gornja Aranka to the north. The second branch, the Gornja Aranka, flows along the northern edge of Bucova Pusta. Nowadays, the Gornja Aranka water system is connected by modern pumping stations to the Mureş River, which provides most of the water. These loess-type soils are easily washed and transported by floodings, allowing the formation of new meanders. Some of these post-Holocene river branches are still visible in the aerial photographs.

During the communist era, Bucova Pusta belonged to Sânnicolau Mare's agricultural enterprises. Several mounds of earth, large and small, were scattered over this flat land. This is the area to which Kisléghi Nagy was transferred in 1902 as chief administrator of Pusta Budovalla and Bucova, and it is here where he undertook his excavations at the beginning of the 20th Century.

As prior academic literature mentions his system of registering the sites of Bucova Pusta, we considered it useful to retain the

same nomenclature for the sites which he discovered and excavated in the area.

Bucova I

Tumulus no. I from Bucova Pusta was excavated by Kisléghi Nagy on 17th and 18th November 1902. He notes that the tumulus' mound is not marked on the military map (Zone 21-Col. XXIII), but locates it close to the right side of the dirt road to Bucova Pusta which is perpendicular to the main Sânnicolau Mare-Dudeștii Vechi road; nowadays, the mound is no longer visible. Kisléghi's information about the mound is imprecise. The excavation which he conducted on the mound was rhomboid in its surface shape. The longest diagonal of 12 metres was oriented west to east (towards Dudeștii Vechi and Sânnicolau Mare); the short diagonal was 8 metres in length with a north-southerly orientation (towards the farm at Bucova and the main road). The top of the mound marked the intersection of the diagonals. The square core of the rhomboid trench (20 m^2) was excavated to a depth of 2.5 m, while the rest of the rhombus-shaped area was dug 2 metres deep.

At the centre of the mound, a square spot 2 metres in diameter was recorded. The spot consisted of a light brown softer soil covering the grave up to 40 cm above the skeleton. Traces of a funeral coffin were identified, and, inside this, a skeleton lying at a depth of 2.5 metres. The bones had turned almost completely to dust. The body was oriented west-east (with the head to the west and the legs crouched), and the skeleton seemed middle-aged. The grave inventory consisted of a ring-shaped silver wire placed under the remains of the skull (Nagy 2015, 82).

Bucova II

The earthen mound designated Bucova Pusta Tumulus II is located on the left side of the aforementioned dirt road to the old farm buildings. Kisléghi locates the site within the third ploughed area, with the coordinates 4603'57''/38011'40'' (Zone 21 Col. XXIII on the military map).

The tumulus is cone-shaped with a height of 0.5 m, and a circumference of 50 m. Kisléghi attempted to excavate the mound on 10th August 1900, but the hard soil caused him to abandon this; rather, excavation was first undertaken between 16th and 23rd September 1902. Acording to the author, the mound was located 600 m south of the old Bucova farm. The trench was 25 m^2 in area, and 2.5 m deep.

He uncovered the following graves:

Grave no. 1. Human skeleton affected by ploughing at a depth of 25 cm; head oriented NE and legs SW; it was a child's grave.

The grave inventory consists of:

Rounded button, with 17.5 mm diameter and 1 mm thickness made of bronze, central perforation of 4.5 mm, 7 pieces found.

Rounded button 23 mm in diameter, thickness 1.5 mm, made of bronze, a circular ring was added on the edge.

Hexagonal-shaped belt mount in secondary function as ornament, diametres 26 and 21 mm.

Oval hoop of an earring with a bead-row pendant earring fragment, length 28 mm, made of bronze wire.

Spherical button made of bronze with attached ring, 6 mm in diameter.

Open-work braid discs, flat disk, 47 mm in diameter, 2.5 mm thick, two pieces. Decorated with a horse and rider.

Iron awl tip with two arrow fins, total length 10 cm.

32 pieces of opal glass beads out of which eight two-piece string beads.

Bucova Pusta II, inv. no. MNBT 9351

This grave inventory was later presented as an important Early Medieval feature (Teckenberg 1950, 251–252).

Grave no. 1 was located in the SW corner of the trench.

Grave no. 2 consists of disturbed fragments of a skeleton. This is probably the first grave of the tumulus, and was robbed. The horizontal distance between the graves is 1 meter and the vertical distance is 0.75 m. A more detailed description of the discovery and the drawings from Bucova II is published in the Romanian version of Kisléghi's diary (Nagy 1904, 419; id. 2015, 78–79).

Present-day field research demonstrates the topographical coordinates to be: N46003'54.8"/E20031'39.3", and a height of 86 metres above sea level.

Bucova III

The earth mound is located 150 m NW of Bucova II, it has a regular shape and is smaller than Bucova II. Kisléghi's excavations were performed on 28th August 1903.

Geographical coordinates: N 46003'57.3"/ E 20031'32.6", height 84 m.

Uncovered structures:

1. Grave of a horseman in intact condition; it was located in the middle of the mound, at a depth of 0.50 m, with the head to the west, and no trace of a coffin.

Inventory:

Cast button with attachment ring, of globular shape, situated in the area of the left ear.

Lock ring of circular section, in the area of the right ear.

Six belt mounts in shape of a shield, in the belt area. Dimensions: 2 x 1.5 cm.

Rounded belt mount with with a diameter of 2.3 cm, found in the belt area.

Fragments of a small ornaments made of thin metal plate.

A quiver of arrows was uncovered by the skeleton's right shoulder. The quiver was 80 cm in length and 9 cm in width. Inside, there were 6 iron arrow tips with two arrow fins. A flint and a strike-a-light were placed on the chest of the body (Nagy 1904, 420).

The horse skull was placed at the skeleton's left side, resting on top of horse leg bones. Fragments of stirrup and 3 bronze harness ornaments were recovered from the same location (Nagy 2015, 90–91).

Bucova V

In his diary, Kisléghi mentions two mounds of smaller dimensions near Bucova farm, on the agricultural field Vordere Banka belonging to the village of Cenad. The mounds were located on the right side of the road Cenad-Nerău. On 4th May 1904, Kisléghi witnesed a group of workmen excavating the mound Bucova V and carring the soil to sorrounding lower areas. On 5th–6th May 1904, Kisléghi organised an excavation in order to recover the remains of the archaeological structures (Nagy 2015, 113–117). Bucova V was also known as the Waltrich mound. The second mound is never mentioned in the diary (Nagy 1912).

Fig. 1. Sherd decorated with a goat or deer representation. Bucova Pusta VI. MNBT, inv. no. 446.

Neither of these mounds is recognisable on the surface today.

Bucova VI

About 600 metres south of Bucova IV lies a very small earthen mound which was rounded and slightly conical with a height of 0.25 metres and a diameter of 6–8 metres in Kisléghi's time. Nowadays, the area displays traces of modern buildings and few ceramic fragments (Early Neolithic).

The geographical coordinates are N 46004'02.7"/E 20032'20.5". The mound is 85 m in height.

The excavation was begun by Kisléghi's collaborator Demeter Racsov in late December 1905, with Kisléghi continuing during the last days of the month.

The author describes four reconstructed ceramic vessels which he uncovered from this site along with a special artefact, a sherd decorated with the representation of a goat or deer (Nagy 2015, 133–135, Fig. 1).

Bucova VII

This archaeological site is located 40 paces south of Bucova VI; its earthen mound was rather modest in dimensions. The excavation brought to light only a grave with no ceramic fragments. The head of the skeleton was oriented to west and the legs were crouched. The grave lay at a depth of 2 metres, dug directly into the earth.

Bucova VIII

This earthen mound is located on the right side of the dirt road extending perpendicularly from the main road Sânnicolau Mare between Dudeştii Vechi, in the vicinity of Humka Mare, towards Cenad village. Near the road, on the right side, there is a small canal, and situated next to it a modest mound 15–25 m in diameter and 0.5 m in height. It is located at 83 m above sea level, and its geographical coordinates are N 46004'13"/E 20032'38.9".

Kisléghi describes this mound as being approximately 1300 m east of Bucova Pusta, in the vicinity of a shadoof well. On 23rd August 1906, he excavated a trench with a length of 6 m and width of 2 m in the centre of the mound, within which he found a horseman's grave at a depth of 1 m. The skeleton was buried together with a horse skull and two horse legs (Nagy 2015, 140–142).

Bucova IX

Kisléghi describes this mound as being situated at 1100 m South-East from Bucova Pusta farm. It is documented on the Military

map (Area 21-col. XXIII) under the name Humka Mare. Its height is 5.5 m. Excavations were undertaken between 26th September and 15th October 1907. Located in the middle of the mound, the trench was 12 metres long and 5.5 metres wide and oriented east-west, in the middle of the mound.

Altitude 95 m. Geographic coordinates N 45003'55.5"/E 20032'24.0".

Kisléghi documented the following:

1. Grave – Two metres south from the mound's centre point, at a depth of 60 cm, a very poorly preserved skeleton with coffin was discovered. The skeleton was probably supine with the head oriented westwards and the legs pointing towards the east.

Inventory of the grave:

Trapeze-shaped stirrup.

Iron knife.

Trapeze-shaped stirrup, broken.

Arrowheads.

A piece of polishing stone.

Horse bit with single-piece bar.

On 5th October 1907, he divided the trench into three equal segments, and continued excavating the middle part. On 7th October, at a depth of 3 metres, he reached a cavity in the centre of the mound in the shape of a cupola. He recorded it as a grave with a rotten wooden roof. He noticed the filling of the grave was circular, with a diameter of 2.5 metres. The grave reached the natural soil at 4.5 metres. The soil in the grave structure was different than the natural soil, and also different than the surrounding layers. The ceramic fragments uncovered belonged to two phases: a Neolithic layer and a Late Iron Age layer. In the middle of the mound at the bottom of it, Kisléghi found an untouched grave. The human skeleton was lying in a crouched position and was covered with a red-brown ochre paint.

The head was oriented towards the west and the legs eastwards, with the knees turned to the north.

The inventory of the grave consisted of:

Fragment of an ashy quartz transparent blade, 4 cm long and 1.5 cm wide with triangular section.

Similar fragment of a flint blade with the colour of light meat.

Two quartz splints of darker colour.

Fragment of a flat polished axe tip, 4.1 cm long.

4 smaller flint splints.

Kisléghi concluded about the mound the following:

The tumulus was lying on top of a Neolithic settlement.

The tumulus was built after the Neolithic Age, probably in two phases.

In the migration period, the mound was even higher than today.

The upper part of the tumulus was excavated in the antiquity, but the grave remained intact. It is not sure whether there was another central grave in the middle of the mound but grave inventory was collected few meters near the center of the mound consisting of

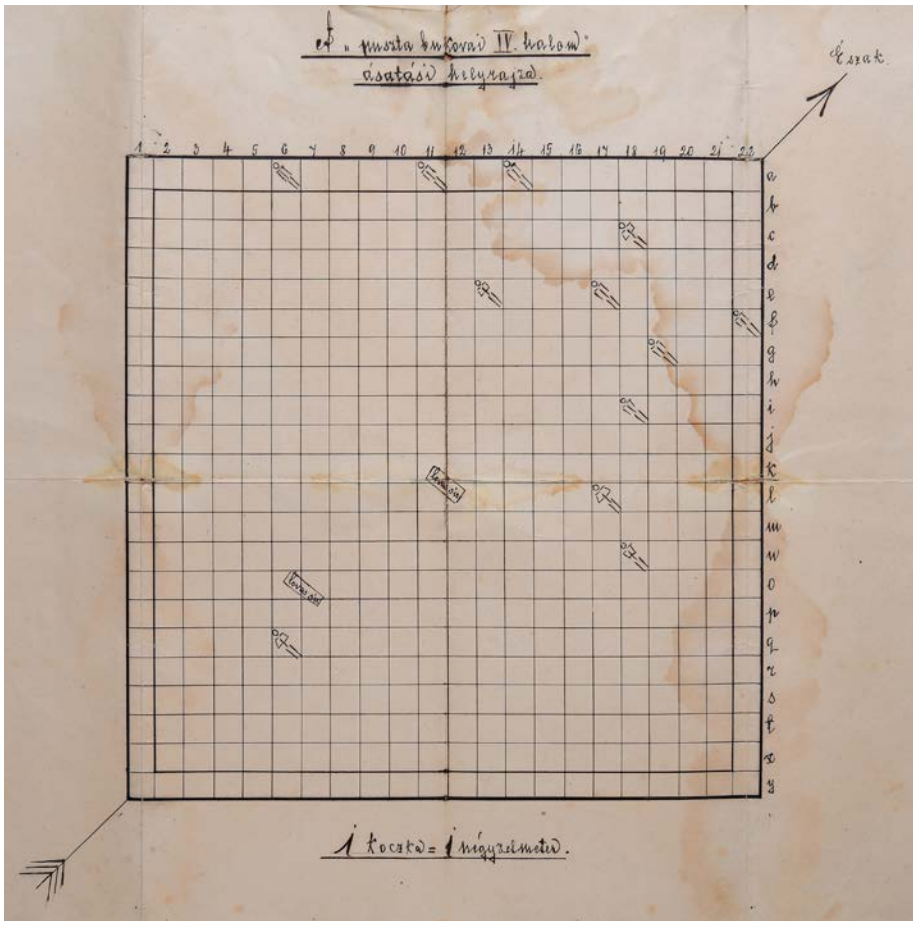


Fig. 2. The grid designed by Kisléghi for the Bucova Pusta IV excavations. MNBT, inv. no. 21043.

a spearhead, a rectangular perforated iron attire ornament, fragments of an iron knife, a piece of an iron buckle, three fragments of a thin silver pendant and a human tooth. This inventory indicates a potential disturbed grave on the site (Nagy 2015, 149–152).

Besides the 9 earthen mounds excavated by Kisléghi, he also probed some other sites in the vicinity:

On 16th–17th August 1907, he also excavated the ploughed area Bucova III.I, which is located on the west side of Bucova sheep farm, at the edge of the Islaz pasture belonging to Dudeștii Vechi (coordinates: N 46003'39.4"/E 20031'44.1"). Ceramic fragments, polished and grinding stone fragments, and a piece of a silver denarius from the reign of Antoninus Pius were found within the excavated area. The ceramic repertoire consisted of coarse pots, La Tène sherds, and greyish wheel-made ceramics. At the highest point of the mound, Kisléghi dug two trenches extending east-west and north-south respectively. Two areas revealing a softer mixed soil were excavated to a depth of four metres without significant findings. These excavations continued on 28th–29th August 1907 and fragments of fireplaces and a small biconical spindle were uncovered here.

Another prehistoric site was excavated between 28th October and 11th November 1902 near Bucova Pusta, on soil plot no. 4953 from section 40 of the cadastral record. The place was interesting due to the presence of brick fragments, sherds and bones on the surface of the soil. The trench was 104 m^2, and was extended with two ditches to the east and west, so that the excavated surface finally was

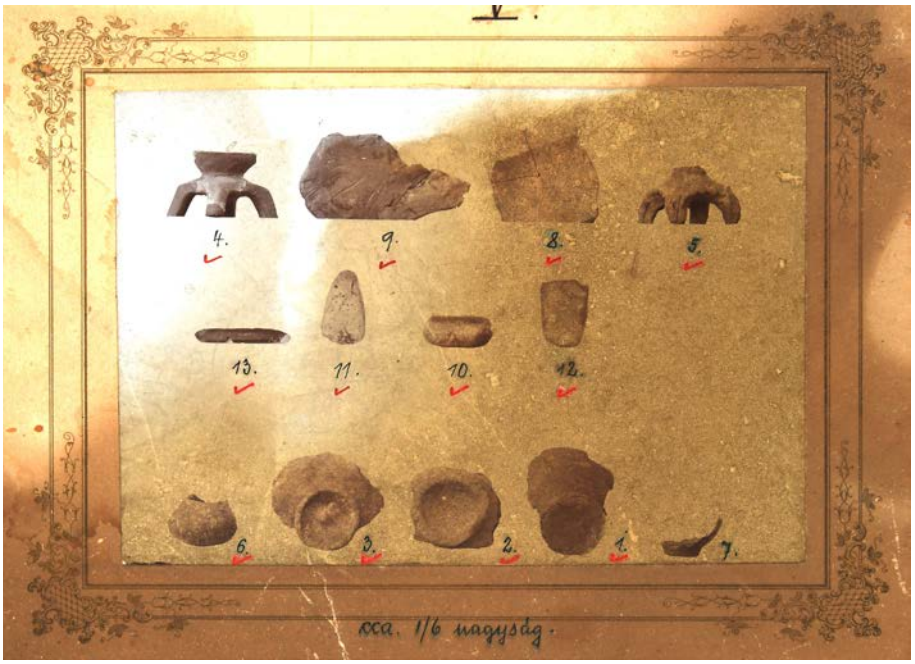


Fig. 3. Original plate of Bucova Pusta IV inventory made by Kisléghi. MNBT, inv. no. 21021.

114 m^2 with a depth of 2 metres. The digging revealed fragments of a rectangular building's wall. The structure was 4.1 m wide. The foundation wall started at 20–25 cm under the surface and lasted until 70–80 cm deep. The width of the wall was 80 cm. The dimension of the bricks was 35 x 17 x 4.8 cm. The filling of the building consisted of hard clay mixed with brick fragments, plaster, ash spots with iron nails and decomposed wooden planks. The filling included also mixed human bones. There was not an entire skeleton until 1 m deep. In turn, there were mixed bones under the walls of the buildings, so the cemetery seemed to be older than the building (Nagy 2015, 80–82).

Inventory of the building filling:

Three small silver coins (Hungarian denars from the reigns of Ludovic [1343–1382], Maria [1382–1386], and Vladislav I [1440–1444] respectively).

Pendant in the shape of a heart.

Silver ring.

In our opinion, the site uncovered by Kisléghi is identical to the large Medieval settlement located north of the site of Bucova IV in the direction of Cenad village. This is the place where the site covers a surface of several hectares. Ceramic fragments are present on surface along the dry fossil canals meandering on the field. One particular dry canal provided a significant amount of human skulls and bones on top of the soil.

3.2. The Kisléghi excavations on Bucova Pusta IV

(Dan Ciobotaru)

The earliest archaeological information in the central Aranka-Mureș Basin is connected to the discovery of a prehistoric site at Beba Veche (Ó-Beba) in May 1878. The site yielded an archaeological inventory now preserved in the National Museum of Banat in Timișoara (Milleker 1897). The earliest discussion of prehistoric sites in the vicinity of Sânnicolau Mare-Dudeștii Vechi begins at the end of the 19th Century with Kisléghi.

Fig. 4a. Bucova Pusta IV pinched ornament. Nagy 1907, 269, drawing no. 1.

Fig. 4b. Same sherd from Kisléghi plate nr. 85. MNBT, inv. no. 3587.

He worked as a chief administrator of a large agricultural estate in the north of the Banat. He began his archaeological prospections in the north-western Banat in 1893, and developed his own methods of documenting the archaeological surveys and excavations, and published four articles about his research (Nagy 1904; id. 1907; id. 1909; id. 1911) and also wrote a significant contribution regarding archaeological discoveries which was published in the academic volume dedicated to the Torontál County of the former kingdom of Hungary (Nagy 1912). Most of his research documentation was preserved as manuscript of his diary, and has been published in a Hungarian-language edition in 2010 (Nagy 2010) and in Romanian in 2015 (Nagy 2015).

According to his publications, he began excavating the most appealing mounds in the Bucova Pusta area, in the vicinity of Sânnicolau Mare, which were in danger of artificial levelling of the agricultural fields (Nagy 1904, 418; id. 1907, 267). The amateur archaeologist used Austrian-Hungarian military maps (1:75,000-Zone 21, Col. XXIII) to identify the site, and gave precise topographical references: 460 4' 27" latitude and 380 12' 17" longitude (Nagy 1907, 267; id. 2015, 100). By the end of his field activity, he had undertaken archaeological test excavations in nine mounds which he described as tumuli in the Bucova Pusta farming area (Nagy 1912, 311).

Kisléghi's archaeological team of local village workmen excavated from 9th October 1903 to 10th March 1904 on Mound IV of Bucova Pusta (Nagy 2015, 100). This site was located on the cadastral land parcel no. 4717 of the Serbian Csanad village, and consisted of a rounded soil mound 1.5 m high and 30 m in diameter (Nagy 1907, 267).

He designed a square grid for the research, marking a rectangular surface of 22 by 22 m, divided into 1 m^2 units identified by letters and numbers (Nagy 2015, 100, Fig. 2). The workers started by removing the earth from the outer units, making a line of 22 metres on each side, then they uncovered the inner surface, from the north-west towards the south-east. The excavated area finally consisted of 484 m^2 (Nagy 2015, 100; id. 1912, 312). The information provided by his diary has been confirmed by geomagnetic investigation; Kisléghi's excavations were visible in the magnetometric mapping undertaken by Jean-Michel Maillol and Cornelius Meyer.

Fig. 5. Bucova Pusta IV, net ornament. MNBT, inv. no. 3587.

Fig. 6. Bucova Pusta IV, pierced ornament. MNBT, inv. no. 3587.

Fig. 7a. Bucova Pusta IV, warts ornamentation. Nagy 1907, 269, drawing no. 8.

Fig. 7b. Kisléghi plate no. 84. MNBT, inv. no. 3692.

Kisléghi's diary offers a general description of the uncovered archaeological inventory of the site, starting with the Neolithic artefacts (Fig. 3). He very accurately identifies the Early Neolithic ceramic fragments, and draws the attention to the 50–60 cm deep level in which most of the artifacts were located (Nagy 2015, 101; id. 1907, 267). Also relevant is the indication that the Neolithic sherds were uncovered on the whole surface, but mostly on the north-western edge of his grid. Moreover, he describes a storage pit located at the middle of the grid underneath a Medieval grave. This pot was deposited in normal position in a pit, and was filled with clay balls and soil (Nagy 2015, 104; id. 1907, 270). His intuition told him that the mound, which seemed to be severely disturbed by later interventions, was not the actual habitation of the Neolithic community, but the core of the

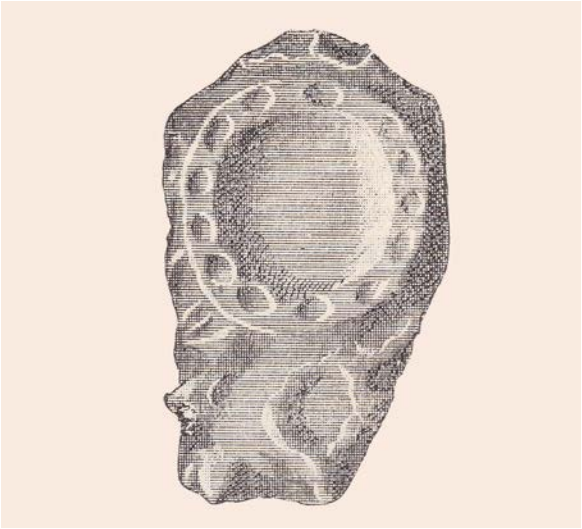


Fig. 8a. Bucova Pusta IV, sherd with plastic ring. Nagy 1907, 269, drawing no. 11.

Fig. 8b. Photo of the same sherd. MNBT, inv. no. 3692.

Fig. 9. Bucova Pusta IV, spiral ornament. MNBT, inv. no. 3692

Fig. 10. Bucova Pusta IV, spiral ornament. MNBT, inv. no. 3692.

prehistoric village must be near the mound (Nagy 2015, 107). This proved to be correct, and the site is actually much larger than what he tried to uncover with his grid.

The following pages are dedicated to the description of the Early Neolithic sherds according to temper, shape, and ornamentation. He mentions the presence of only one ceramic fragment with incised ornaments on the bottom of the pot, and only one ceramic fragment with pierced ornaments. Pots with four legs have also been documented. The author mentions only one ceramic fragment with a painted decoration, and it can be concluded from his description that the fragment actually belonged to a small red-slipped fine pot which had both inner and outer burnished surfaces (Nagy 1907, 268; id. 1912, 312). The aforementioned fragment has not been identified among the artefacts preserved from his collection in the National Museum of Banat in Timișoara.

A basic tally of the ceramic fragments indicates 1500 sherds, consisting of 9 groups according to the part of the pot from whence they come (Nagy 1907, 267–270; id. 2015, 102).

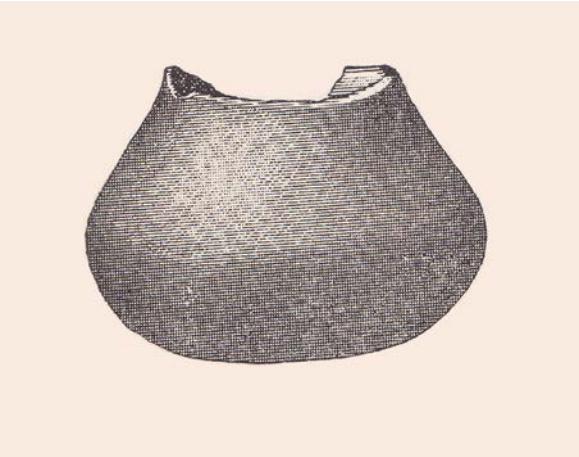


Fig. 11. Bucova Pusta IV, small hemispherical pot. Nagy 1907, 271, drawing no.15.

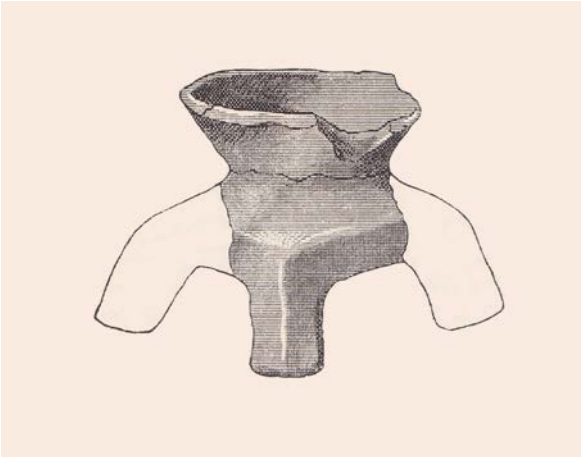


Fig. 12. Bucova Pusta IV, unornamented altar. Nagy 1907, 271, drawing no. 18.

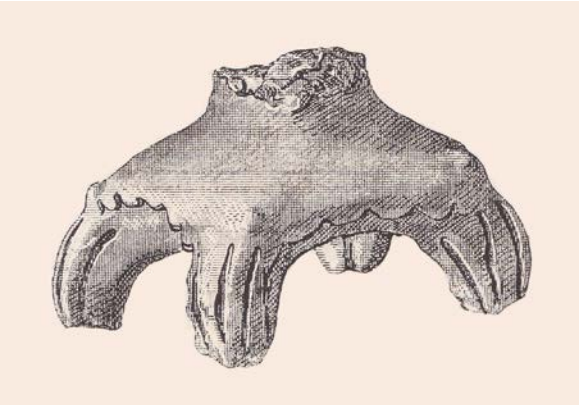


Fig. 13a. Bucova Pusta IV, ornamented altar. Nagy 1907, 271, drawing no. 19.

Fig. 13b. Photo of the same altar. MNBT, inv. no. 566.

From this amount, approximately 75 % were ornamented sherds. The most common decoration consisted of impressed ornaments (mostly made with fingernails), distributed in horizontal or vertical rows, or sometimes variants of those two, whereas others were decorated by irregular distribution of fingernail imprints. A variant of this ornamentation is made by pinching the surface with fingernails, the model resulting in a 'V' shaped symbol (Nagy 1907, 267; id. 2015, 101, Fig. 4a&b).

Kisléghi mentions another pressed ornamentation consisting of a net of incised lines, distributed in different dimensions and orientations. Sometimes, the net pattern is also distributed on the bottom of the pot. (Fig. 5). A variant of the aforementioned is the combination of parallel lines and fingernail pinches.

The author also mentions only one case of round ornaments made with the tip of a stick (Fig. 6).

The relief decoration is also frequent among the ceramic fragments found by Kisléghi. This category mainly consists of barbotine ornamentation, organised as warts of clay distributed on the surface of the freshly modelled vessels. This category

Fig. 14. Bucova Pusta IV, special clay object. Nagy 2015, 209, cat. No. 381.

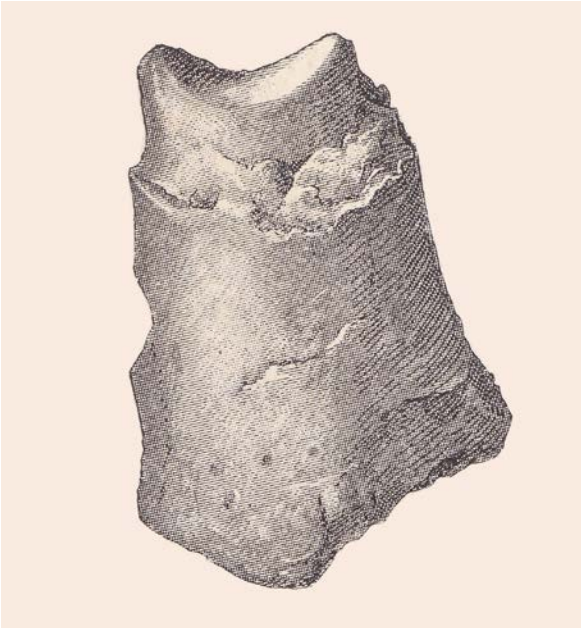


Fig. 15. Bucova Pusta IV, monumental horned clay figurine. Nagy 1907, 271, drawing no. 20.

of ornaments has many variants, depending on the dimension of the warts, their shape, and distribution on the surface of vessels (Nagy 2015, 101; id. 1907 no. 8; fig. 3692/33, Fig. 7 a&b).

A special group of ornaments described by Kisléghi are the plastic ribbons. These are present in different shapes, from rounded rings on sherds or pots to stripes of clay with nail imprints distributed in lines, curves or spirals (Fig. 8 a&b).

In respect to rim ornamentation, Kisléghi remarks the presence of 160 fragments of rims which can be divided in two groups. The first group consisted of undecorated rims, and the second represented the rims with nail impressions and the ones which had fingernail impressions (Nagy 1907, 268).

The author gives a thorough description for seven restored ceramic pots he uncovered (Nagy 2015, 103–104). Some of these pots have been photographed and published by the author, and are still preserved in the collections of the National Museum of Banat in Timişoara.

A large Early Neolithic pot was located immediately underneath the uncovered Medieval graves. The pot was lying on its bottom, and some clay balls or weights were documented within its inner filling of soil. The pot's estimated dimensions indicate a diameter of approximately 60 cm. Kisléghi preserved only few sherds from this pot, mainly the spirals which decorated the belly of the pot at the maximum diameter. The fragments were integrated in the plate 84, which was preserved in the National Museum of Banat, inventory number 3692 (Fig. 9&10). Also, a small hemispherical pot, with the height of 5.8 cm and diameter of 8.5 cm comes from the same Early Neolithic site (Nagy 1907, 268; id. 2015, 103 cat. no. 69; Kutzián 1947, Pl. XXVI, 7, Fig. 11).

From the category of small altars, the author describes two almost complete pieces which had four legs (Nagy 1907, 271, Fig. 18–19; id. 2015, 103, C–D; Kutzián, 1947, Pl. XXXV/5, 9). One of them preserves the conical recipient, and has the two missing legs restored by Kisléghi. The altar is not ornamented (Fig. 12). The second altar lacks the recipient, and has the legs restored. The body is ornamented with excised triangles

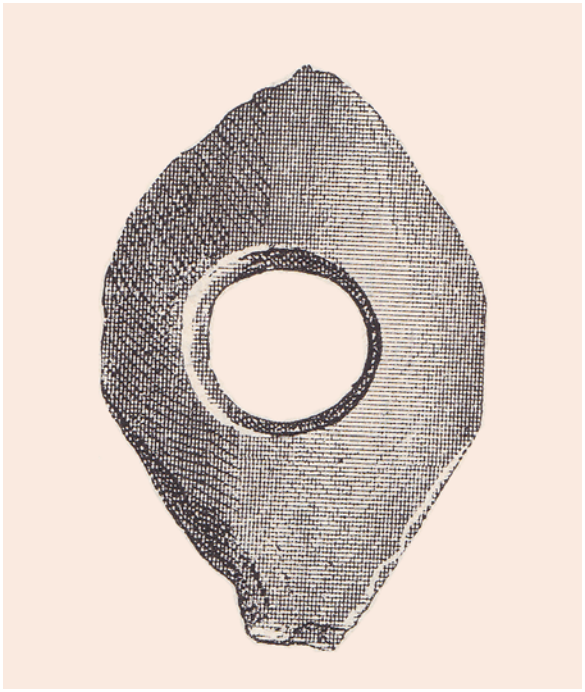


Fig. 16a. Bucova Pusta IV, bone tool. Nagy 1907, 273, drawing no. 25.

Fig. 16b. Photo of bone tool. MNBT, inv. no. 3698.

Fig. 17. Bucova Pusta IV, sharpening tools. MNBT, inv. no. 3698.

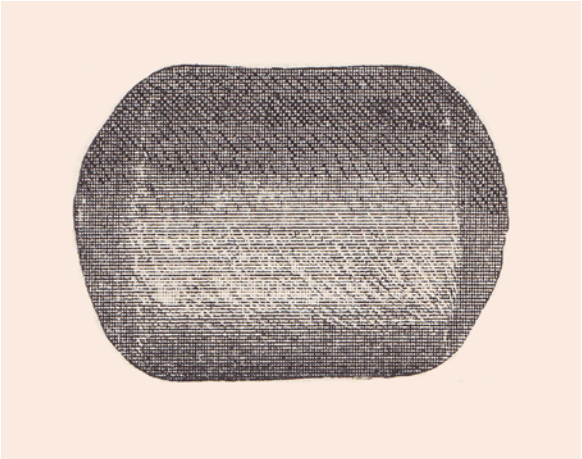


Fig. 18a. Bucova Pusta IV, grinding stone. Nagy 1907, 271, drawing no. 21.

Fig. 18b. Bucova Pusta IV, grinding stone. MNBT, inv. no. 3698.

and parallel vertical grooves on the legs. A protuberance is displayed on each corner of the altar body. A central protuberance is also located under the body (Fig. 13 a&b).

Kisléghi recorded also the presence of clay weights, typical artefacts of this stone-deficient region. The region's lowlands are formed solely of loess, clay, sand, and other alluvial soils transported by the river, and there are no deposits of rocks available for long distance. The author described a group of 14 clay weights located in the a17 quadrant of the excavated surface. The clay weights mentioned were different in shape and ornamentation, and the author tried to define an explanation for the functionality of this kind of pieces (Nagy 2015, 106–107; id. 1907, 275, Pl. I/1, 3).

He noticed that there are some fragments among the clay weights shaped as elongated clay objects with rounded edges. These pieces have a flattened upper surface, sometimes with a circular depression and they are most probably not weights (Fig. 14).

This observation proved to be correct, as several pieces of the same category have been unearthed within our recent research. The use of so-called clay weights is still debated today, and their presence is recorded at all the Early Neolithic sites within the plain.

A special clay object was noticed by Kisléghi Nagy. Very intuitively, he documented a conically shaped object formed from two layers of clay. Unfortunately, the artefact is fragmented and the preserved piece has a height of 18.5 cm. The base's diameter is 14.5 cm. The upper part of the object is modelled in the shape of a half-moon. His suggestion is that this is a special architectural object to be used in front of the fireplace for hanging up fire tools. In fact, it is most probably a monumental horned clay figurine specific to Körös and northern Starčevo cultural aspects (Bánffy 2019, 47–57). This artefact has not been identified among the Bucova Pusta inventory preserved in the National Museum of Banat in Timișoara (Fig. 15).

Kisléghi the amateur archaeologist also noticed the small bone inventory in the Early Neolithic layers. Only few bones and antler fragments have been uncovered in an area of almost 500 m^2, surrounded by Neolithic features (Nagy 2015, 107). One particular bone tool was described and drawn by him,

Fig. 19a. Bucova Pusta IV, stone axe fragment with boring trace. Nagy 1907, 271, drawing no. 22.

Fig. 19b. Same axe photo. MNBT, inv. no. 3698.

Fig. 20. Bucova Pusta IV, stone axe fragment. MNBT, inv. no. 3698.

Fig. 21. Bucova Pusta IV, stone axe fragment. MNBT, inv. no. 3698.

made from a long bone surface in a rhombus shape. In the centre of the tool, a large hole had been drilled by the ancient craftsman (Nagy 1907, 273, Fig. 25, inv. no. MNBT 3698, Fig. 16 a&b).

The lithic inventory is described extensively and classified according to use (Nagy 1907, 270–272; id. 1912, 312; id. 2015, 104–106). The stones were analysed by a famous geologist and palaeontologist, Antal Koch, a member of the Hungarian Academy of Sciences. He mentions two grinding stones made of basalt tuff, and a yellow-brown mica phyllite piece.

Among sharpening stones, four stone fragments were documented, these being fashioned from sandstone, calcareous tuff, sandstone with quartz granules, and a fine yellow granite respectively (Fig. 17).

Grinding stone cores are represented by two pieces, both cylindrical, with rounded

Fig. 22. Bucova Pusta IV, stone axe. MNBT, inv. no. 3698.

Fig. 23. Bucova Pusta IV, stone axe fragment. MNBT, inv. no. 3698.

Fig. 24. Bucova Pusta IV, stone axe fragment. MNBT, inv. no. 3698.

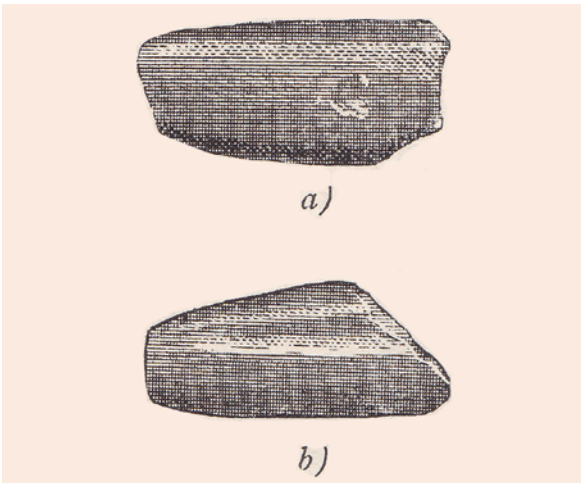


Fig. 25. Bucova Pusta, stone axe fragment. Nagy 1907, 273, drawing no. 24a–b.

conical edges made of yellow-grey granite (Fig. 18a&b).

Kisléghi also discovered seven fragmentary polished stone axes (Nagy 1907, 270; id. 1915, 104, Fig. 19–25). The author gives detailed description of the above mentioned pieces and of two special flint blades, and also two undetermined stone fragments (Fig. 25–26).

The description of the second phase of habitation on the site is truly striking, as Kisléghi succeeds in noticing and defining the material inventory belonging to a more recent phase, which is dated to the Chalcolithic (Nagy 2015, 107–110). His observations concerning the quality of the pottery and the lack of calcite deposits on the surface of ceramic fragments are both correct and accurate. Therefore, he can distinguish the distribution of the pots which contained the remains of incinerated bodies. These facts have been confirmed by the similar features excavated in the recent

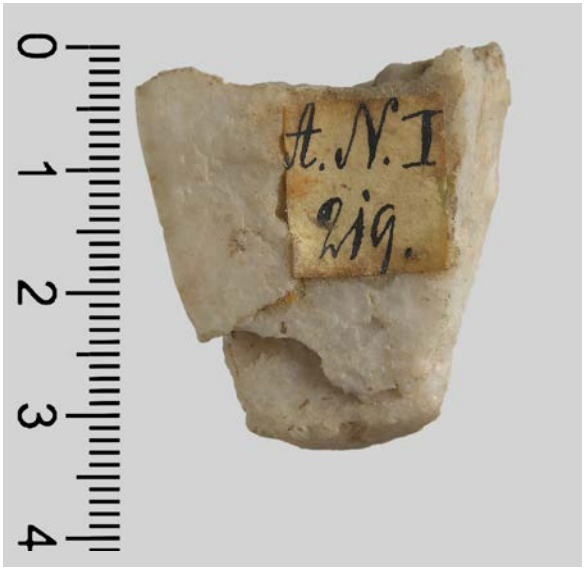


Fig. 26. Bucova Pusta IV, quarzite tool fragment. MNBT, inv. no. 3698.

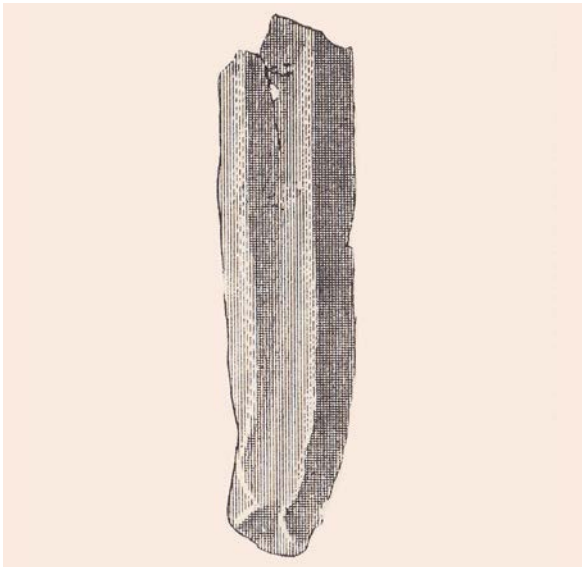


Fig. 27. Bucova Pusta, flint blade. Nagy 1907, 271, drawing no. 23.

project (Krauß et al. 2016). He concludes his description of the post-Neolithic pots by connecting them to the migration era (represented by the graves he uncovered). Although he realised that this represented a second phase of the site, Kisléghi failed to realise that he had found traces of a Chalcolithic cemetery, and interpreted the incinerated graves rather as Medieval (Nagy 2015, 110).

The introduction to the inhumation graves is detailed, and considered very important by the amateur archaeologist, as his main focus was on the search of the traces of his ancestors in the given region (Nagy 1907, 273–278; id. 2015, 110–113). He describes with accuracy the disposition of the skeleton fragments and the funeral inventory belonging to 18 graves with skeletons. Some of the graves were recorded according to coordinates on the excavation grid designed by him. The description of the metal, mostly iron, is consistent and detailed. The arrow heads, stirrup, and other metal artefacts are described using coordinates.

According to the observations which we made when uncovering Kisléghi's old trenches, it is now clear that he did not uncover the entire space, but rather probed the terrain and opened occasional graves. Some of the grave pits were completely emptied by his workers, others were merely opened and the human bones of the burials at the very least were filled back into the burial pit. His sketch shows the position of 15 inhumation graves, which were oriented east-west after correcting the orientation. Our excavations have been able to identify many of the burial pits opened by him, but their positions do not entirely correspond to those within his sketch. This documentation is accordingly of only some value for the reconstruction of the original Medieval burial ground.

As he himself wrote in the diary, the excavations were largely undertaken by his employees mostly in the weekends of the cold season, from October 1903, until the beginning of March 1904. Kisléghi was not able to attend the diggings and relied on the observations made by his team leader and a worker. Some of the graves were uncovered in

December, most probably using heavy tools. From his documentation, we can infer that the Neolithic pits which were located under the inhumated graves could have been missed by the excavators. More than that, according to magnetometry investigations, after the first line of outer trenches have been excavated, the large surfaces dug inside the perimeter had irregular shapes, mostly following the graves and identifiable archaeological features.

The results of his archaeological research concerning prehistoric sites of the Aranka region were briefly mentioned in the ensuing decades, mostly based on Kisléghi's published articles. Endre Krecsmarik includes the deer representation on a sherd from a large vase from Bucova Pusta VI in a short study from 1912 (Krecsmarik 1912, 367). Geza Gárdonyi mentions only the existence of mounds with prehistoric assemblages at Dudeștii Vechi-Movila lui Deciov following Kisléghi's publications; additionally, he mentions the existence of ten tumuli or mounds at Bucova Pusta, of which two were investigated by Kisléghi and proved to be Medieval graves (Gárdonyi 1914, 397). In 1927, Ferenc Tompa discussed the results of Kisléghi's excavations, seeking to integrate them into the East Pannonian Neolithic (Tompa 1927, 48, notes 10–11). Moreover, Janos Banner mentions the decoration styles of the ceramic assembly discovered at Bucova Pusta and Dudeștii Vechi-Movila lui Deciov in an article dedicated to the development of Neolithic research in Hungary (Banner 1934, 17, notes 23–24).

Gathered until shortly before the outbreak of the Great War, an important part of his archaeological collection was transferred to the inventories of the National Museum of Banat in Timișoara in 1927 where it has since been preserved (Nagy 2015, 9). This collection's presence in the National Museum of the Banat in Timișoara was mentioned shortly after the war (Moga 1949, 85, note 22), and served as one of the main sources for the archaeological inventory of the new prehistoric exhibition in the Timișoara Castle which was exhibited in the 6th decade of the 20th Century. Unfortunately, during the communist era, the curators of the Banat Museum's archaeological collection decided to split the collection of Kisléghi; as a result, some of the artefacts in the archaeological register are documented as "formerly of the Nagy collection". This decision bore long-term consequences, as part of this collection cannot be identified within the general inventory even today.

The articles published by Kisléghi were one of the main sources for the monograph on the Körös Culture published by Ida Kutzián in 1944. She had no access to the Banat Museum's collection, so she employed the pictures and drawings published by Kisléghi. Kutzián also notes Kisléghi's intuition in determining the oldest Early Neolithic ceramic materials among the excavated inventory (Kutzián 1947). The inventory of Bucova Pusta included in the monograph is correctly attributed to each of the sites excavated.

The most comprehensive analysis of the Early Neolithic assemblage belonging to the Aranka Basin has been published in the 1970's by Gheorghe Lazarovici. Starting with his dissertation, dedicated to the Early Neolithic of Banat in 1968, which has been published as an article in 1969 (Lazarovici 1969, 3–26), the author introduces for the first time the artefacts collected by Kisléghi and preserved in the collections of the National Museum of Banat in Timișoara. Most of the objects from the collection was still attached to the cardboard plates fashioned by Kisléghi. Although some of the artefacts have previously been exhibited in the permanent exhibition of the Banat Museum located in Timișoara's Huniade Castle, this was the first time they

were documented and published according to Kisléghi's articles and labels. Kisléghi's diary was only recovered in the 1980's, and thus the artefacts belonging to the sites of Bucova Pusta and Dudeştii Vechi have been confused due to a lack of additional information. Moreover, poor management of the Banat Museum deposits in the 1970's and 1980's led to the mixing of the Aranka Basin inventory with other collections. Therefore, some of the old artefacts could not be reidentified within the archaeological depots.

3.3 Investigations at Bucova Pusta IV after Kisléghi

(Dan Ciobotaru)

Until 1980, Gheorghe Lazarovici developed his chronological system dedicated to the Starčevo-Criş Culture in Banat and publishes a series of articles in which the Bucova Pusta artefacts were represented (Lazarovici 1971). Correlations between the Early Neolithic sites of the Middle Mureş River and the Aranka Basin sites excavated by Kisléghi have been introduced by Florin Draşovean in an article of 1981 (Draşovean 1981). A consistent integration of the Early Neolithic sites of the Aranka Basin was published by Lazarovici in a synthesis of the Early Neolithic in Romania published in 1984 (Lazarovici 1984). The problematics of Romania's Early Neolithic were further developed in the monograph dedicated to the site of Gura Baciului (Lazarovici/Maxim 1995). Information concerning the Early Neolithic architecture of the Aranka Basin was also included in the first volume of a monograph dedicated to the Neolithic architecture in Romania, published in 2006 (Lazarovici/Lazarovici 2006).

Some of the main Early Neolithic sites of the Bucova Pusta and Dudeştii Vechi are mentioned in a recent study dedicated to the archaeology of the Mureş Valley (Sava 2015). However, the territory of Bucova Pusta's farmland was not part of the Dudeştii Vechi cadaster; these sites were initially registered as belonging to Cenad, and then Sânnicolau Mare. A doctoral thesis by Andreea Iosza on the Early Neolithic pottery of the region is largely based on the old finds from the Kisléghis excavation at Movila lui Deciov (Iosza 2013).

All the excavations in the Bucova area before the First World War were conducted by Kisléghi. The excavation of Bucova Pusta IV covered an area of 484 m^2, according to Kisléghi's diary and the grid introduced at Fig. 2 (Nagy 2015, 100; id. 1912, 312). Until the publication of his diary, the information concerning the Bucova mounds were unclear, and Bucova Pusta IV was confused with Bucova IX/Humka Mare/Movila Mare. Also, Milleker has never excavated in the Bucova area (Lazarovici 1979, 187, pt. 8c; Sava 2015, 22 and 81).

Although Kisléghi's materials have been mentioned in several scientific publications after the First World War, as mentioned above, the Bucova area was introduced into the scientific research only starting with the summer of 2000.

In connection with the excavations of Dan Ciobotaru and Iosif Moravetz on Movila lui Deciov, northwest of Dudeştii Vechi (Maillol et al. 2004) the site was reintroduced in research and Jean-Michel Maillol performed the first geomagnetic prospection of the northern side of the site in 2005.

The research of the Institute for Prehistory, Early History and Medieval Archaeology of the Eberhard Karls University Tübingen in cooperation with the National Museum of Banat in Timişoara began in 2009, also initially with geomagnetic prospections. Parallel to our work in Foeni-Gaz (Krauß/Ciobotaru 2013), the company Eastern Atlas carried out geomagnetic gradient

measurements at various sites in the northeastern Banat, including 8,000 m^2 on the Bucova Pusta IV. Overall, the magnetic measurements in the Years 2005 and 2009 had covered only a part of the site. The evaluation of the geomagnetic prospection of all measured sites was particularly promising at the site Bucova Pusta IV. Below the tumulus, in addition to the traces of the old excavation, strong signals of burned clay and numerous old river channels were visible in the measurements. In addition, almost exclusively Early Neolithic finds appeared on the plowed surface.

Chapter 4

Geophysical investigations at Neolithic sites in the Romanian Banat

Cornelius Meyer, Dana Pilz, Henning Zöllner

Overview

Within the framework of the archaeological research project on Neolithic settlements in the Banat, three survey campaigns were realised between 2009 and 2013: During the 2009 campaign, the sites of Foeni-Gaz and Parţa Tell II were investigated by means of magnetic measurements using the fluxgate gradiometer array LEA MAX. Furthermore, magnetic measurements were effectuated at the site of Bucova Pusta IV, following the investigations of Jean-Michel Maillol. During the campaign of 2012, magnetic measurements were continued at Bucova Pusta IV, while the campaign of 2013 featured an extension of the surveyed area and GPR test measurements at the site, as well as magnetic measurements at the site of Kalcsov I.

The main objective of the geophysical investigations was the localisation of Neolithic settlement structures such as pit-houses and ditches in order to delimit the inhabited area during this period. In addition, the evaluation of the data demonstrated that the magnetic prospection can also provide information on the geomorphological development of the landscape, i.e. the magnetic data partly also reflect the location of silted-up palaeo-channels, from which information on the origin and development of the settlements can be derived.

Previous work

The first geophysical investigations were carried out by Maillol at some of the region's prehistoric sites in the early 2000's. His results already proved the potential of geophysical prospection techniques in investigating Neolithic sites in the Banat. Maillol and colleagues accomplished geophysical prospection work on a small part of the Bucova Pusta IV site, at the site of Movila lui Deciov (a multi-phase Körös-Criş site located to the north of Dudeştii Vechi), and at the site of Kalcsov I.

Morphology and landscape

The investigated sites are located in the plains of the Rivers Timiş and Mureş. In lithological terms, the plains consist of sands and gravels, and loess on the higher plains and silt in the lower areas. The wetlands have now disappeared due to the regulation of the rivers begun in the 18th century, when the Banat became a province of the Habsburg Monarchy. Thus, many of the smaller river branches and oxbow lakes of the Timiş and Mureş river systems have silted up and have been used agriculturally ever since. These natural and human-made geomorphological processes also led to new soil formations of great thickness in some parts. Today, the topsoil layers of the investigated sites consist of highly fertile soils

such as Chernozem, especially above loess layers. Generally, the topsoil is rich in clay and organic material. These conditions and the knowledge on the structure of prehistoric settlements in this region, the strategy for geophysical investigations inevitably leads to the planning of large-scale magnetic measurements.

Methodology of the geophysical investigation

Magnetic prospection

a) General

Magnetic anomalies are caused by changes in the complex magnetic properties of the soil. The intensity of the magnetic anomalies is determined by the contrast between the different magnetic susceptibilities of archaeological structures and surrounding uninfluenced soil, as well as by the volume and depth of the magnetic structures. Two types of magnetisation can be observed during magnetic measurements: the induced and the remanent magnetisation. The induced magnetisation is ascribed to the effect that the elementary magnets of a matter are enhanced by external magnetic fields (e.g. the Earth's magnetic field) and, consequently, partly align with it. The propensity for this alignment and the enhancement's strength is determined and described by the magnetic susceptibility. In soils, the highest magnetic susceptibility values are observed at ferromagnetic or ferrimagnetic minerals like the iron oxides magnetite and maghaemite. These minerals are ubiquitous in the soil, forming microscopically small grains. There are several possibilities to explain their origin and concentration in soils:

Heating: In soils with rich organic content and in reducing conditions, iron oxides of low magnetisation can be transformed into magnetite and maghaemite under the influence of fire.

Microbial mediation: Microbes populating rich organic deposits can change the soil conditions sufficiently to favour the conversion of weakly magnetised iron oxides into more magnetic forms.

Magnetotactic bacteria: These bacteria are able to produce intracellular crystalline magnetite which allows them to navigate using the Earth's magnetic field. These magnetite crystals remain in the soil after the bacteria's death.

Pedogenetic origin: The magnetic susceptibility can increase during soil formation processes in which organic material is absent.

Incorporation of magnetic material: Increased magnetisation of the topsoil can be a result of anthropogenic accumulations of magnetic materials.

Rocks and soil materials rich in ferromagnetic iron oxides are the carriers of induced magnetisation. Therefore, volcanic rocks, in particular, are characterised by strong magnetic field intensity which can be traced back to their induced magnetisation.

While induced magnetisation requires an external magnetic field for its development, remanent magnetisation stays fixed in a material after its creation. The most important type of magnetic remanence is caused by the heating of a material over its specific Curie temperature. When this happens, the elementary magnets become mobile and align with the external Earth's magnetic field. During the subsequent cooling, the alignment of the magnets is conserved and, consequently, the burnt material becomes a strong magnet. Since the average Curie temperature of soil

Colour	Magnetic anomaly type	Magnetic field intensity	Type of magnetisation	Related structures
Modern features				
	Clearly defined dipole anomalies	>±20 nT	Induced	Modern disturbances caused by scrap metal and other ferromagnetic sources
	Superposition of positive and negative anomalies in areas with partly straight edges	±3 to ±20 nT	Unclear	Refilled archaeological excavation trenches
	Clearly defined circular dipole anomalies	>±20 nT	Induced	Fix points marked with iron bars set in concrete
	Linear negative and positive anomalies	Variable	Unclear	Agricultural features, ploughing marks
Archaeological and geomorphological features				
	Distinct circular and oval positive anomalies	+1 to +5 nT	Induced and remanent	Fillings of pits and post holes, cultural layers; contain pottery fragments and burnt daub
	Linear but partly irregularly shaped zones of positive anomalies	+1 to +5 nT	Induced and remanent	Fillings of ditches, cultural layers; contain pottery fragments and burnt daub
	Distinct dipole anomalies of moderate to high amplitudes	±5 to ±20 nT	Predominantly remanent	Remains of kilns and fire places, accumulations of larger amounts of burnt material and ashes
	Extended sling forming zones of weak positive and negative anomalies	±1 to ±5 nT	Induced and remanent	Silted up palaeochannels
	Extended sling forming zones of weak positive and negative anomalies	±1 to ±5 nT	Induced and remanent	Silted up water course, dated by OSL to be existing between 10,000 and 2,500 BP

Tab. 1 Colour scheme of magnetic data interpretation.

components is around 650°C, fireplaces, kilns, layers of burnt daub, accumulations of pottery, and other burnt materials can be detected on the basis of this effect.

In addition, other types of remanent magnetisation can occur in soils. For example, small grains of magnetic minerals tend to align with the external magnetic field during sedimentary processes, producing the so-called detrital or depositional remanent magnetisation (DRM). This effect can also be observed in anthropological deposits, and thus remanent magnetisation can be registered in filling materials of human-made pits or ditches.

b) Technical application

For the magnetic measurements, arrays of 6 to 10 Förster fluxgate gradiometer probes were

Fig. 1
Foeni-Gaz, results of the magnetic prospection.

used. The probes were mounted on a light and foldable cart. This gradiometer array is a component of the convertible LEA MAX system.

The Förster FEREX fluxgate gradiometer probes register the vertical gradient of the vertical component of the Earth's magnetic field with an accuracy of 0.1nT (Nanotesla). The measured gradient (the difference between two vertically arranged sensors in the gradiometer probe) is insensitive to the typically large fluctuations of the Earth's magnetic field, and is determined only by magnetisation, depth, and volume of local subsurface objects. In 2009, the measurements were carried out using probes with a vertical sensor distance of 40 cm (CON400), while in 2012 and 2013 the measurements were conducted using CON650 probes with a vertical sensor distance of 65 cm. The higher sensor distance of 65 cm causes surface effects to weaken slightly, and the deeper lying magnetic structures and objects provide slightly higher measured values of the magnetic vertical gradient.

The data positioning for the magnetic survey was realised by means of differential GPS. In 2009, a single two-frequency GNSS receiver in RTK mode (Real-Time Kinematic) was used, while in 2012 and 2013 a pair of GNSS receivers, used as base and rover, was applied. The coordinate system used during the magnetic measurements was WGS84 UTM Zone 34N (EPSG: 32634). For the measurements in 2012 and 2013, the base position was corrected by using the coordinates of the fixed points set up for the archaeological excavations at Bucova Pusta IV. Thus, as a result of the base position

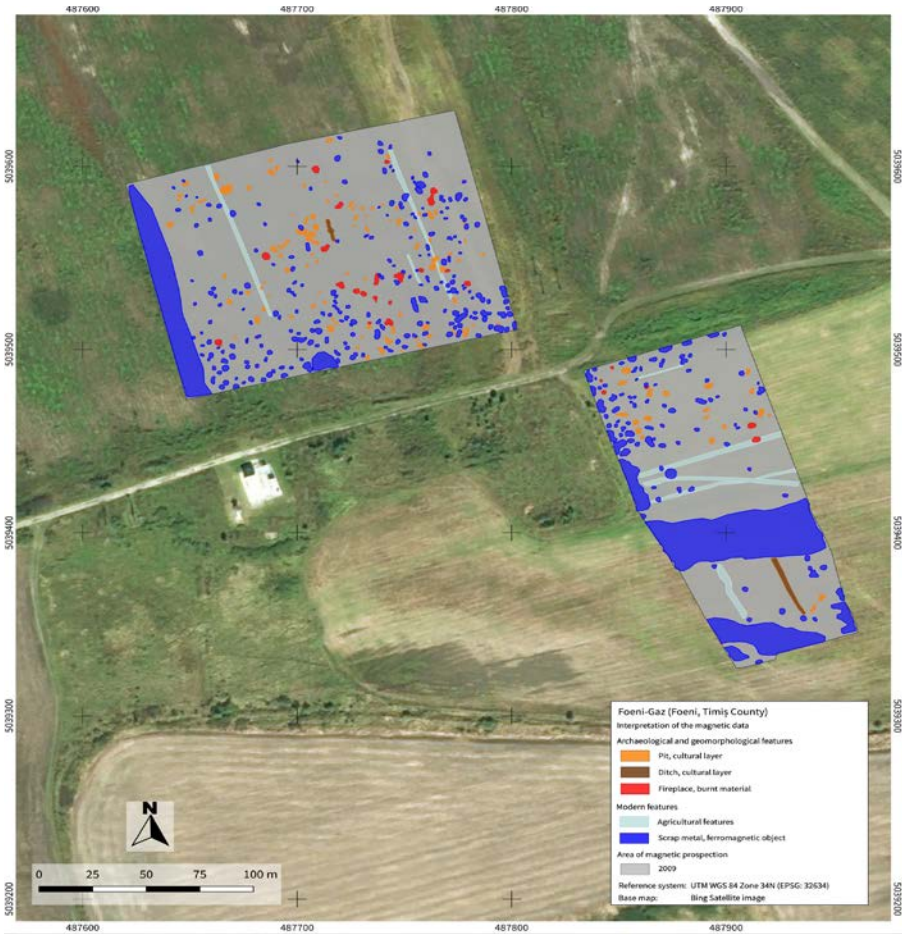


Fig. 2
Foeni-Gaz, interpretation of the magnetic data.

correction, the absolute accuracy of the data positioning is in the range of ±2 to ±10 cm, while, the data from 2009 without using a base receiver is in the range of ±50 cm. Moreover, the geophysical data from the sites of Bucova Pusta IV and Kalcsov I were transformed to the coordinate system used at the archaeological excavations: Dealul Pisculi 1970 / Stereo 70 (EPSG: 31700).

GPR prospection

c) General

The ground-penetrating radar (GPR) method is based on the propagation of high-frequency electromagnetic waves into the ground. The waves are reflected and refracted by different layers and objects. The register of travel-time differences and amplitudes of the electromagnetic waves provides information about the position, depth and specific properties of buried objects and layers. Spherical resolution and depth of penetration depend on both the GPR antenna's frequency and the electromagnetic properties of the ground. A general rule of thumb is that the higher the frequency, the better the spherical resolution, albeit with diminishing depth of penetration.

The propagation conditions of electromagnetic waves are determined by soil properties. The main factor is water content, since water has a very high dielectric permittivity ε, which causes a strong attenuation of electromagnetic waves. Thus, dry and slightly moist grounds offer more favourable conditions for GPR measurements compared to saturated soils. Another important influence comes from clay

Fig. 3
Parța Tell II, results of the magnetic prospection.

minerals. In clayey soils, both penetration depth and resolution of GPR measurements are very poor in most cases because of the presence of crystallisation water binding the clay minerals.

d) Technical application

For the investigation at Bucova Pusta IV, the GPR system SIR-3000 from GSSI with a 270-MHz antenna was used. The GPR data positioning was realised by means of differential GPS, using two GNSS receivers as base and rover.

Interpretation of the magnetic data

The general approach for classifying magnetic anomalies is to distinguish them by means of their field intensity, polarisation, and shape respectively. As part of the first step, anomalies of unambiguously modern human origin were separated and marked in a blue colour. The second step was to sort the remaining anomalies which were assumed to have an archaeological or geomorphological background. In order to structure these anomalies, several classes were introduced with corresponding causal physical structures. The specific characteristics of the anomalies, the related archaeological structures, and the colour scheme, as used in the interpretation maps, are set out in Table 1.

The interpretation here presented is the outcome of a subjective approach taking both the general archaeological context and environmental conditions under consideration; it does not claim to be

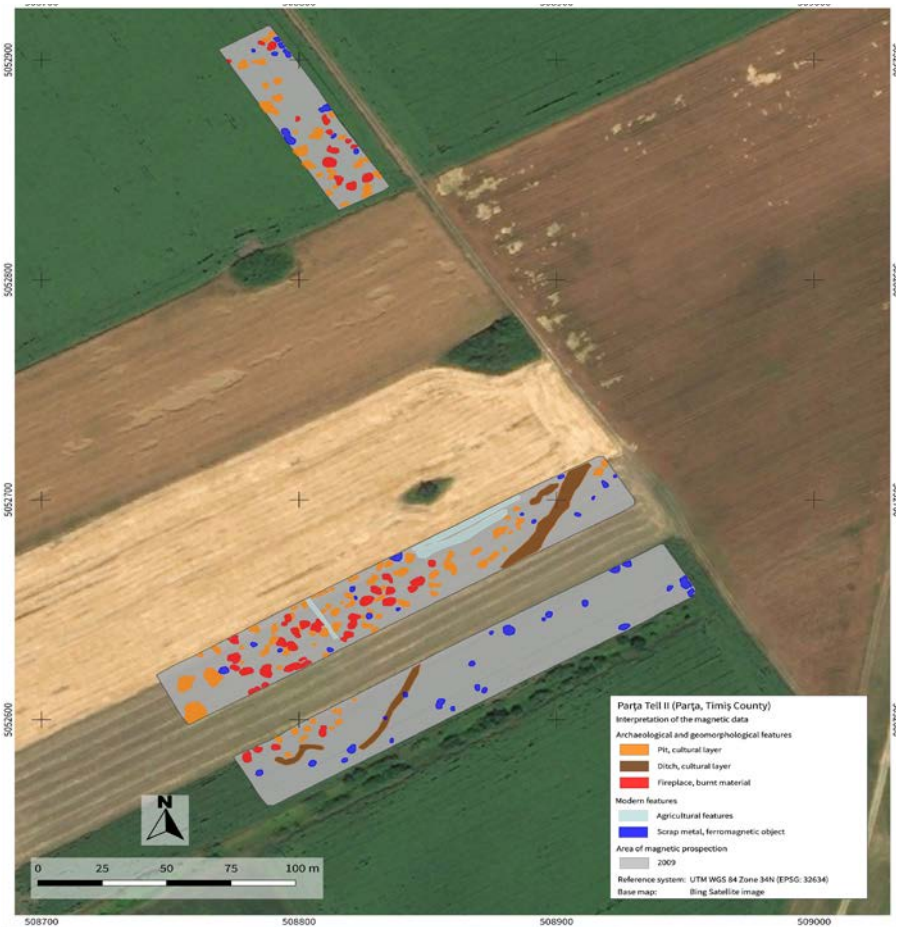


Fig. 4
Parța Tell II, interpretation of the magnetic data.

exhaustive. It is preliminary and conservative, serving as a basis for further archaeological research; the precarious character of any interpretation must be recalled, as the reading of magnetic results can always be subjected to change and to new suppositions.

Results of the geophysical surveys

Foeni-Gaz

Since surface finds suggested the existence of an Early Neolithic site of the Starčevo-Criș period in the area of the former natural gas plant (located 2.5 km to the northwest of the village of Foeni), the area was subjected to archaeological surveys and magnetic prospecting. Two areas, located to the north and east of the former plant were investigated, their total surface measuring about 3.3 ha.

The magnetic data are strongly influenced by the effects of gas pipelines and ubiquitous debris and scrap metal stemming from the gas plant (Fig. 1). In addition, the measurement area was traversed by deep ploughing furrows, which are also clearly visible in the magnetic data. Nevertheless, the data also display large concentrations of archaeologically relevant anomalies. Groups of positive and dipole anomalies were detected, indicating the existence of pits filled with organic matter, remains of fireplaces, and accumulations of burnt daub in the area to the north of the pathway running east-west (Fig. 2). Similar magnetic anomalies are observed in the northern part of the smaller south-eastern survey area. Despite the severe impact of modern disturbances on the data, the existence of prehistoric settlement structures on an area of at least 1.5 ha can nonetheless

Fig. 5
Bucova Pusta IV, results of the magnetic prospection by Jean-Michel Maillol in 2005.

be concluded. However, regular settlement patterns or the existence of enclosing ditches cannot be derived from the data.

Parța Tell II

The Neolithic Tell of Parţa II, associated with the Vinča period and located on the northern bank of the River Timiş to the west of the village of Parţa, was already known and systematically excavated in the 1970's. In 2009, magnetic measurements were realised on three accessible fields outside of the excavated part, in order to detect the limits of the tell settlement and to gather more data on the distribution of house remains and other structures. Two areas of 0.5 ha each located on the south-eastern flank of the tell were surveyed alongside a small field section in the north-eastern part of the tell, resulting in a total surface area of 1.2 ha investigated (Fig. 3).

Despite the fragmentary nature of the dataset, the main features of the tell are recognisable in the data. The modern impact is negligible at this location. Sections of enclosing ditches can be identified by very weak linear, positive anomalies. A high density of strong magnetic anomalies is observed in the interior of these ditches, indicating the superposition of signals originating in the thermoremanently magnetised material of burnt-down houses (Fig. 4). Similar structures are visible in the north-eastern area. Even the arrangement of the houses in pairs, as identified in the archaeological excavations, can be partly reconstructed.

Fig. 6
Bucova Pusta IV, results of the magnetic prospection by Eastern Atlas, 2009 to 2013.

Bucova Pusta IV and VI

- Magnetic survey

Bucova Pusta IV is located 5 km to the northeast of Dudeştii Vechi. The layout of the measurements at this site based, on one hand, on Gyula Kisléghi Nagy's archaeological excavations 100 years ago and, on the other, on Maillol's magnetic measurements in 2005 (Fig 5). During the first campaign in August 2009, an area of about 0.8 ha around the Chalcolithic burial mound was investigated by magnetic gradient measurements. The southern part of Maillol's survey area was covered again. Despite the different magnetic parameters measured (2005: total field, 2009 to 2013: vertical gradient of Z component of the magnetic field), the comparison of the data sets demonstrated a broad consistency in the archaeological information which could be derived from them. In 2012 and 2013, the survey area was extended towards the north and the west. Eventually, a total area of 5.8 ha was covered during the three campaigns (Fig. 6).

The impact of modern disturbances on the magnetic data is particularly noticeable along the field paths, where construction debris was apparently deposited to reinforce them. Additionally, the location of the historic archaeological excavations directed by Kisléghi Nagy in the first half of the 20th century was identified and marked in the data (Fig. 7). The same procedure was applied to Test Trench A located at the north-eastern flank of the burial mound, which was

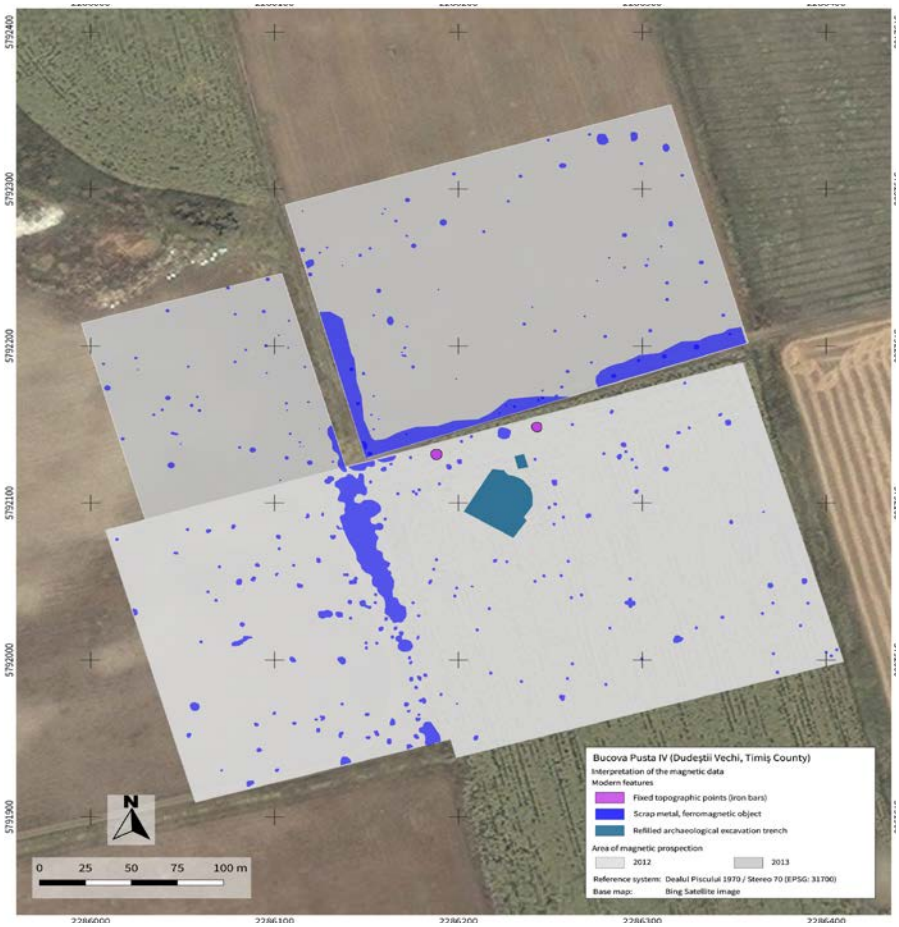


Fig. 7
Bucova Pusta IV, interpretation of the magnetic data, modern features.

opened by Raiko Krauß and Dan Ciobotaru together with their team in 2009. Moreover, the positions of the fixed topographic points for the excavations, marked with iron bars set in concrete, reflect in the magnetic data.

Magnetic anomalies of archaeological relevance are found in the central part of the investigated area, i.e. in the surroundings of the burial mound. To the west of the mound, distinct positive anomalies indicate the existence of large pits with axis lengths of 3 to 10 m. The values of the magnetic gradient suggest thick accumulations of burnt daub and pottery fragments in a humous matrix. The archaeological excavations in this area revealed that the larger features reflect Neolithic house structures, while some smaller features with lower magnetic amplitudes were associated with later, Iron Age structures.

To the north of the burial mound, the density, dimensions, and intensity of the magnetic anomalies all decrease. However, surface finds indicate a continuation of the prehistoric settlement. Compared to the area further to the southwest, the different manifestation of the magnetic data is probably due to a thicker colluvial layer on top of the prehistoric structures.

Besides the small-scale anomalies caused by near-surface structures and prehistoric settlement remains, several large-scale patterns can be observed in the data. The vertical gradient of the field intensity found at these features is generally low, and can be both positive and negative. A comparison with the satellite images shows that these linear or bow-shaped features are related to silted up palaeochannels of the Mureș river system. Soil samples were taken from the structure

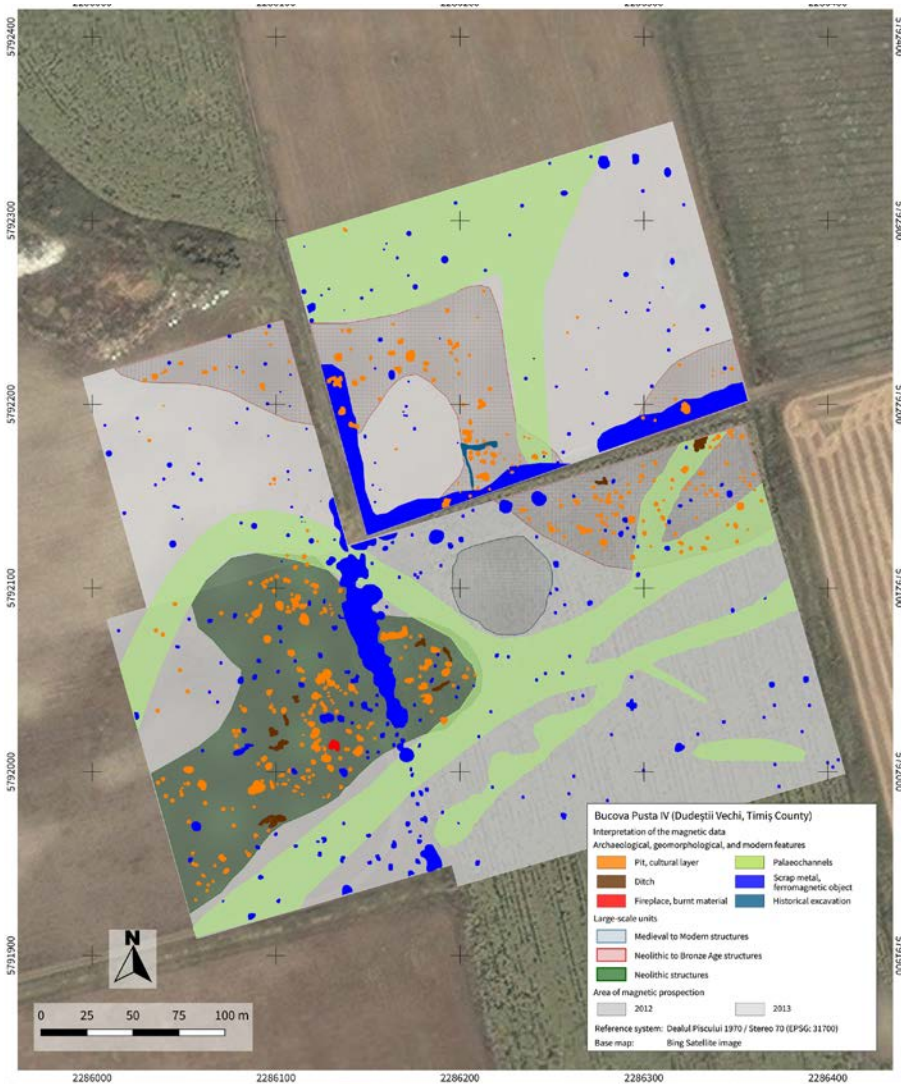


Fig. 8
Bucova Pusta IV, interpretation of the magnetic data, archaeological and geomorphological features.

which runs in a south-facing arch between the Chalcolithic burial mound and the Neolithic settlement area, revealing that this channel was open in Neolithic times. After the Late Iron Age, the channel was silted up, this mainly caused by two major flood events (Fig. 8). Due to the high sedimentation rates observed for the last 2,000 years, the prehistoric structures are partly covered by colluvial layers of several decimetres in thickness.

At the burial mound in the centre of the investigated area, a superposition of several magnetic anomalies is observed. On the top, a group of negative anomalies can be recognised. These most probably reflect the archaeological trenches of Kisléghi Nagy, excavated in 1904 and filled in again shortly afterwards (see Chapter 3). Negative magnetic anomalies were observed where an excavated pit was refilled with the same material. The resulting magnetic field intensity, which is a result of the induced plus remanent magnetisation, is now randomised by the intermixing and hence diminished by the remanent part of the soil (Fassbinder 2015).

Maillol's magnetic measurements on the adjacent site of Bucova Pusta VI, located some 600 m south of Bucova Pusta IV, covered an area of only 36 x 35 m. The data display unspecific patterns of weak magnetic anomalies mainly caused by apparently randomly distributed near-surface objects

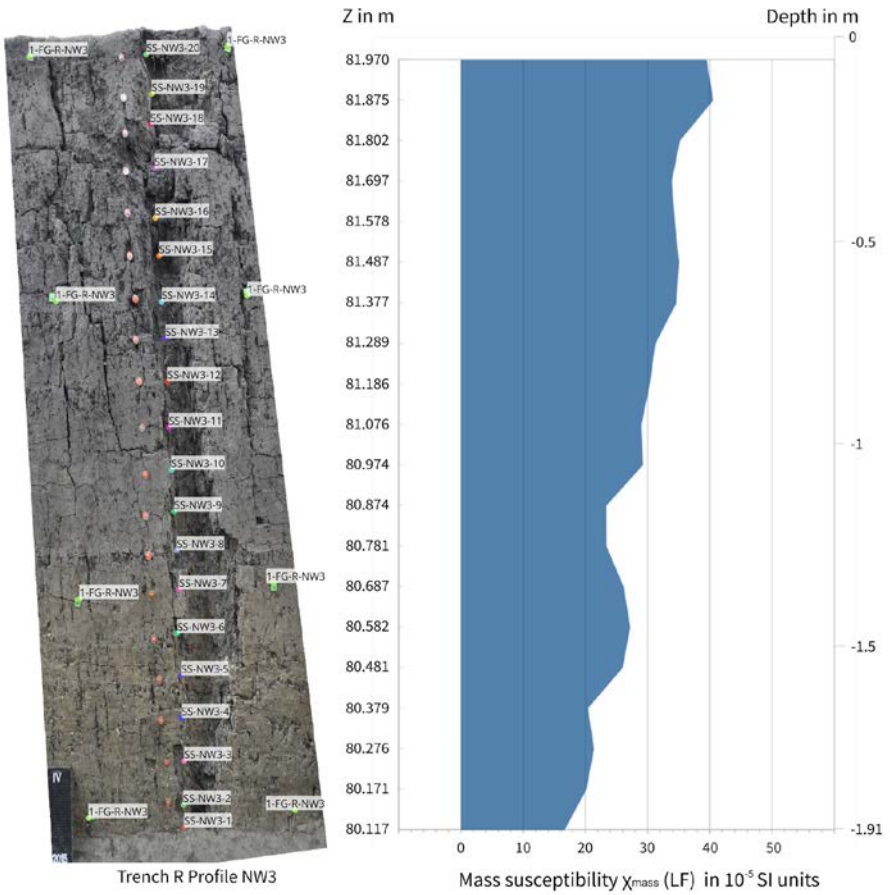


Fig. 9 Bucova Pusta IV, Trench R. Section in the centre of the NW profile with location of susceptibility samples.

and soil features. This result suggests a severe destruction of the archaeological layers caused by modern agricultural processes.

- *Magnetic susceptibility measurements*

The mass-specific magnetic susceptibility was measured for 20 soils samples taken from the vertical profile NW3 of Trench R. The sampling distance was approximately 10 cm. Thus, the profile reflects the susceptibility values between the surface and a depth of 1.91 m (Fig. 9). The location of the profile was selected in order to analyse the filling of the assumed arch-shaped river channel, that crosses the centre of the archaeological site. The primary hypothesis is that this channel was open in Neolithic times, silting up after the Late Iron Age during a series of flooding events, during which period the settlement had already been abandoned.

The values of the mass-specific magnetic susceptibility demonstrate a largely homogeneous curve and decrease with depth. The curve displays the values of the low-frequency measurements. The values of the high-frequency measurements are similar, i.e. there is no frequency dependency in the magnetic susceptibility of the analysed samples. Significant peaks cannot be observed, suggesting that the channel was successively filled with sediments without longer intermediate phases of human activity. Settlement activity would be reflected in clearly increased magnetic susceptibility values in relatively thin layers. Hence, the hypothesis formulated of sediment filling the

Fig. 10
Kalcsov I, results of the magnetic prospection by Eastern Atlas, 2013.

river channel after the end of the prehistoric settlement activity must be understood as the most plausible.

- GPR test

A GPR test measurement was carried out on an area of 30 m x 5 m, located west of the north-southerly-running field path cutting across the Neolithic settlement. The data displayed a very poor penetration due to the high electrical conductivity of the clay-rich colluvial top soil. Thus, no information on the prehistoric structures at a greater depth could be gathered. These results confirmed that the only suitable geophysical approach for the investigation of prehistoric sites in the flood plains of the Banat region is the magnetic method.

Kalcsov I

The site of Kalcsov I has been known to be a prehistoric site since Kalcsov's surveys in the early 2000's. It is located 2 km to the east of Dudeştii Vechi, near the road to Sânnicolau Mare. On and around a slight elevation of only 0.5 m above the surrounding land, Early Neolithic pottery of the Starčevo-Criş period was found. The first magnetic measurements were carried out by Maillol in 2005. These measurements covered an area of 30 m x 38 m on top of the slight elevation. During the 2013 campaign, the magnetic measurements were extended, using the LEA MAX fluxgate magnetometer array. This time, an area of 95 m x 75 m was investigated, including the surroundings of the elevation (Fig. 10).

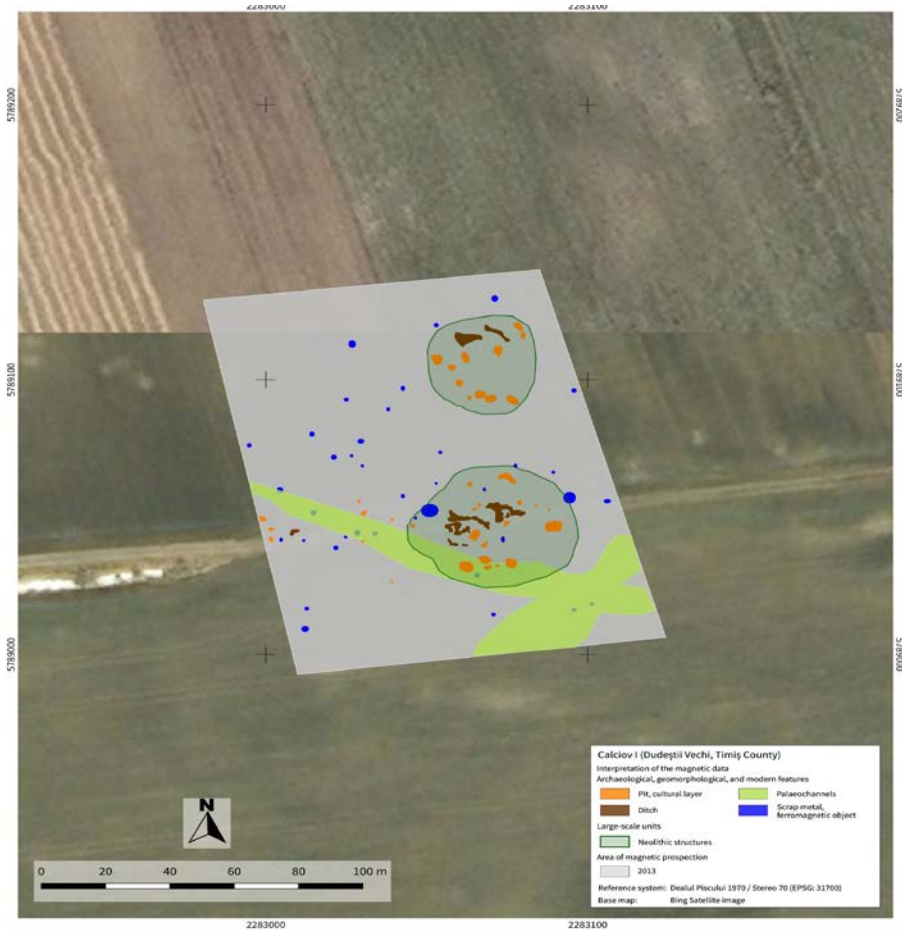


Fig. 11
Kalcsov I, interpretation of the magnetic data.

The data show two accumulations of positive anomalies which can be associated with prehistoric layers. Especially in the northern area, the significance of the data is limited due to the effects of deep ploughing marks. However, the contamination with scrap metal and modern debris is rather negligible at this site. The southern group of anomalies is related to the elevation, and covers an area of about 900 m². At a distance of 40 m to the north, the second group can be identified within an area of smaller than 500 m². To the south, a crossing of two silted up palaeochannels can be observed (Fig. 11). A dating of these structures is presently impossible since no soil samples were taken at this site. A test excavation at the south-eastern edge of the site carried out by Krauß and Ciobotaru in 2015 revealed the existence of Iron Age pit-houses which also contained material from the Early Neolithic in a secondary deposition. The assumption must be that the Neolithic settlement was located further to the north, and is possibly related to the northern anomaly group.

Process of the excavation works at Bucova Pusta IV

Raiko Krauß, Dan Ciobotaru

Microtopography of the area

In the course of the excavations, it became clear that the flat character of today's landscape only emerged as a result of formation processes over the past centuries. The landscape in which the Early Neolithic farmers settled was much more contoured than it appears today. The Early Neolithic settlement was laid out in a space shaped by various river beds, some of which had already dried up when the settlement was built. Clearly recognisable in Google satellite imagery is an old river meander north of the site, which is still partially preserved today as a fencing depression (Fig. 1). However, the settlement seems to be oriented more towards the south, facing another river course now only recognisable in the geomagnetic imagery. Another linear depression runs through the settlement, from a silted-up former river. The prehistoric find layers follow this depression, and it appears that it was not filled with sediment until after the 1st century AD, possibly during a flood event. After the Early Neolithic settlement was abandoned in the second half of the 6th millennium BC, a burial mound was built in the northeast at some point during the first half of the 3rd millennium BC. Apart from the main burial in the tumulus and an incendiary grave recovered south of it, there are only a few finds from this chronological horizon. Any evidence of a Chalcolithic settlement is absent from this site. However, the burial mound itself has contributed greatly to changing the landscape, and still marks the otherwise extremely flat landscape to this very day. Traces of a Late Bronze-Early Iron Age settlement can be primarily found in the area northeast of the tumulus, and also in the zone of the depression running through the Early Neolithic settlement. About 100 m east of Bucova Pusta IV, several pieces of handmade Iron Age pottery were found, interspersed with finds of grey wheel-made ware, which indicate a settlement during the later Iron Age. The Chalcolithic burial mound, which was probably still clearly visible in the landscape, served an early Medieval nomadic population as a landmark for the construction of a burial field, which included at least the entire fence of the tumulus and that running through our own excavation Trenches K, L, and Q (Fig. 2). To the west, the early Medieval burial ground seems to have extended at least to the north-eastern edge of our Trench R, where we were able to recover a child's grave from this period. The location of the graves suggests that the pronounced micro-relief of the landscape had already disappeared by the early Middle Ages.

Fig. 1 Google satellite image with the geomagnetic mapping of the archaeological site around the tumulus Bucova Pusta IV. Well recognizable are the old, today silted up river meanders of the Aranka. In the center of the geomagnetic map the Bucova IV tumulus is visible as a circular structure. The Early Neolithic settlement extends across the area of the tumulus and is located on another old river bed, which is still visible in the south of the geomagnetic mapping. However, this riverbed is no longer visible on the satellite image.

In the geomagnetic imagery, the prehistoric pit features are clearly visible, in which ceramic finds and burnt mud from house constructions give a strong signal, evident as a dark colour. With the exception of those in Trenches S and T, the pits which we uncovered are too irregular and (above all) too small to be identified as pit-houses. Rather, the residential buildings seem to have been ground-level structures which could not be captured by the extent of the excavation. Some of the larger pits were apparently used for clay extraction for the construction of the houses. A large number of burned wall fragments suggest a structure using the post, wattle, and daub technique. It is possible that some of the pits also served as subterranean installations within houses. However, this cannot be proven in any single case. Some of the dark structures could be identified as earth ovens during the excavation. The installation of these furnaces required a construction pit in front of the furnace opening, which could reach the size of small houses in the case of furnaces with the feature numbers S6 and S7 as well as S15 and S29. In relation to the ovens, the pits to the east are somewhat too small to have served as regular residential buildings. Rather, they are reminiscent of the equipment for the production of ceramic vessels (for example), or special food preparation equipment (baking or smoking ovens).

Because of the low penetration depth of the geomagnetic soundings, the post-Neolithic

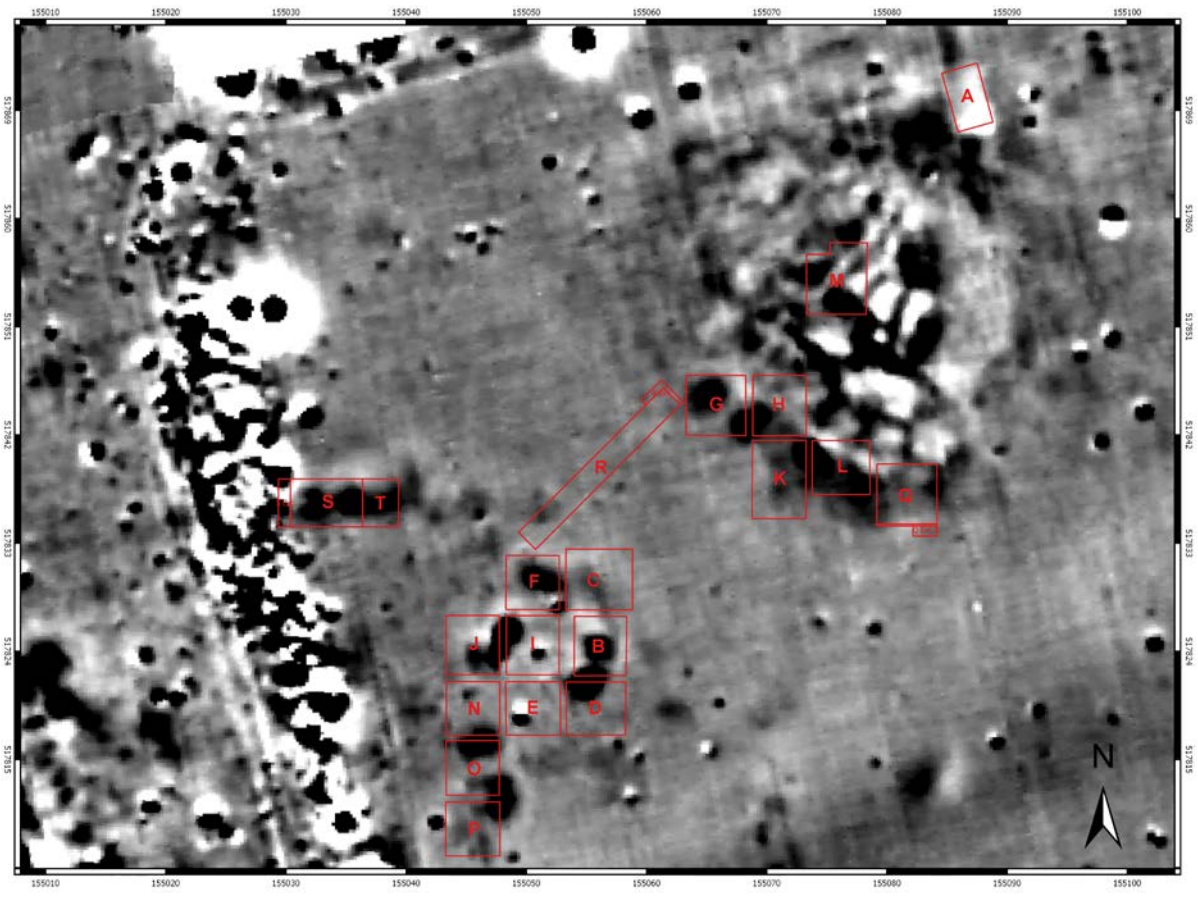


Fig. 2 Geophysical gradient measurement with location of the excavation trenches. The north-eastern settlement area is dominated by the tumulus Bucova IV; in the south-west, dark signals of the Early Neolithic settlement pits are visible. The area of the Early Neolithic settlement is crossed from northwest to southeast by an old river course, which is intersected transversely by our Excavation Trench R.

backfilling of the old river courses are also clearly visible as areas free of findings. The grid of the old excavation of Gyula Kisléghi Nagy in the area of the Chalcolithic tumulus is also clearly visible in the geomagnetic mapping.

The sequence of excavation work

The excavation trenches were lettered in the order in which they were opened. Dismantled profile bars were given the designation of the two neighbouring sections. The following trenches were created in order of years:

2010 Trench A (15.35 m²)

2012 Trench B (21.41 m²)

2013 Trenches C (28.02 m²); D (21.83 m²); BD (2.47 m²); E (20.2 m²); F (19.74 m²); G (24.89 m²); GH (3.51 m²); H (22.42 m²)

2014 Trenches I (21.55 m²); IJ (2.51 m²); J (21.87 m²); K (28.99 m²); KL (2.38 m²); L (21.7 m²); M (27.91 m²); N (19.75 m²); NO (2.23 m²); O (20.05 m²)

2015 Trenches P (20.2 m²); Q (24.85 m²); Q extension (2.87 m²); R (35.06 m²); R extension (2.95 m²); S (23.88 m²); S extension (3.95 m²); T (12.03 m²); T extension (4.16 m²)

Hence, we exposed a total area of 458.59 m².

Where possible, the archaeological features were negatively emptied and numbered within

the trenches. If necessary, larger structures were removed in artificial layers, which were then each given their own feature number. In turn, when necessary, intermediate plana and profiles were created. In any case, all of the profiles were documented at the respective trench edges.

Our work on the site of Bucova Pusta IV was initially financed by the University of Tübingen's funding program for young scientists (GZ: VI 4.5-7532.22). This permitted the preparation of a research proposal at the German Research Foundation (DFG). Additionally, a camera, two GPS devices, and spatial data analysis software were procured through a grant for research investment funding from the University of Tübingen.

Excavations in 2010

On the basis of the this funding, the first excavation campaign was undertaken from 21.08. to 17.09.2010. Measuring 3 x 5 m, Trench A was opened just north of the tumulus. Accompanying the excavation, surface surveys were begun in order to assess the extent of the site. An initial 3D modelling of the terrain also allowed the tumulus' extent to be precisely recorded. A few finds of the Late Bronze Age were found in the area north of the flat mound on a now desiccated arm of the Aranka river, which were superimposed upon the Early Neolithic settlement in this area. Gyula Kisléghi Nagy's excavation area from 1904, could be located approximately in the southern part of the tumulus by means of the geomagnetic image. Trench A was dug in such a manner that it cut the tumulus marginally in the south, and it touched the Bronze Age features in the north. Thus, as far as possible, all post-Neolithic deposits were recorded in order to evaluate most efficient expenditure of resources for future excavation. The excavation also unearthed four Medieval graves, of which two were completely exposed by the trench, and two only partially. In the north of the trench, a shallow Late Bronze Age pit was encountered. The Early Neolithic find horizon consisted of only one layer of scattered finds; neither building structures nor even pits were encountered.

Activities in 2011

In 2011, we did not excavate in the Banat. Together with the staff of the Museum of the Banat, the future work process for the site was developed, and we met in Dudeştii Vechi to clarify on-site infrastructural matters.

Excavations in 2012

In the spring of 2012, the DFG approved an initially three-year research project for the excavations on Bucova Pusta IV (KR 2951/4-1). Through this funding, the excavation campaigns of the years 2012 and 2013 were realised. As of October 2013, the project was transferred to Subproject A01 of the Tübingen Collaborative Research Center 1070 "RessourceCultures", with the DFG generously retaining the remaining funds for individual funding with additional approval. Thus, the excavations on the Bucova Pusta IV could be continued until the summer of 2015.

In 2010 and 2012, a surface survey was carried out in a quadrant grid of 5 x 5 m to determine the area of the Early Neolithic settlement. Through to a very dense network of height measuring points using the total station, Jonas Abele was able to create a second digital terrain model in 2012, which most prominently clearly visualised the contour of the tumulus.

In the summer of 2012, excavations at Bucova Pusta IV were resumed. Between 30.07. and 17.08., a 5 x 5 m large area was opened southwest of the mound as Trench B, which showed conspicuous structures in the

geomagnetic mapping. Just below the present field surface, Early Neolithic finds were encountered, which, however, were affected in their uppermost horizon by modern agricultural activity. Below the ploughing horizon, however, the features revealed two distinct structures considered remnants of Early Neolithic settlement. These comprised a small, approximately square structure approximately in the centre of the trench, and another, rectangular structure continuing south and southwest of Trench B. Both structures are the remains of wattle-and-daub constructions, but considered individually are somewhat too small for houses. Quite possibly, these are two admittedly archaeologically separate structures, which once shared a superstructure. There was a large inventory of finds within the concentrations of collapsed mudbrick. Noteworthy in the southern portions were several large clay items of differing shapes, which may have served as structural elements of the buildings or as weights. In the north-western corner of the excavated section, a larger find emerged which appeared as a linear structure in the geomagnetic, albeit the date of which was initially unclear.

The company Eastern Atlas also continued geophysical surveys west of the excavation site in 2012. This demonstrated that the settlement continues significantly farther in this direction, and is cut approximately in the middle by a modern field road. A raster survey was also extended to this area, now demonstrating the maximum extent of the settlement area.

Excavations in 2013

The excavations in 2013 immediately followed on from the previous year. Fieldwork was led by Mario Gavranović, who also kept the excavation diary during this campaign. The works were conducted from 05.08. until 27.09. We opened two 4.5 x 5 m large areas north (Trench C) and south (Trench D) of Trench B. Two additional areas of 4.5 x 4.5 m were opened west of Trench D (Trench E) and west of Trench C (Trench F). In Trench D, the building structure from the southern area of Trench B could be traced to its conclusion. In order to record the entire structure, the profile baulk between both trenches was finally removed. The overall result is a building structure of 3.5 m in length and 2.5 m in width, which is slightly recessed within the ground. Hardly anything more than a small hut can be reconstructed above this structure.

In Trench E, there were no signs of prehistoric settlement except for a few finds in the plowing horizon. The sterile loess soil began immediately below. Due to the geomagnetic mapping, no findings were to be expected in this area.

The opening of Trench C was to help clarify the structure to the northeast of Trench B. This was a roughly 2.5 m wide ditch extending from the south-eastern corner of the trench to its north-western corner. Shortly before the northern section of the trench, the ditch turns westwards, and is there cut by a deep pit, which continues into Trench F adjacent to the west. The pit has a diameter of 2 m, and could not be exposed to its bottom due to the penetrating groundwater. A drilling demonstrated that it continued 40 cm below this. On account of the discovery of a nearly complete vessel at the bottom of the ditch, both this structure and the stratigraphically younger pit can be dated to the Iron Age. Parallel to the river's ancient arm, which runs through the Early Neolithic settlement, a well was apparently dug in the Iron Age to reach clean drinking water. This later, heavy digging seems to have destroyed a large Early Neolithic structure, as much Early Neolithic material was found in the backfill of both the trench and the well-shaft.

In Trench F, next to the well-shaft, another ditch cut from the well-shaft could be uncovered, possibly representing a continuation of the wide ditch in Trench C. Even for this structure, isolated finds of Early Iron Age sherds present a terminus post quem within post-Neolithic times.

A second focus of the excavations of 2013 was the exploration of the settlement area on the other bank of the stream running through the Early Neolithic settlement. At the western edge of the hill, two 5 x 5 m sections (Trench G, west) and 4.5 x 5 m sections (Trench H, east) were opened side by side in an east-westerly direction. In addition, the edges of Kisléghi Nagy's old excavation were to be recorded by means of these sondages. As indicated by the geomagnetic mapping, we were able to confirm the course of his excavation in the northeast of Trench G, and then diagonally across the entire width of Trench H. Kisléghi Nagy's excavation method consisted of removing the soil until the outline of the Medieval burial pits he wanted looked into the planum. In the north-eastern two-thirds of Trench H, it was apparent that he had completely cleared two graves. Interestingly, the bones of the western burial were piled on a heap in a corner of the burial pit. In this one case, the skeletal remains were apparently returned to the grave pit after Kisléghi Nagy's investigations. A third grave in the northeast of Trench H was only uncovered by him, and was still articulated in the grave from the hip down to the feet. He appeared to deal with the accidental Early Neolithic finds similarly, one of which was only partially excavated within the area which he had probed. Hence, our excavation method consisted of first removing all fills from the Kisléghi Nagy excavation, so that we might then dig the undisturbed areas.

Among the most surprising findings was the observation of the mound's stratification, which proved to be largely natural. The virgin soil rises slightly in this area. Although the Neolithic settlement contributed to a certain increase in the terrain, it was built on a slight pre-existing hill. The Medieval tombs were thus only sunk into an existing mound.

In the north-western quarter of Trench G, a strong anomaly in the geomagnetic mapping was uncovered. This was the exceptional find of a stand-alone furnace of about 3.4 m in length and 2.8 m in width oriented in northeast-southwest direction. The furnace had been formed from the soil by first excavating a work pit in the southeast, from which a cavity in the form of the furnace dome was laterally dug into the loess soil. The resulting chamber was then fired and solidified. The bottom of the furnace is very even, and the walls and the preserved parts of the dome have clear traces of the excavation of the floor with the aid of tapered instruments, possibly simple timbers. Inside, but primarily in front of the furnace, there were still ash layers interspersed with charcoal particles. The find material recovered from the backfill contained not only numerous ceramic fragments, but also animal bones, notably numerous bones of large fish, and shells of freshwater snails and mussels.

We were also able to document in the southeast of Trench G (and continuing into the southwest of Trench H), a structure aligned parallel to the furnace and created in a similar manner to it. There, too, an elongated hole was first dug, from which lateral excavation was then undertaken. However, this lateral excavation was not extended so far that a real dome would have arisen. Rather, this resulted in a kind of protected mould. Also, this feature demonstrated no traces of a permanent fire, and the find material itself indicates a different use. This structure is clearly too small to be a house. The pit fill was interspersed with much Early Neolithic settlement waste. Including numerous vessels, one of which

had been heavily depressed while already in a leather-hard state, and subsequently burned to complete the hardening of the clay. These finds prove that ceramics must also have been produced locally. The neighbouring furnace may potentially also have been used to make ceramics, in its environment and in the backfilling. Furthermore, in the pit between Trenches G and H, the cone of a very large cattle horn was found. The pit's shape is reminiscent of a clay extraction pit which had then been filled with settlement waste. Possibly, the pit was also used for other purposes between its creation and final backfilling, for example as a storage pit, but the find material presently does not betray its use.

A third feature, comparable to that just described, was found in the south-eastern quarter of Trench H. However, this pit was dug into the ground without undermining its walls. At least half of the feature had already been cleared by the Kisléghi Nagy excavation, so that we were only able to examine its fill in the southern part. This structure was also filled with settlement waste of the Early Neolithic, but the feature is clearly too small for a house or even a hut.

Excavations in 2014

Investigations in 2014 were undertaken from 27.07. to 27.09. During this campaign, Clemens Schmid kept the diary from 05.09. until 09.09. Building on the results from 2012 and 2013, the settlement areas at the tumulus as well in the area southwest to it were expanded. The main focus of this research was, on the one hand, to answer the question as to the Early Neolithic structure, and on the other hand, to deduce a timeframe for the post-Neolithic settlement patterns in this area. Therefore, the southwest area was expanded by Trenches I and J (each trench: 4.5 x 5 m), and by N and O (each trench 4.5 x 4.5 m). Trenches K and L (each 4.5 x 4.5 m with an expansion of Trench K to the south by 2 x 4.5 m) were laid out southeast to Trench H (from the previous year's excavation), in the north-eastern settlement area. For further clarification of the technical methods used in the first excavations by Kisléghi Nagy (Nagy 2010), and possibly to narrow down the tumulus' timeframe, a further trench, Trench M (5 x 5 m), was opened in approximately the centre of the hill, which was later expanded 2 x 3 m to the north.

Accompanying geomorphologic investigations by Bastiaan Notebaert (Catholic University Leuven, Belgium) revealed, that an apparently empty strip between the settlement areas on the geomagnetic mapping is a landscape depression, on which ground deposits from a Neolithic settlement can be expected. In contrast to the north and south courses of desiccated river branches related to the habituated area, this depression is not the result of a river branch, since no associated sediments were found in borehole investigations. Under the instruction of Elena Marinova, areas within the old river branches which might preserve organic material were probed for palynological studies. The zoological material from the previous year's excavations was sorted by Bea de Cupere. Further studies on a selection of fish bones and mollusc shells are planned at the Natural History Museum in Brussels.

In addition to the studies of previous years, the process and methodology from the excavation in 1904 by Kisléghi Nagy were reconstructed in detail. It was possible to follow the south-western edge of his excavation with Trench L. The southern profile of Trench M in particular demonstrates the sondages created by Kisléghi Nagy. Along with the aforementioned traces of the old excavation visible in the geomagnetic mapping, it is now possible to reconstruct these excavation

activities from 110 years ago in detail. The Kisléghi Nagy trenches are relatively irregular strips with a tub-like cross-section extending in a north-easterly direction. The sediment extracted from one trench was emptied into the one preceding it. Quite evidently, not all of the finds were recovered from the surface, as a large find accumulation was piled up against the border of the old cut edge.

Within the tumulus' extent, three entire burials from the early Middle Ages were recovered in the Trenches K, L, and M. As in the previous year, more human skeletal remains were found in the old Kisléghi Nagy trenches, which apparently hail from graves uncovered at that time. The discovery of two glass beads in the grave of an infant as well as a bronze bead in the grave of an adult male render for the first time a clear indication for the dating of these graves. Due to similar finds from Hungarian cemeteries, the burials can be dated to the late 8th and the early 9th century AD. Based on the fragility of the infant's grave, it was recovered en bloc, and was further exposed under laboratory conditions at the Museum of the Banat Bulgarians in Dudeştii Vechi. On account of its significance, it is now displayed in a vitrine as part of the exhibition.

One of the main results of the excavation campaign of 2014 was the indications for the dating of the tumulus. In the northern half of Trench L, a cremation burial of an infant covered with an urn was salvaged. The vessel is a bowl with a slightly inwards curved edge; based on the characteristic incised decoration on its outside, it can be assigned to the Baden-Coţofeni group in the Banat. On the northern border of Trench M, a grave with an inhumation appeared, for the recovery of which a northward extension was necessary. The burial was only grazed by an overlying section of the old Kisléghi Nagy excavations and otherwise untouched. The grave pit was slightly trapezoidal in shape with its contours narrowing towards the feet. The bottom of the pit was completely covered by a dark matter, which have resulted from a past organic material, possibly a mat. In the underlying sediment, in the vicinity of the ankles and the head, are traces of three small post holes, which indicate a grave installation. The grave contained a woman provisionally determined to be elderly lying on her back with bent knees slightly offset to the left from the pressure of the earth. In the chest area were numerous snail shells. According to the zoologists they should be interpreted as a natural assemblage rather than an anthropic one (see Chapter 15).. They are therefore understood as grave goods. In addition to the shells, a shaped piece of red ochre was found to the right of the woman's head. The type of this burial and the piece of red ochre suggest that we are dealing with a classic ochre grave dating from around 3000 BC, the late Chalcolithic. This grave could well be the tumulus' central burial, and the child's cremation burial can be considered a secondary burial from the same time period. The cultural and historical significance of the ochre tomb lies in its geographical position, since it is one of the westernmost burials of a funeral custom hailing from the northern Pontic area (cf. Ecsedy 1979, Fig. 3).

In the south-western settlement area, in Trenches I and J, another tall pit was documented. The structure of the feature is curved and presents no defined outline. In approximately the centre of this pit is a smaller pit reminiscent of a well, in which a complete foot vessel was found. The feature was exclusively filled with Early Neolithic artefacts. The backfilling reconstruction, however, is very complex, and appears to have occurred in several episodes. An interpretation of this context is difficult. Apparently, this area was first used for extraction of construction clay, and was then later used for water extraction. The shape of the pit is too irregular to be considered a building feature. Nevertheless,

the feature is to be understood in the context of Early Neolithic settlement activity at Bucova Pusta. In the area south of the pit, the terrain descends into an old watercourse visible in the geomagnetic mapping. For clarification, two further trenches (N and O) were opened south of Trench J. The descent of the natural surface is clearly visible, especially in the south of Trench O. Many Early Neolithic finds remained along the banks of the old river arm, including another vessel which could be completely reconstructed. The find concentration in this area suggests that this old river branch existed contemporary to the Early Neolithic settlement. However, a lack of time prevented geomorphological investigations in this year to confirm this situation.

In the north-eastern settlement area, a very complex situation could be documented in Trenches K and L. The Early Neolithic features are disturbed by later pitting, and therefore are at times still quite unclear. Clear, however, was another Early Neolithic pit in the north between Trenches K and L, which had already been observed in the southern section of Trench H in the previous year. This pit also has no regular shape and presents a complex fill replete with Early Neolithic settlement material. One of this year's most important findings is another oven in the northern section of Trench K. Similar to the oven from Trench G, which was documented in the previous year, this is a freestanding oven fashioned from the earth. However, in this case, it possesses a very elaborately designed dome leading to a cylindrical flue. The southern part of Trench K displays other Early Neolithic pitting, all examples of which are heavily cut by later disturbances. It is becoming apparent that the earlier terrain descends sharply in this area. Contrary to the original assumption, it seems (as mentioned earlier) to be a terrain depression, as would accord with the geomorphologic investigations. This depression is filled with black sediment, which could be rearranged material from the eroded tumulus. A terminus ante quem for the filling of this depression is presented by another Early Medieval grave embedded into this dark fill.

The exposed excavation was photographically documented by the company "Andron Solutions" with a Quadcopter from the air. This documentation can now be used to complete the terrain model's previously recorded total station measurements.

All sediment samples of the Early Neolithic features obtained in the previous year, were floated at the excavation camp at the Museum of the Banat Bulgarians in Dudeştii Vechi. An archival data system was set up for the finds, allowing investigation at any time by other scientific experts. The labelling was done entirely in English, in order to enable international collaboration. The community of Dudeştii Vechi offered us the possibility to create a new archaeological exhibition in the museum in the future in order to display the most important results of our research.

Excavations in 2015

In the time between 03.08 and 30.10.2015, we managed to open four sections with a total area of 120 m².

Trench P: This 4.5 x 4.5 m trench was excavated in the southern extension of last year's Trench O. The purpose of this trench was the examination of the southern settlement boundary. The geomagnetic map demonstrates that the settlement is bordered by the old course of a river. In this area, there were several Neolithic features without clear contours, found in the slightly southwards-sloping natural soil. These features include a series of pits which overlap each other to some extent. Noticeable is that many flint artefacts were found, constituting more than 50 % of

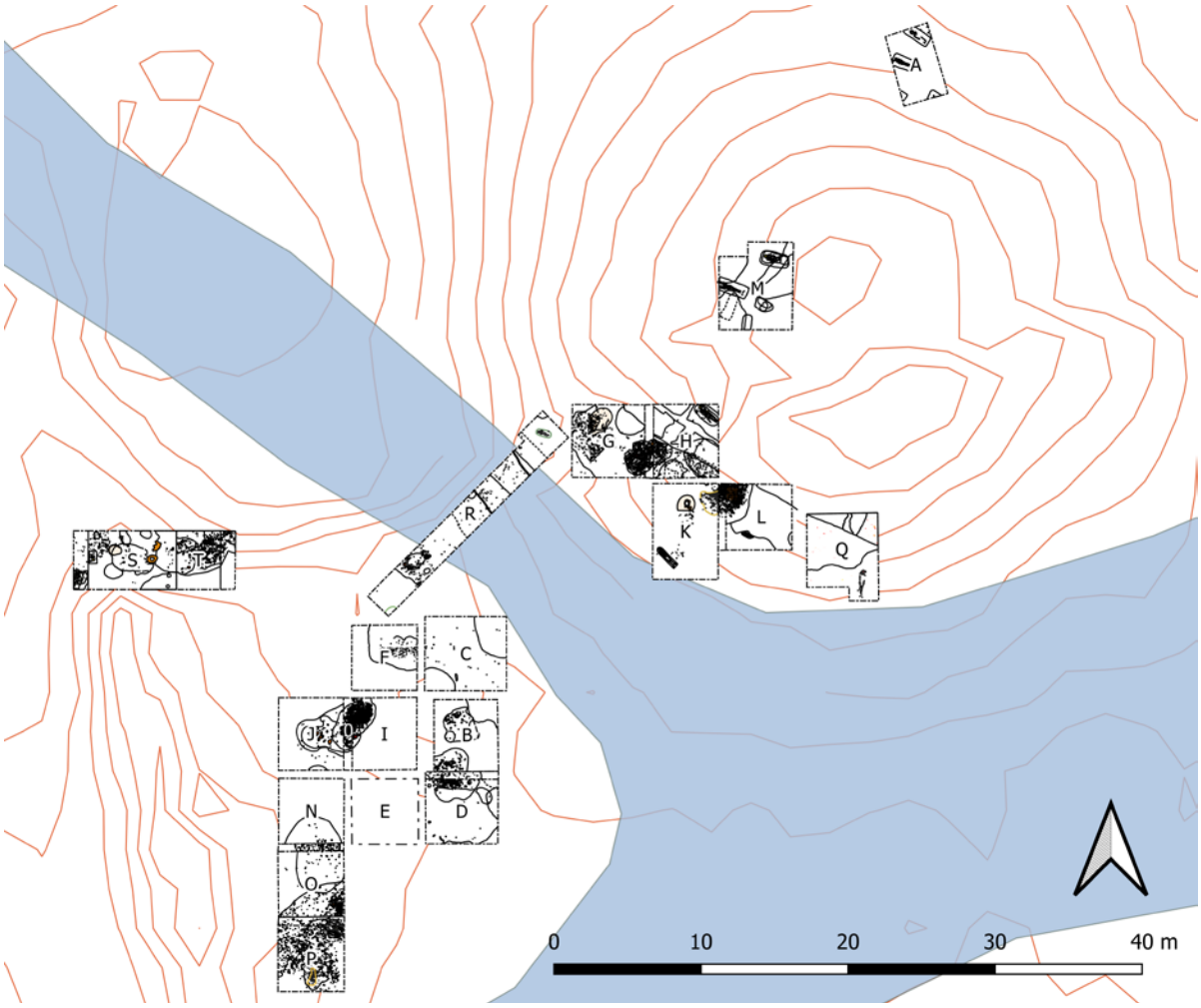


Fig. 3 Location of the individual excavation trenches on the Bucova Pusta IV site.

all flint artefacts found at Bucova Pusta IV. All of these artefacts are either complete or fragmented finished tools, but there is no sign of flint artefact production in the site. This settlement area was apparently primarily used for the extraction of clay and secondarily for garbage disposal. The large number of flint artefacts suggests that this area on the southern settlement border was also used for crafting activities.

Trench Q: In line with the Trenches K and L from the previous year, an additional trench with an area of 5 x 5 m was opened in the eastern part of the settlement. On account of the Chalcolithic tumulus excavated by Kisléghi Nagy in the last century, which can be clearly seen on the geomagnetic scan, this sondage was shifted 2.5 m to the south. In its northern part, the south-eastern border of the previous year's trench is clearly visible. In the southern part, a long ditch could be documented throughout its extent. This ditch was already visible in previous year's Trench L. The filling's finds date post-Neolithic, most probably Early Iron Age. Another Medieval grave was found in the south-eastern corner. The grave's north-south orientation clearly differs from the other already excavated Medieval graves. In order to fully excavate the grave, the trench was extended in this part one metre to the south. The skeleton was in good condition, with very few bones unarticulated. In the chest and hip area, various iron and

Fig. 4 Localisation of archaeological sites north of Dudeştii Vechi and north of the road to Sânnicolau Mare.

bronze artefacts could be documented, which can be interpreted as a belt's metal fittings and buckle. These seem to belong to the late period of the Avars. Throughout Trench Q, only relocated Early Neolithic artefacts were found.

Trench R: This 17 x 2 m trench runs from the south-west to the north-east diagonally between the previous year's Trenches C and K. This trench was created to examine a signal-poor, linear strip on the geomagnetic scan which runs through the whole Early-Neolithic settlement. Last year's geomorphological examination presented the first intimations of cultural debris on the bottom of this oblong depression. Further examinations undertaken by a geomorphological team from the University of Szeged led by György Sipos could prove the existence of a former stream course, which was covered by a loess-like sediment during the last Ice Age. At the arrival of the Early Neolithic settlers, the old stream course must still have been visible in the landscape. In the trench's western part, an Early Neolithic artefact was found at the bottom of the depression, and another from the Early Iron Age above it. Above this horizon, Late Iron Age grey wheel-thrown pottery was documented in the middle of the trench. This trench hence contained an Early-Neolithic, an Early Iron Age and a Late Iron Age layer respectively. It was after the Late Iron Age when this valley-like, linear structure completely filled up to today's surface. This last fill was apparently caused by a single natural occurrence because the soil above the archaeological features is sterile, humic-dark, and of a uniform consistency. In

the north-eastern part of the trench, another Medieval child burial was found, and so the trench was extended for 40 cm to the north-east and for 60 cm to the north-west in this area in order to block-lift this out.

Trench S–T: At first, a 6 x 4 m trench was created in the north-west of the site. Its purpose was the examination of structures appearing as large black shadows on the geomagnetic scan. At a depth of 60 cm, many Early Neolithic structures already appeared and continued eastwards. For this reason, the decision was made to extend this trench with another 5 x 5 m trench to the east. This new trench was called Trench T. From 60 cm depth downwards, two larger settlement-structures cut into the sterile soil were documented. The eastern of these turned out to be a pit-house with two ovens in it. These ovens were on the western wall dug into the surrounding naturally accumulated soil. The northern of these (S7) had a collapsed dome and could only be documented in the field. The other (S6) was in a very good condition and had a chimney in its dome-structure. This oven was block-lifted and is stored in Dudeştii Vechi museum for further examinations under laboratory conditions. West of the first pit-house, another was found, which also had two ovens in its western part. In contrast to the others, these were not dug into the natural soil, but were rather erected in dome structures. In the trench's far west (west of the second pit-house), a north-south orientated child-burial was excavated. It is a westward-facing crouched burial placed above a deposit of over 60 Early Neolithic clay weights. The grave's sediment fill also contained only Early-Neolithic finds. Two samples were taken in order to perform a ^{14}C-dating. One sample was taken from the child's long bone, and another one from an animal bone which was found in the burial's sediment filling. According to preliminary studies of the fieldwork, all of Trench S–T's features date to the Early Neolithic.

Trench I–J: In the area of the earlier Trench I–J, a small section with the dimensions of 2 x 2 m was re-opened in order to continue excavating an Early-Neolithic well-shaft. On account of the previous year's high groundwater level, it was necessary to cancel excavation. The re-opened shaft was now fully excavated to its bottom at a depth of 2.24 m. Additional large Early Neolithic pottery sherds were found in the shaft's fill.

In sum, the layout of the trenches can be outlined as follows. Trenches B to F, I, J, and N to P display a large coherent area exposing the structures clearly visible in the geomagnetic mappings in the southern area of the settlement. Trench P reaches the bank area of an old river course, which can be considered the southern limit of the site. Likewise, the area with Trenches G, H, K, L, and Q covers an area with clearly visible structures of burnt clay in the geomagnetic. Trench M was positioned roughly in the centre of the tumulus in order to capture its structure and also to clarify Kisléghi Nagy's excavation strategy. Trenches S and T with their extensions to the east and west served to elucidate a larger linear structure in the west of the excavation area (Fig. 3).

Follow-up campaign in 2016

No further excavation work was carried out this year; rather, the field was merely visited on various occasions. From 24.07–06.08.2016, a recording campaign was carried out in the Museum of the Banat Bulgarians in Dudeştii Vechi, where the documentation of the finds was largely completed.

Excavations in 2015 at the Kalcsov 1 site

In 2015, parallel to the excavation campaign on Bucova Pusta IV, a small-scale investigation took place on the site Kalcsov 1, which will

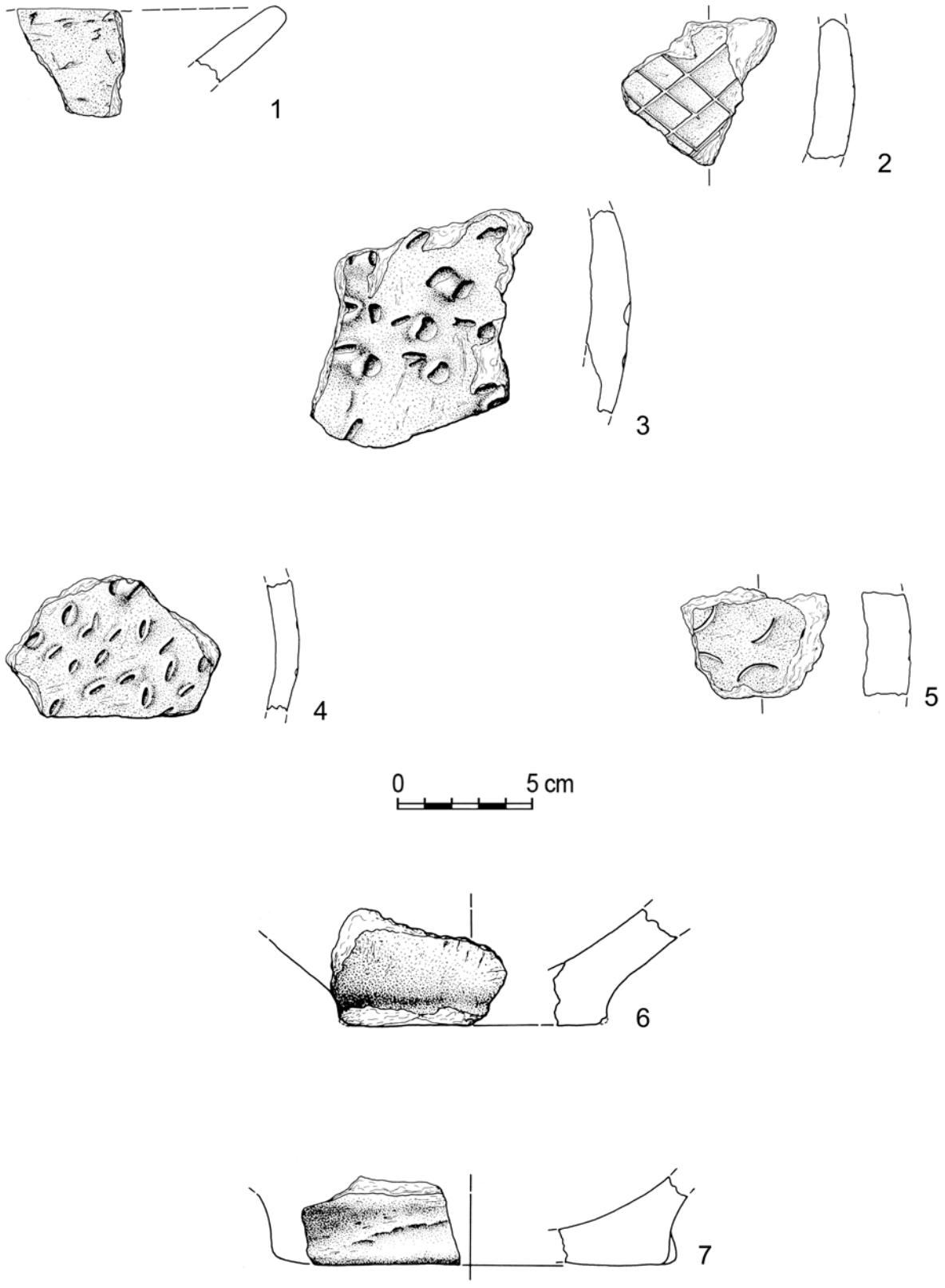


Fig. 5 Early Neolithic pottery fragments from the site Kalcsov 1.

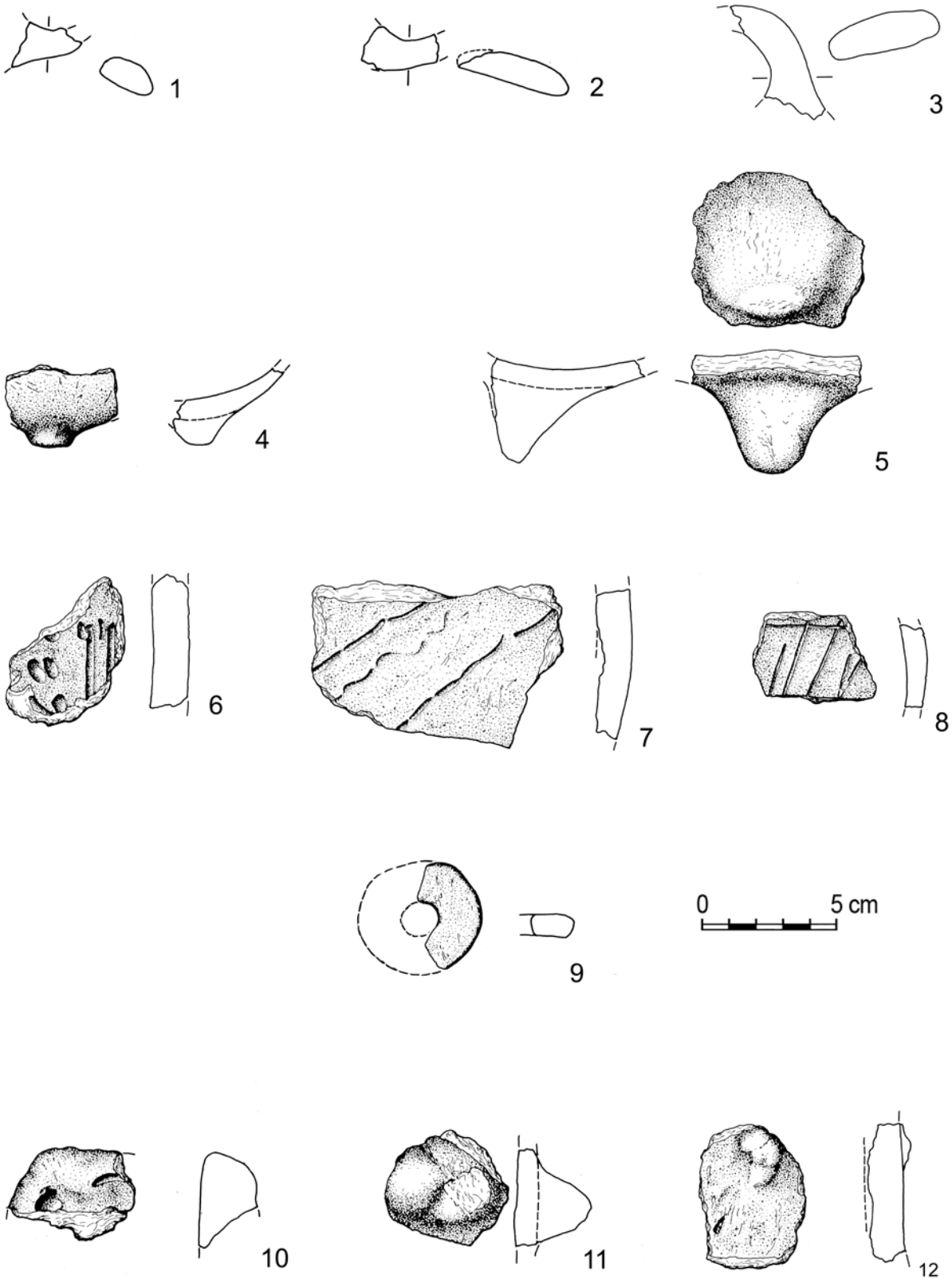


Fig. 6 Early Neolithic pottery fragments from the site Kalcsov 1.

be briefly mentioned here.The site is located about one kilometre from the exit of Dudeştii Vechi in the direction of Sânnicolau Mare, immediately north of the road, south of the small tumulus "Na Pesaka" (Fig. 4). It was only recognised as a Neolithic settlement site by Constantin Kalcsov, which is why we have named it so. The site was subsequently geomagnetically prospected by Maillol in 2005. In 2013, the site was once again geomagnetically prospected over a large area by Eastern Atlas (see Chapter 4). At the same time, we carried out a surface survey, which documented further Early Neolithic finds.

To clarify the stratigraphy, a sondage-excavation was conducted from the 9th August to the 2nd September 2013. Directly to the south of a dirt track, a trench with the dimensions of 5 x 5 m was dug out, cutting the site in a west-eastern direction. During the excavations, only Early Iron Age contexts and finds were documented, which we will publish elsewhere. Due to this later disturbance, the Early Neolithic finds apparently came to the surface. We assume the centre of the Early Neolithic occupation to be a little further north of the dirt track based on the signals of the geomagnetic measurements (see Chapter 4). The finds from the surface surveys show clear characteristics of Early Neolithic pottery. They are coarsely ceramic fabrics with numerous organic lean components. The surfaces are partly slickened and smoothed with a thin clay coating. As far as the fragmented condition allows, some bowls and pot forms can be recognised (Fig. 5). There are two feet of a footed vessels and the three fragments of ribbon handles (Fig. 6). The plastic decoration patterns correspond to those of the neighbouring Early Neolithic sites. The evidence of a vessel with a ribbon handle suggests a somewhat younger stage within the Early Neolithic development than at Bucova Pusta IV. This relative chronological position is confirmed by a radiocarbon date from this site (Poz-179984: 6720±40 BP), which was measured on a rib fragment of a medium size ungulate. With a calibrated value between 5719-5561 calBC (2-sigma) it is within the range of our expectation.

Methodology of the excavation at Bucova Pusta IV

Clemens Schmid, Raiko Krauß

The scientific work at Bucova Pusta IV was divided between different teams and areas of responsibility, with a central distinction between excavation and field laboratory work. An excavation supervisor held the main responsibility for all excavation work carried out in the field. He coordinated the work of several, usually more junior trench supervisors and a digital documentation team. The latter handled all digital data production as outlined below. In the field lab, multiple independent teams received the finds from the excavation, washed and sorted them, drew, photographed, and catalogued them, and engaged in reconstruction and pottery fitting. Both teams met for a coordination meeting at every regular workday evening (Monday–Friday).

Over the years, the organigram was slightly modified, and the (leading) roles were filled by differing colleagues, but this general structure remained stable.

1. Excavation

The excavation work at Bucova Pusta IV was usually (albeit with some exceptions) carried out with a derivation of the Wheeler-Kenyon method, thus with a regular grid of 5 x 5 m^2 trenches separated by small 50 cm wide balks, which were only removed after full excavation and documentation of the surrounding trenches. The trenches were placed to uncover either structures indicated by the preceding geomagnetic analysis, or to expose the remaining parts of already excavated features in neighbouring trenches. All excavation was done exclusively by hand, and without the assistance of motorised construction machinery.

After lifting the 30–40 cm deep plough horizon in a trench, which was severely disturbed by modern agricultural use, the uncovered soil was thoroughly levelled and cleaned. The resulting surface ("planum") was analysed and documented. If sufficiently distinct features could be identified in this planum by sediment colour and consistency, then these were individually excavated in artificial layers of 5–30 cm according to their extent and the occurrence of finds. If no clear features were visible, then successive plana were created 5–15 cm below the first until this was the case.

Here, a feature is defined as an abstract unit which can be attributed to a relatively coherent genesis process. For example, a simple grave is one feature, as it is clearly linked to a singular burial event in which a

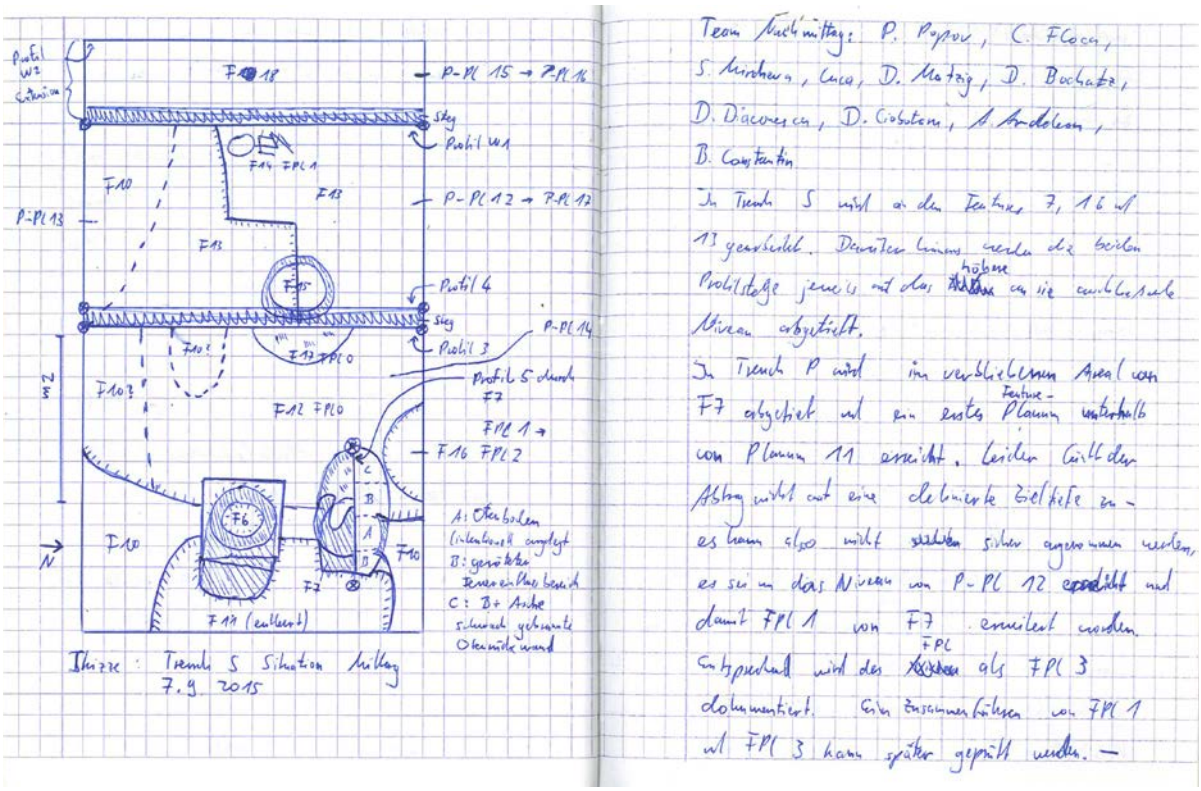
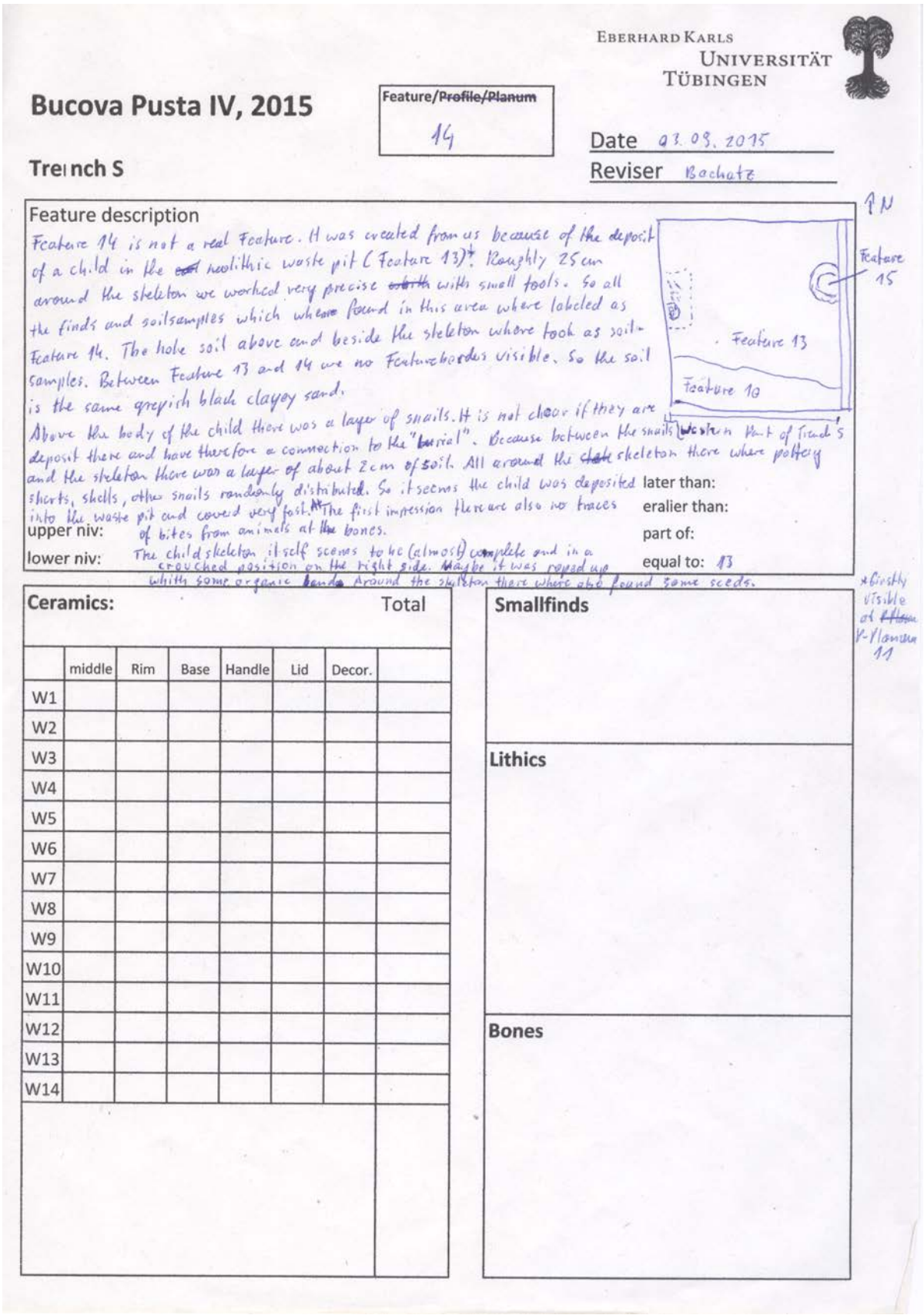


Fig. 1 Insight into the diary of the excavation campaign 2015. The find situation in Trenches S and T is described with a sketch of the most important findings on 7th September by Clemens Schmid.

pit was excavated, the body and grave goods deposited, and the pit filled again with the soil. If this grave were to be cut by a later intrusion, e.g. a posthole, then this would be considered another feature. This terminology allows the recording and interpretation of even complex stratigraphic situations, despite the obvious limitation that some features are created over extended periods of time, e.g. a pit fills slowly accumulating with many heavy rain events, or the only stepwise interpretative process of the excavator when uncovering features from top to bottom. Both issues render it usually necessary to modify previous feature attributions and descriptions, leading to the merging, division or even dissolution of individual units.

Each feature was given its own identifier, which is composed of the letter of the respective trench and a consecutive number. In cases where a feature was excavated in several, artificial steps, it was sometimes assigned multiple feature numbers. The limits of the features were sometimes difficult to recognise due to bioturbation, soil washout, bleaching processes, and animal passages. Animal traces identified as such and changes in the soil due to vegetation were not assigned a feature number. In order to clarify the relationship among features, as well as their complex internal history, sometimes small helper profiles cutting multiple features needed to be created within the trenches. Features which were particularly large or difficult to interpret were cross-cut or excavated in grid squares.

The features were documented individually, and usually in several stages before, during, and after excavation. The excavation supervisor kept new features in the excavation diary, and roughly described them (Fig. 1). In



EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Bucova Pusta IV, 2015

Feature/~~Profile~~/~~Planum~~: 14

Date 03.09.2015

Reviser Bochatz

Trench S

Feature description

Feature 14 is not a real Feature. It was created from us because of the deposit of a child in the ~~east~~ neolithic waste pit (Feature 13)*. Roughly 25 cm around the skeleton we worked very precise ~~earth~~ with small tools. So all the finds and soilsamples which where found in this area where labeled as Feature 14. The hole soil above and beside the skeleton where took as soil-samples. Between Feature 13 and 14 we no Featureborders visible. So the soil is the same greyish black clayey sand.

Above the body of the child there was a layer of snails. It is not clear if they are deposit there and have therefore a connection to the "burial". Because between the snails and the skeleton there was a layer of about 2 cm of soil. All around the ~~child~~ skeleton there where pottery shirts, shells, other snails randomly distributed. So it seems the child was deposited into the waste pit and covered very fast. The first impression there are also no traces of bites from animals at the bones.

The child skeleton it self seems to be (almost) complete and in a crouched position on the right side. Maybe it was roped up with some organic bands. Around the skeleton there where also found some seeds.

later than:

eralier than:

part of:

equal to: 13

upper niv:

lower niv:

*Firstly visible at ~~Plan~~ Planum 11

Ceramics: Total

	middle	Rim	Base	Handle	Lid	Decor.	
W1							
W2							
W3							
W4							
W5							
W6							
W7							
W8							
W9							
W10							
W11							
W12							
W13							
W14							

Smallfinds

Lithics

Bones

Fig. 2 Example of a feature list filled in by Dominik Bochatz. Described is the finding situation S14 on 3rd September 2015.

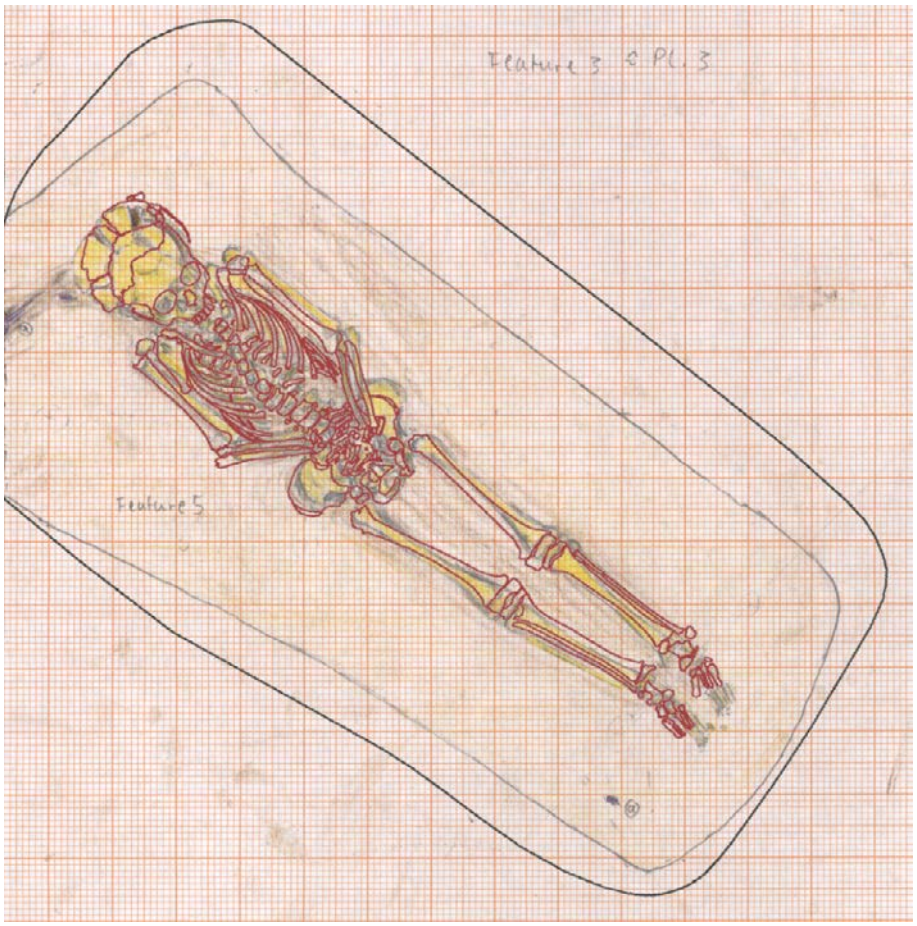


Fig. 3 Overlay of a hand drawing with a digital redrawing of an orthophoto of a Medieval child burial (A5) in the excavation year 2010. Drawing: Martin Riesenberg; digital redrawing: Jonas Abele.

addition, the trench leader produced parallel documentation on a feature sheet specially created for this purpose. It described the location, dimensions, and stratigraphic position of the feature, the soil colour and consistency, and the density of finds (Fig. 2). When all features in a trench were removed and only natural soil remained at the bottom of the trench, all four main trench profiles were documented.

1.1. Digital fieldwork documentation

In the first year of excavation in 2010, the plana and main profiles were drawn by hand on a scale of 1:20 on graph paper, parallel to experimental digital documentation (Fig. 3). From the second excavation year 2012 onwards, the excavation documentation was largely digital. Various methods were available for this:

- 3D point recording and measurement with a total station
- High definition digital photography
- 2D photogrammetry and orthophoto generation
- High dynamic range photography
- 3D photogrammetry based on Structure from Motion
- Time-lapse photography

The measurement of individual finds with the total station is now widespread on archaeological excavations. In the course of the excavations on the Bucova Pusta IV, however, not all individual finds were measured. The sheer number of finds would

Fig. 4 Digital redrawing of the Medieval grave (A5) in the excavation laboratory in Dudeştii Vechi in summer 2010 by Jonas Abele.

Fig. 5 Silvia Mircheva working on the Leica total station in summer 2014.

Fig. 6 Matthias Lang and Anna Loy setting up the Leica DGPS in the excavation summer of 2015.

have increased the workload enormously, and the scientific knowledge gained from such an approach is questionable for extensive outdoor sites. Instead, only finds considered representative or noteworthy by the respective excavator were measured. All finds for which this criterion did not apply were only attributed to the respective feature. For large and find-rich features, the finds were additionally allocated to square-meter grids to preserve spatial distribution information.

From 2012 onwards, plana and profiles were not drawn by hand in the field, but only digitally measured and photographed for later digital drawing on top of orthophotos. Reference points of known position (as measured with a total station) in the picture

allow the georeferencing of photos of flat surfaces. This process of trapezoidal image rectification complements digital plans with true-to-scale raster textures, and thus allows digital drawing over real world image information. Until 2014, digital drawing was performed with the proprietary CAD (Computer-Aided Design) software AutoCAD supported by the also proprietary add-in software ArchaeoCAD. 2014 marked the switch to a GIS (Geographic Information System) based workflow, with the free and open-source software QGIS for the same task.

Digital drawing saved a lot of time in the field: In some cases, the recording of a main profile could already be completed in 30–60 minutes. The drawings were usually done either by the trench manager or another member of the team in the field lab shortly after the documentation so as to remember the respective context well, and, if necessary, to be able to check the real profile again the following day (Fig. 4). Sometimes, they could be completed in the same evening, but due to time limitations and technical hurdles (e.g. user proficiency, a limited number of workstations, and a growing backlog with new documentation coming in every new working day) occasionally only months later. This turned out to be a critical shortcoming in some cases, as the drawing step is traditionally interlinked with stratigraphic interpretation. The processes were optimized throughout the campaigns to immediately engage the trench manager with the digital drawing and stratigraphic reconstruction.

Given the soil conditions and long occupation history at Bucova Pusta IV, two tools were of great help to analyse the stratigraphy: The Harris matrix validation and visualisation software Stratify, which allows to computationally model stratigraphic relationships and check their logical consistency (Herzog 2004), and HDR (High Dynamic Range) photography. As laid out below, this photographic method significantly enhances the information density compared to traditional photos. Some observations were more easily possible from the picture than they were in the field. A photo of almost any light value can be artificially generated from an HDR image. This is relevant when the natural lighting conditions were unfavourable for photography when taking the picture, for example at noon, dawn, or dusk.

Since classical orthophotos (2D photogrammetry) are naturally only able to accurately represent relatively flat surfaces, 3D photogrammetry with Structure from Motion was used to create textured 3D models for extraordinary features and emptied out trenches. This proved to be a useful tool both for science and public engagement. 3D models of half-excavated stratigraphic situations, human skeletons, and fragile pottery could later be consulted by trench managers, osteologists, and pottery specialists.

As a last digital documentation measure for the Bucova Pusta IV fieldwork, the excavation process was photographed in short intervals from an elevated position. From 2012 onwards, one or two outdoor cameras were mounted on ladders above especially relevant excavation areas. The cameras took pictures every minute for up to 3.5 hours (limited by battery life) in the mornings and afternoons. The resulting photo series were transformed to short timelapse videos.

The following sections explain the described methodology in more technical detail.

1.1.1 Total Station, CAD and GIS

A total station from Leica Geosystems (TS02) was used to measure 3D positions for feature

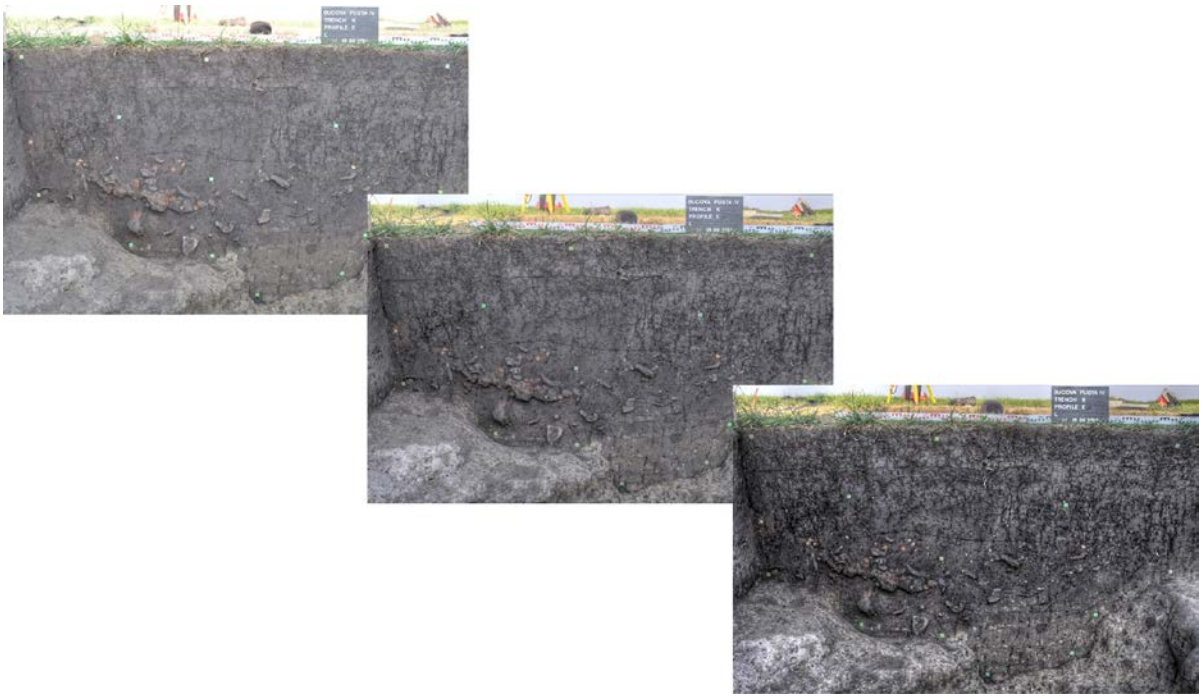


Fig. 7 Example of tone mapping (LDR) of a photograph in five different exposure levels on the east profile of Excavation Trench K.

outlines as well as individual find points (Fig. 5). The x and y coordinates were recorded in the projected coordinate reference system Stereo70 (Proiecția Stereografică 1970). This is due to the preferences of the Romanian surveying contractor who prepared the geographic reference points for the excavation in the immediate vicinity of Bucova Pusta IV with a mobile DGPS (Differential Global Positioning System) device (Fig. 6). Of course, these coordinates can be transferred to more common reference systems such as the WGS84 (World Geodetic System 1984) with a slight loss of accuracy.

The measurements can be exported from the total station into an ASCII text file, including an incremental measurement number, a human-defined code, and the coordinates for all three spatial axes. The code allows interpretation of the points in CAD software for automatic plan drawing and layer management – given it is syntactically correct. This may generally simplify some digitisation efforts, but was gradually abandoned during the Bucova Pusta IV excavation, as it turned out to be error-prone and the fully digital drawing process required manual reconfiguration regardless.

1.1.2 Digital photography and photogrammetry

The excavation photos were taken with the DSLR (Digital Single-Lens Reflex) cameras Nikon D3000 (10.2MP) and Nikon D5000 (12.3MP) with a standard lens (18–55 mm focal length). All pictures were taken multiple times with different camera settings depending on the time of the day and planned post-processing (e.g. HDR). The images were stored in .jpg format.

For the 2D photogrammetry image rectification and georeferencing, first the AutoCAD add-in PhoToPlan, and later QGIS was used. In some cases, HDR photos were also subjected to this transformation process.

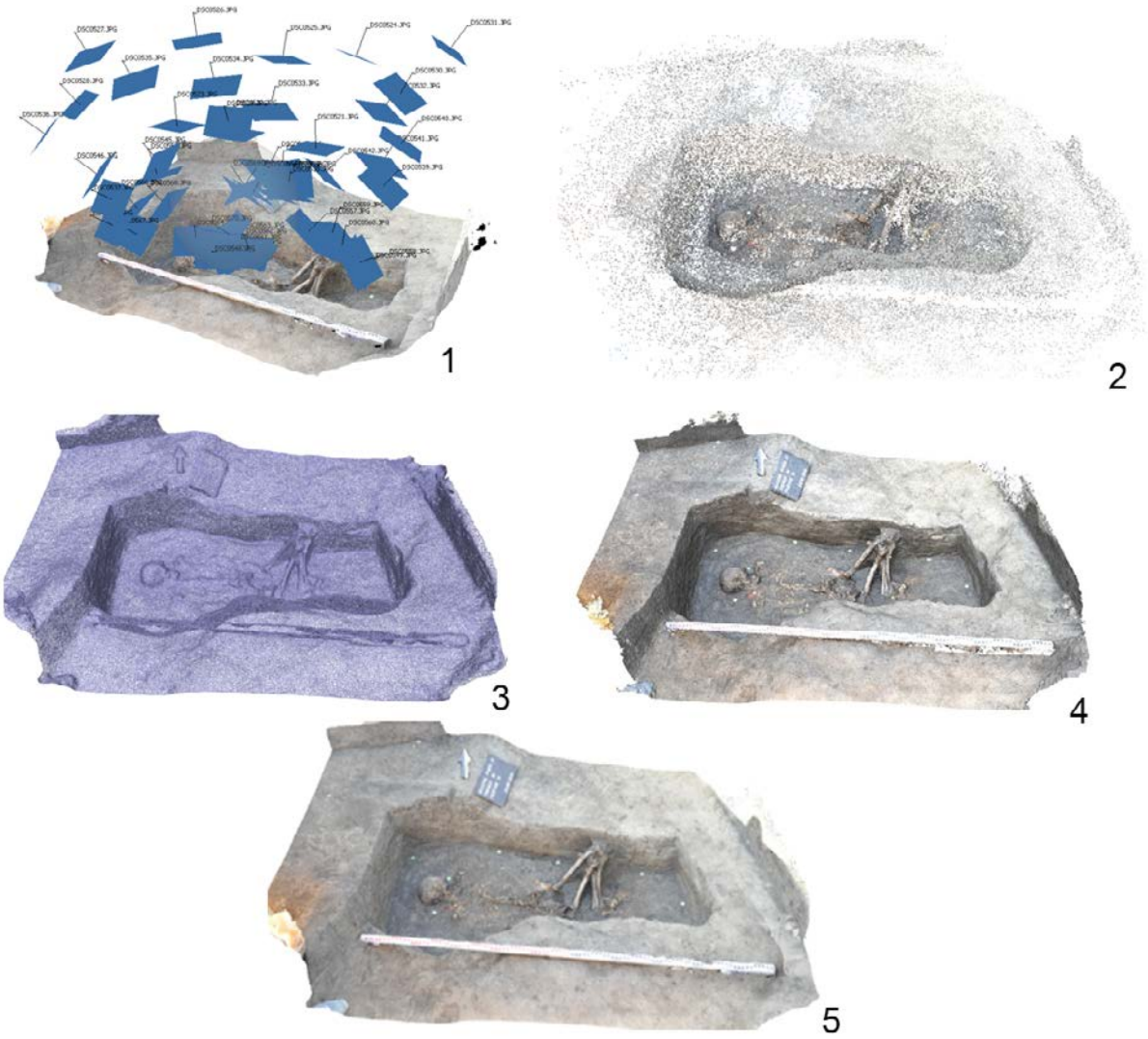


Fig. 8 Photographic documentation of the Chalcolithic burial (M 13) and 3D modelling with the aid of Structure from Motion. 1. Photographic recording from 51 different camera positions. 2. Examination of the individual photographs for common control points (align) – formation of a point cloud. 3. A grid is created from the point cloud (Mesh). 4. Condensed point cloud (Dense Cloud). 5. photo texture is placed over the created grid (Texture).

1.1.3 High dynamic range

A HDR (High Dynamic Range) image is an image with a high contrast range. This means that the spectrum of maximum and minimum luminance of a motif is higher than usually possible for digital photographs, whereby luminance is defined as the location- and direction-dependent intensity of a light source.

A real daylight scene covers a contrast range of around 100,000:1, whereas a normal digital camera can only measure a contrast range of 1000:1. As a result, bright surfaces appear fully white and dark surfaces fully black in the resulting photo, without any visible textures in the bright and dark spots, even when a human observer could still distinguish features within these surfaces.

One solution to this problem is more sophisticated image sensors capable of recording a larger contrast range. However, as of now, these are still mostly experimental or

Fig. 9 Work setup for interval recordings with a GoPro HERO3 for the later realisation of a time-lapse film of the excavation process.

Fig. 10 Example of the image area of the GoPro HERO3 camera on Excavation Trench S, S Extension, T and T Extension in summer 2015. Due to the fisheye effect of the camera, the straight trench edges appear curved.

Fig. 11 Aerial view of the excavation area in summer 2013 taken from an agricultural aircraft from Sânnicolau Mare. Photo: Ivan Vasilchin.

Fig. 12 Two staff members from the company "Andron Solutions" setting up a photographic drone during the 2014 excavation campaign.

expensive. Another, more realisable solution is to generate HDR images by digitally merging several individual images, each with the identical motif but a different exposure value. These can be taken in the field with a tripod and manual exposure value adjustments. Modern DSLR cameras also often have automatic exposure bracketing, which makes it easier to create a series of images with different exposure values. For Bucova Pusta IV, five individual pictures were taken with a light value distance of two units (Fig. 7).

HDR images cannot be saved in common raster graphic formats such as .jpg or .png. Therefore, alternative storage formats such as .tiff or special developments such as .hdr, .pic (Radiance HDR), or .exr (OpenEXR) are required. In addition, conventional screens or printouts are not suitable for displaying HDR images. In fact, the HDR image must be converted back into a low dynamic range (LDR) image for further use. The procedure used for this is called tone mapping. While the lifelike contrast range information is lost

Fig. 13 Washing, sifting, and documenting pottery finds in the excavation laboratory in Dudeştii Vechi in 2015. From left to right: Adrian Ardelean, Cristi Floca, Alexandru Ionescu, and Franziska Mandt.

Fig. 14 Drawing table and repro table for photo shoots in the excavation laboratory in Dudeştii Vechi in 2015. On the left in the picture, Achim Frey drawing a find.

in the process, certain properties of the HDR image can be emphasised or overemphasised, depending on the tone mapping algorithm. This allows the creation of an image with more natural colour and brightness, more detail and contrast – or, indeed, a surreal piece of art. The LDR image generated thereby can be saved in conventional raster graphic formats.

For the Bucova Pusta IV excavations, HDR generation and tone mapping was accomplished with the proprietary software Photomatix Pro 4.2.7 from HDRSoft.

1.1.4 Structure from Motion

Structure from Motion is an umbrella term for various computer-aided methods for 3D vector model generation from 2D raster images. The relevant algorithms take a collection of images showing the same motif from different perspectives. They then determine the relative position of identical points in space displayed on multiple of the input images. The point cloud determined this way can be transformed into a wire mesh by triangulation, and then textured again

Fig. 15 The archive of excavation finds and the reference collection in the Museum Dudeştii Vechi.

from the input raster graphics. The textured 3D model can finally be georeferenced and linked to other spatial data.

The method makes it possible to produce 3D models in very short time, and at very low cost. No special hardware or measurement technology is required to create the model beyond a digital camera and a powerful computer.

The procedure was first applied to Bucova Pusta IV as part of the 2013 campaign, and proved to be a valuable addition to the digital documentation toolset. Usually, 30–80 photographs were taken for each motif. These were then processed with the proprietary software PhotoScan Professional. A desktop computer with an Intel Core i5 processor and 8 GB of memory were used for the calculations, which took between 20 and 40 hours at a medium to high quality level for each model. The output is initially in a proprietary format (.psz), but can easily be exported to other 3D formats (Fig. 8). It is also possible to generate simple 2D orthophotos from georeferenced models.

1.1.5 Interval recording and time lapse

The cameras used for the interval recording were of the type GoPro HERO3 (Fig. 9). They take 5MP images with a large 150° angle, which causes an obvious fisheye effect (Fig. 10). On the 36 days of the 2013 campaign, around 11,000 usable individual images with a total data volume of almost 40 GB were generated. Time-lapse video generation was automated with the open-source tool ffmpeg.

1.1.6 Aerial Photography

In the excavation years 2010 to 2015, aerial photo documentation on archaeological excavations was still in its infancy. Nevertheless, we experimented with different techniques of aerial photography during the campaigns. In the summer of 2013, the excavation area was flown over with a small aircraft for agricultural use and from this, photographs were taken by hand (Fig. 11), which were then othoreferenced using the SFM technique. In the summer of 2014, a photographic drone operated by the Bulgarian company "Andron Solutions" was used for a short time on the Bucova Pusta IV excavation (Fig. 12). At that time, however,

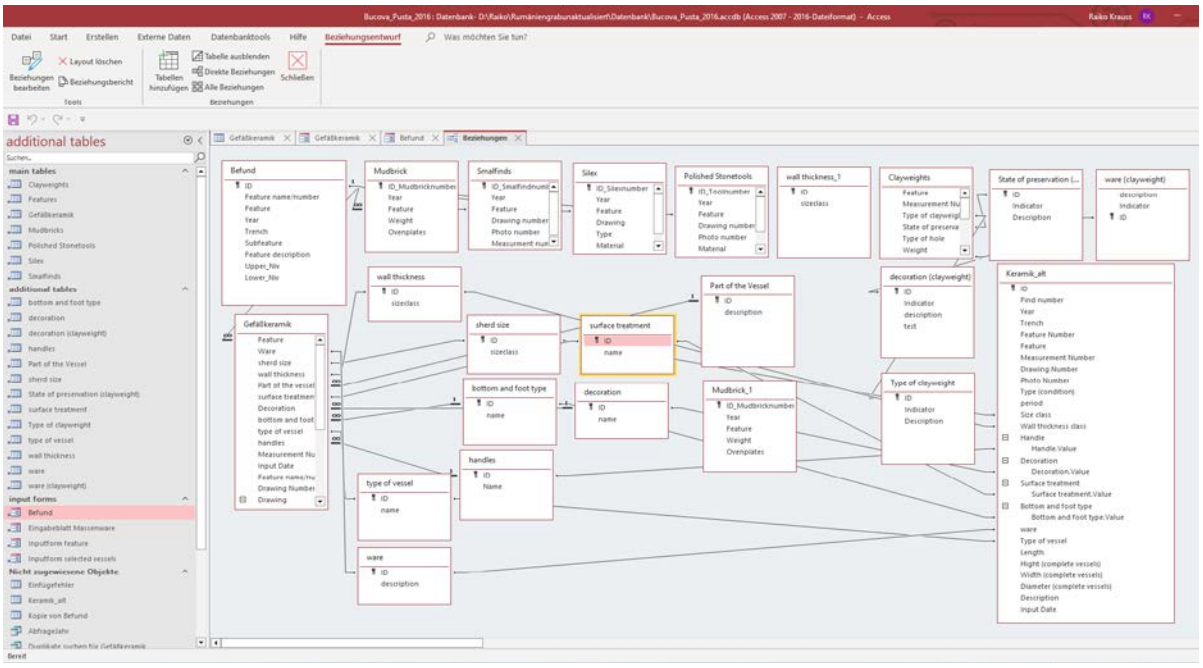


Fig. 16 Structure of the finds database of the Bucova Pusta IV excavation.

these aerial photographs were only used to supplement the documentation with the hand-held camera.

2. Field lab

2.1. Find processing

Finds recovered in the field were labelled and usually processed promptly in the excavation camp in Dudeştii Vechi. Individually measured finds were treated separately, collective finds initially being recorded as a whole, and, after washing, being separated according to material groups. The finds were washed in the camp, mostly by the local worker Elisabeta Uzun, who was specially employed for this work, and occasionally by students and the various conservators. The majority of the finds were soaked in water and mechanically cleaned of adhering sediment with brushes or toothbrushes (Fig. 13). Fragile finds were handed over directly to the conservators and mechanically freed from sediment and other buildup. After the finds had been washed and dried, they were separated according to material groups: ceramics, clay, bones/antlers/horn, and stone respectively. All finds were viewed, and a selection was further processed by the conservators. Individual pieces were freed from sinter either mechanically or by acid. Matching pieces were glued, and gaps were filled with plaster of gypsum if necessary. Isolated pieces were stabilised with a paraloid. Selected pieces were drawn and photographed (Fig. 14).

The storage of the finds took place according to excavation units and features. Within the features, the material was archived according to material groups. All pieces of pottery, the small finds, and the lithic artefacts were archived. The pieces are in plastic bags, each with a handwritten label. At the laboratory in Dudeştii Vechi's museum, all the finds are stored in a steel shelf in plastic boxes (Fig. 15). The unworked stones were not so numerous, and were all counted. The clay and the oven plate fragments were also completely recorded and weighed. Selected pieces were documented photographically,

but the majority of the insignificant pieces were then again disposed of in the excavation area at the end of the project.

Extensive sediment samples were taken from features particularly heavily endowed with organic material for floating on botanical macro remains. The heavy fraction from these flotations was also checked for archaeological finds, which were then included in the normal processing pipeline.

2.2. Quantitative recording and database

All finds were recorded in an MS Access database (Fig. 16). This contains information on 395 units, after which the finds were recorded. These are primarily the excavation features, but also technical units and surface collections. These units were described and entered with their technical parameters and geographical coordinates. The database contains 24,955 pieces of pottery and 1,914 clay weights and fragments of such. From 247 excavation features, there is also information on the total weight of the mudbricks and oven platform fragments. All other finds were recorded separately by the individual processors. The database contains information about which of the pieces were documented graphically, and which photographically.

Chapter 7

Neolithic settlement structures and stratigraphical situation of excavated features

Raiko Krauß, Dan Ciobotaru, Clemens Schmid

The excavation sections were labelled with letters from A to T in the sequence of their excavation (Fig. 1). The description of the Early Neolithic settlement structures is in the order of their importance for the interpretation of the settlement events. Where post-Neolithic features occur, they are described in relation to the Neolithic structures which are intersected or overlain by them.

Neolithic settlement structures in the area of Excavation Trenches S and T

In the west of the archaeologically investigated area of Bucova Pusta IV, a strong elongated signal with an approximately east-west course emerges in the geomagnetic mapping. In the summer of 2015, two trenches S and T were made on these structures and, in the further course of the excavation work, they were connected to each other by the removal of the profile baulk, and successively extended to the east and west in order to expose the Early Neolithic settlement structures encountered there as completely as possible (Fig. 2).

The sequence of building structures in this settlement area can be reconstructed as follows. The stratigraphically oldest feature is an extensive settlement pit approximately in the centre of Trench S. In the course of the excavation work, various numbers were assigned to this structure, essentially S17, S20, and S28. In the west of this longitudinal-oval settlement pit with a roughly east-west orientation (Fig. 3), two ovens were laid out next to each other, S29 and S15. Only for the furnace S29 were the remains of a large platform preserved. For S15, small remains of a dome were preserved next to the furnace slab.

After this settlement area had been abandoned, a similar structure consisting of a longitudinal oval settlement pit with two kilns to the west was created immediately to the east. The settlement pit consists of Features S11, T3, and T6, and appears to have been extended eastwards in the course of its use: Features T2, T5, and T7. The construction of the kilns can be traced particularly well here (Fig. 4). The northern one of the two kilns (S7) had a collapsed dome, and was cut during the excavation to obtain a cross-sectional profile. To the east, towards the settlement pit, was the opening of the oven, which was apparently carved out of the overlying sediment by digging sideways. A dome rose from the base plate, which probably also supported a wide chimney. Such a chimney is clearly visible on the southern of the two kilns (S6), which was completely preserved. This one

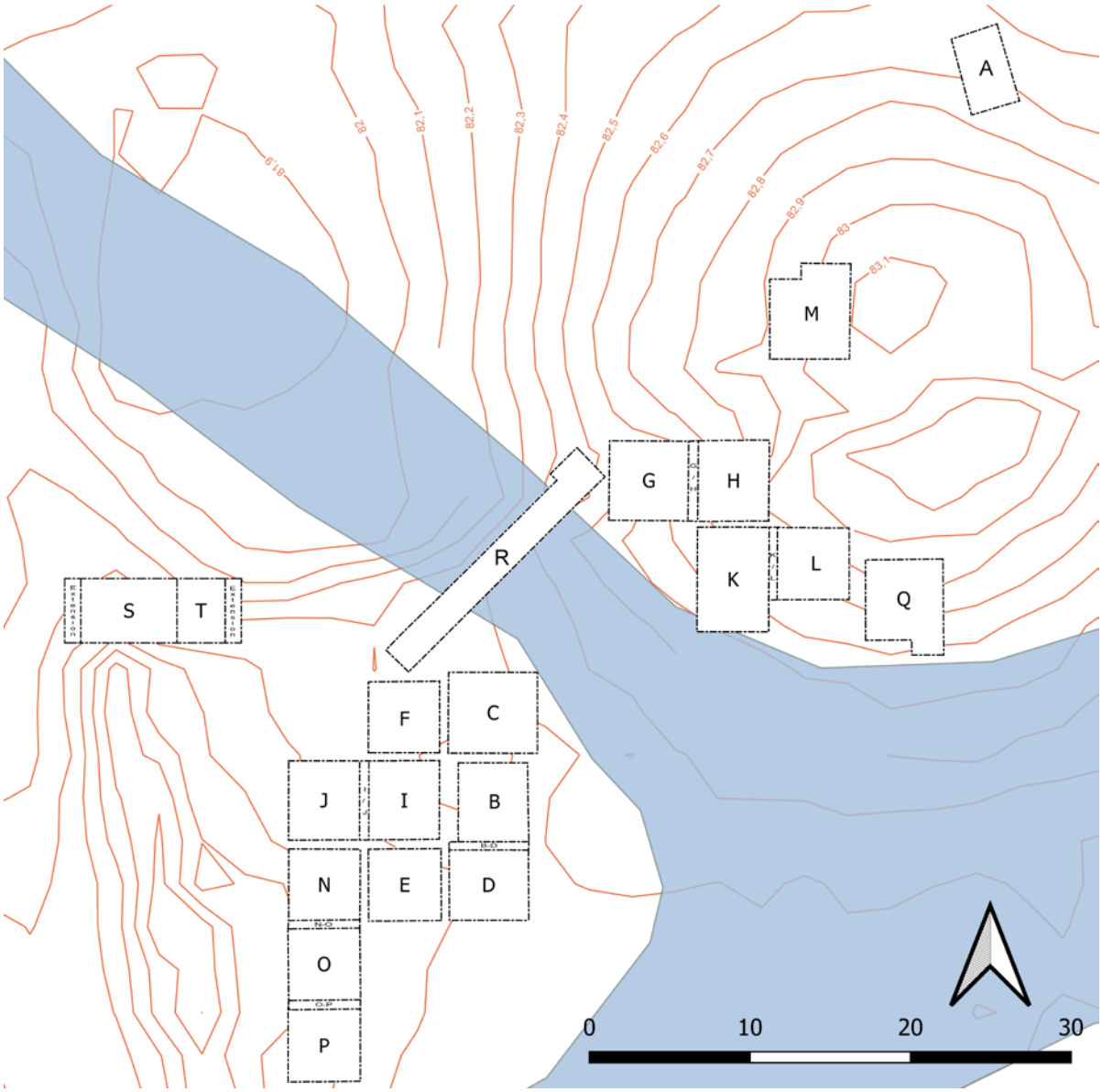


Fig. 1 Overview of the excavation trenches on the Bucova Pusta IV site.

also has an opening in the east, which could be fed from the settlement pit. Compared to the very wide and massive chimney for the smoke outlet, the furnace dome is quite small. It is possible that the production of smoke was more important in these installations than the achievement of high firing temperatures. It may have been used as a smoker for preserving food such as fish.

We understand these two uniform settlement structures as successively used pit-houses with attached furnaces. In their direct vicinity, there are further pits with Early Neolithic finds, the stratigraphic relationship of which to the settlement pits is unclear. Some of them are postholes, of which S8 and S9 are still very clearly recognisable in the planum. Others, such as S16, S25, and S26 next to the older pit-house, and T9, T10, and T11 next to the younger one are larger than postholes, but too small to have served as parts of residential structures. In the south of the western extension of Trench S,

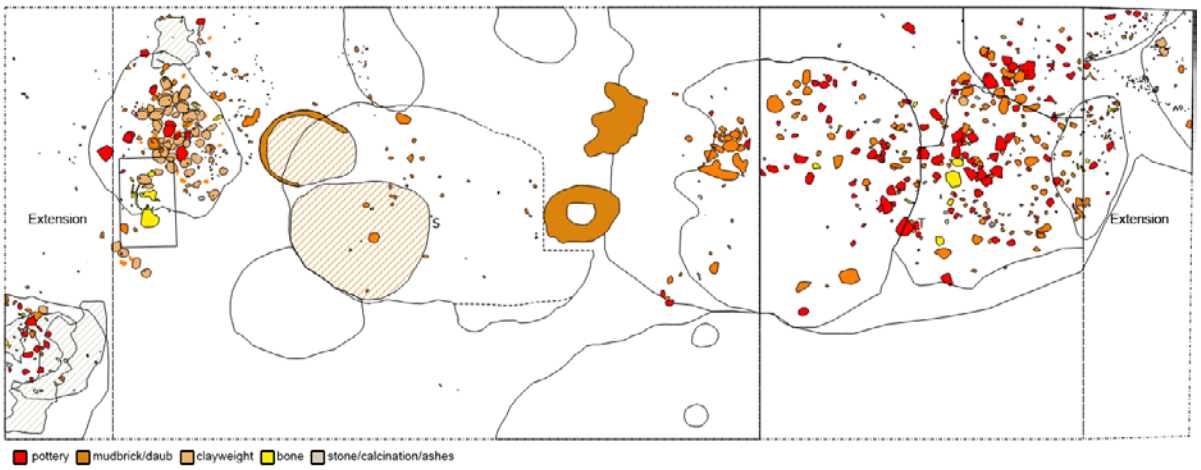


Fig. 2 Redrawing of the archaeological contexts in Excavation Trenches S and T with their extensions to the west and east.

Fig. 3 The large pit complex in the centre of Trench S (Features S17, S20, and S28) with earth oven adjacent to the northwest (Feature S15).

Fig. 4 Two earth ovens in the east of Trench S with openings to the east. The southern kiln (Feature S6) is completely preserved and still has a wide cylindrical flue. The dome of the northern kiln (Feature S7) has collapsed.

Fig. 5 Large pit complex in the west of Trench S (Feature S22). In addition to pottery fragments and other broken remains of household goods, numerous shells of mussels and snails are visible in the backfill, derived from food remains.

Fig. 6 Excavation situation in the west of Trench S immediately before the block recovery of the Early Neolithic child's grave (Feature S24). Visible on the right is the large pit complex with one of the earth ovens (Feature S15). Adjacent to the west, the large pit with the clay weights and the child burial.

Fig. 7 Situation after lifting the child's grave (Feature S24). Numerous burnt clay weights lie on the bottom of the pit.

Fig. 8 The child burial (Feature S24) prepared for block recovery above the pit complex with the clay weights.

a larger pit was found, the fill sediment of which included many Early Neolithic finds (S22). Numerous mussle and snail shells were conspicuously interspersed in the fill sediment (Fig. 5). Such high concentrations of food waste are otherwise rather typical for the areas around the furnaces. However, only a small part of this structure could be uncovered within this extension.

Another large pit (S24) west of the older pit-house is remarkable. In its upper part, a superposition of S24 above furnance S15 could be documented. 43 large clay weights were found at the bottom of this shallow pit, 18 fragments of such, and three larger lumps of clay, apparently fired only secondarily, which might be regarded as precursors in the manufacture of such clay weights (Fig. 6). Some of these weights lay as if they had been strung on a rope (Fig. 7). Above this deposit, and clearly recognisable as a later event by the intervening fill sediment, was the inhumation burial of a child in a left lateral position with legs crouched, head to the south and facing westwards (S14). The fill sediment of the burial pit contained larger fragments of Neolithic pottery and some animal bones, including a large fragment of a goat skull. The stratigraphic superposition of the child's grave above the pit with the clay weights, which, in turn, overlies kiln S15, shows that this is one of the latest features of the Early Neolithic settlement (Fig. 8).

Fig. 9 Photogrammetry image and redrawing of planum 3 in Trench B (Jonas Abele).

The child may have been buried in this area when the Early Neolithic settlement activity ended.

The complex of structures in Excavation Trenches B to F

Trench B had already been excavated in 2012 in order to investigate anomalies in the geomagnetic mapping. The Early Neolithic pit features B9 and B12 proved to be rich in finds (Fig. 9). During the 2013 excavation campaign, the area around Trench B was further investigated with Trenches C, D, E, and F (Fig. 10). A continuation of B12 was uncovered as Feature D14. Trenches C and F were significantly characterised by a deep ditch structure (former river bed) which had destroyed pre-existing Neolithic features. Extensions of this had already been documented in the north-eastern corner of Trench B. No archaeological features could be identified in Trench E.

The following structures can be distinguished (Fig. 11 with profiles on Figs. 12–17):

1. The former river bed and deep pit in Trenches B, C, and F.

2. Feature B9: pit with Neolithic finds in the centre of Trench B.

3. Feature B12/D14: large pit with Neolithic find material extending over Trenches B and D and beyond.

1. The deep linear ditch (former river bed) and deep pit in Trenches B, C and F

Relevant Profiles:

Trench B, Profile N, E and 1

Trench C, Profile N, E and 1–8

Trench F, Profile N, E and 1

A number of settlement features are associated with the extensive ditch structure in the north-eastern corner of the south-western excavation area (B-C-D-F complex). Significant are B14, C18, and especially the deep pit C15 between Trenches C and F.

As discussed below, the internal differentiation of sediment layers filling this ditch feature is quite complex. It is well visible in the geomagnetic image, and we later gained a better understanding of its extent when we excavated Trench R (see below). Concentrations of Neolithic pottery and mudbrick fragments caused strong magnetic anomalies, which, however, could not be understood as definite features. The ditch seems to be a recent depression, which – judging from the most recent pottery found – possibly coincides with the Early Iron Age use of the area.

Impressive evidence for this is an almost completely preserved Iron Age vessel (see Chapter 18). Existing Early Neolithic

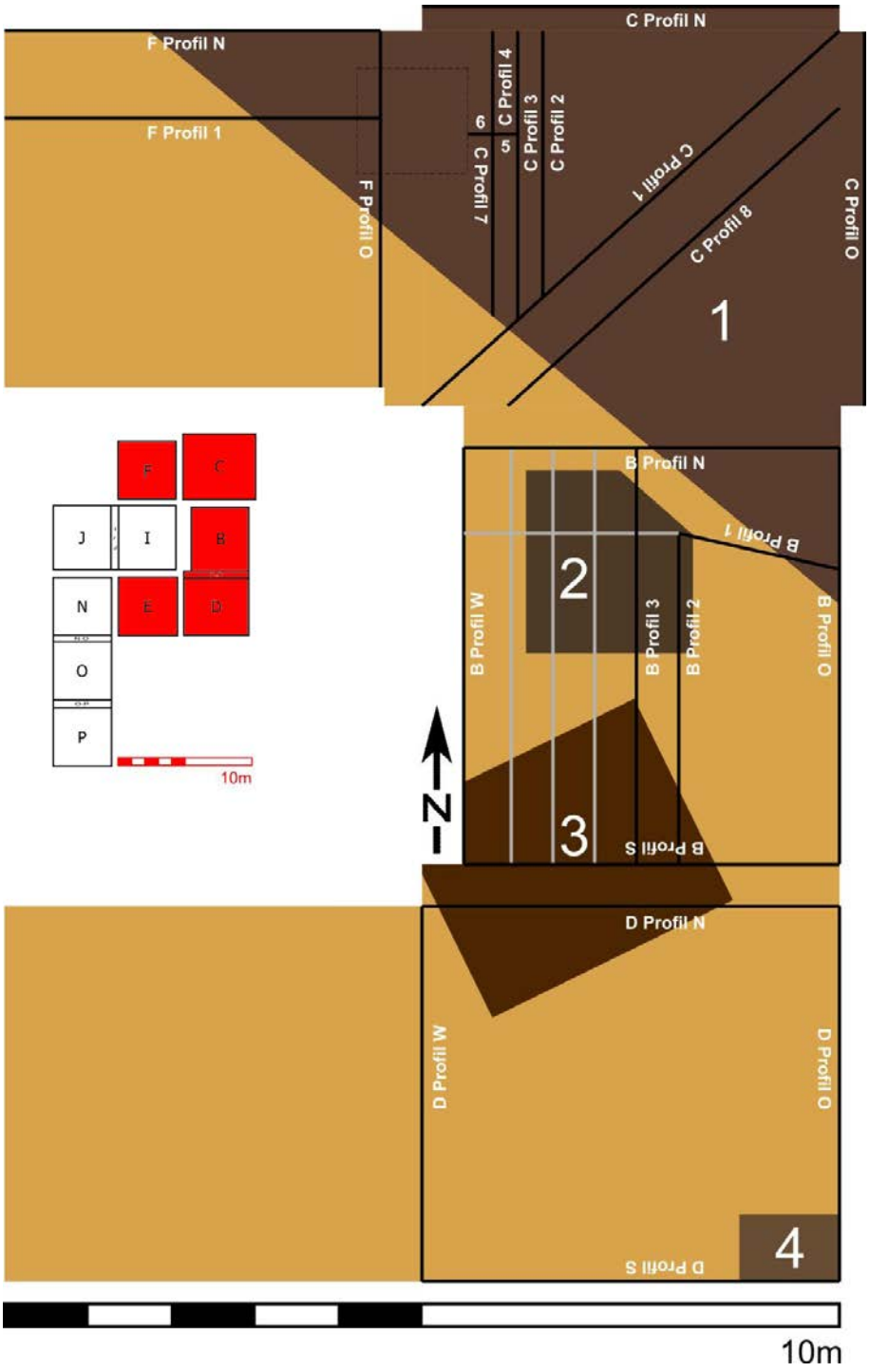


Fig. 10 Sketch of Excavation Trenches B–F with the position of the most important profile sections.

structures were destroyed by the ditch. Despite this seemingly simple fact, it took a great deal of effort in the field and beyond to reconstruct its formation and backfilling. It is against this background that the large number of small profiles (C Profiles 2–7), which were made alongside the large diagonal profile bar (C Profiles 1 and 8), should be understood.

All of these profiles display dark backfill associated with find material, which, although resting on the yellow, in-situ subsoil, is equally detached or even overlaid, especially in the areas near the edges, by likewise yellow, albeit somewhat darker, partly grey discoloured lenses and packings. A similar picture is provided by the middle profile

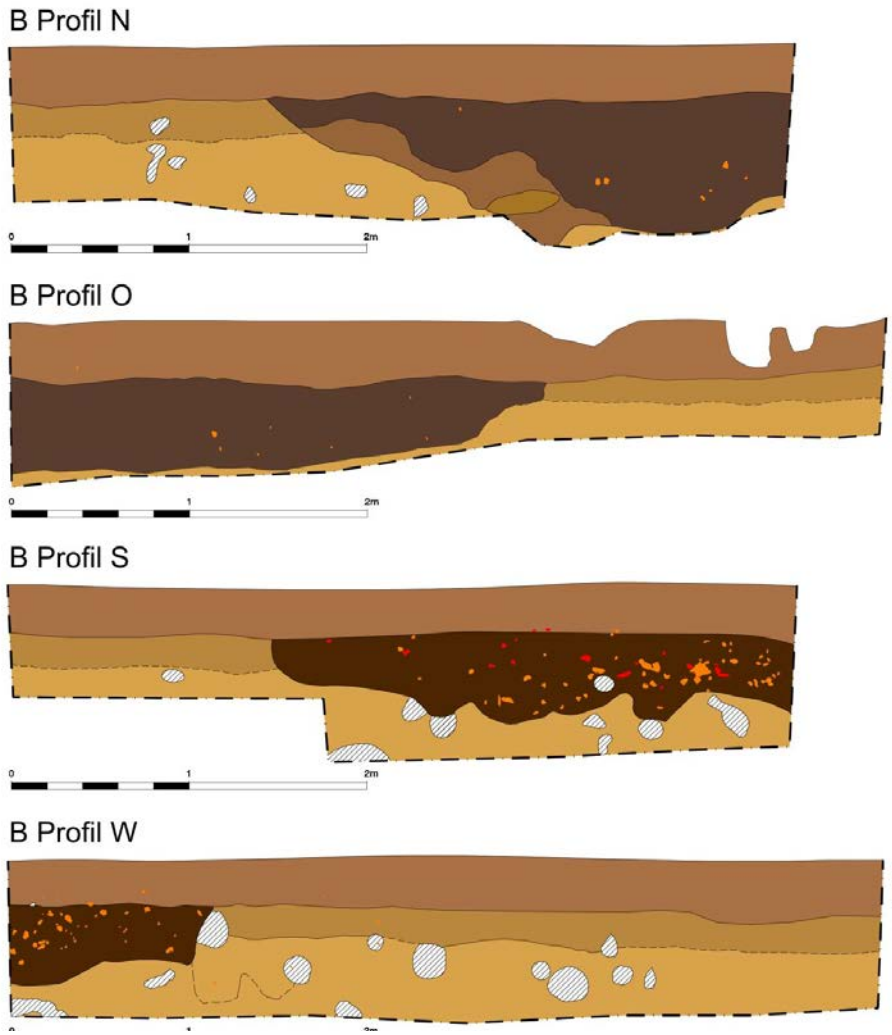


Fig. 11 Main profiles in Trench B.

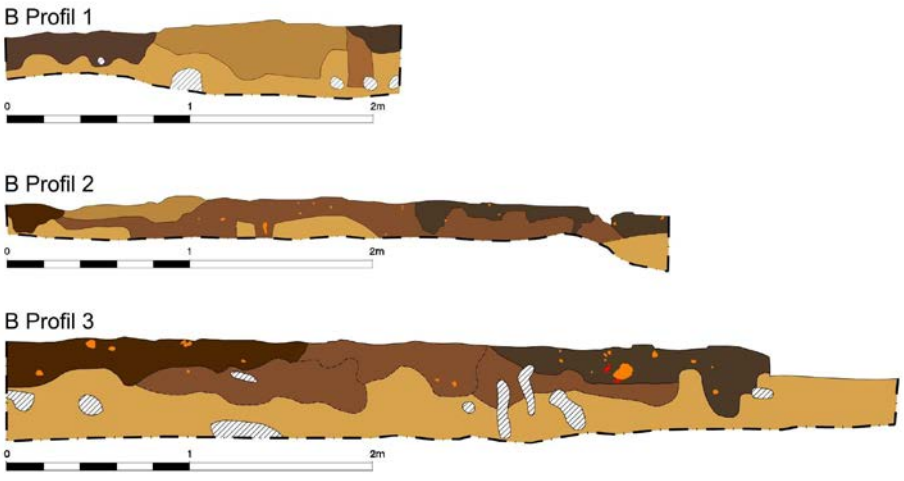


Fig. 12 Intermediate profiles in Trench B.

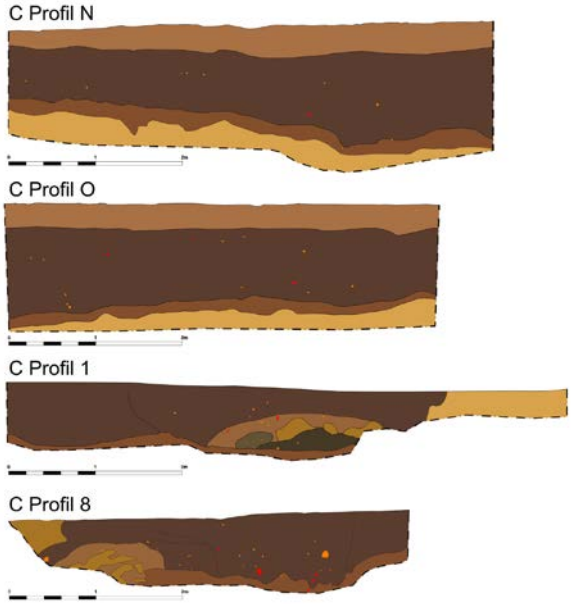


Fig. 13 Main and intermediate profiles in Trench C.

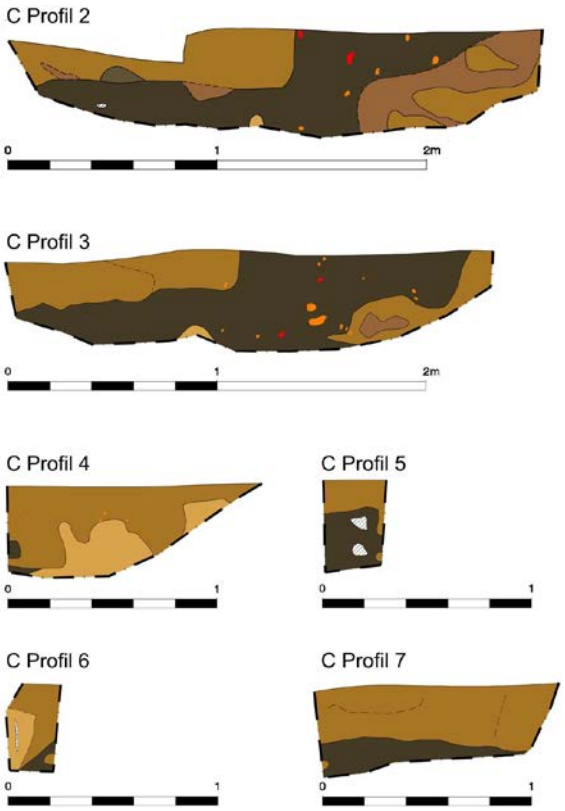


Fig. 14 Intermediate profiles in Trench C.

recorded in Trench F (F profile 1). Natural material input via the flanks of the ditch is central to the interpretation of these findings. For this, the effect of individual heavy rainfall events must be taken into account, which can have an enormous geomorphological effect. The excavation team itself has experienced this first-hand in the course of the excavation campaigns. A single heavy rain event would have been enough to soften the edges of the depression and cause them to fall in.

In the north-east of Trench C, Feature C17 in the planum (but not in the recessed Profiles C N and E) was a sandier and lighter lens than Feature C18, possibly indicating a further backfilling event.

The find material in the ditch was copious, and heterogeneously distributed. Feature C18 proved to be particularly rich in finds, containing Neolithic find material, i.e. pottery and mudbrick fragments. Remarkable here is the large quantity of animal bone fragments.

Although this observation could not be clearly confirmed in F Profile E, the plana recordings indicate that Feature C15 intersects other delineable features such as C18, and must accordingly be younger than a significant part of the ditch fill. In fact, the 2 m wide pit is exceptionally deep, and may have been used as a well, given its distinct vertical shaft structure. Groundwater ingress prevented the pit from being fully excavated; a final deep sounding with the Pürckhauer drill rod revealed that the bottom of the pit must be more than 2.3 m below the ground surface. The find material within it was mostly Early Neolithic; probably, the shaft penetrated and destroyed an Early Neolithic feature.

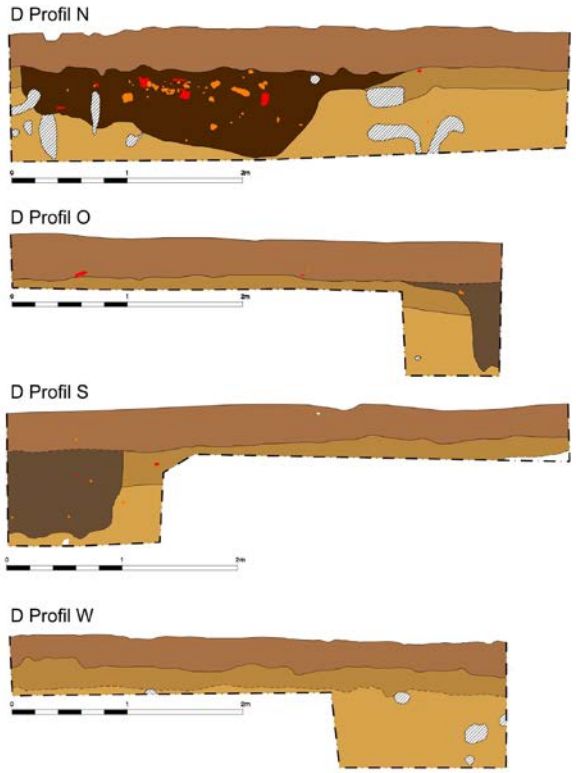


Fig. 15 Main profiles in Trench D.

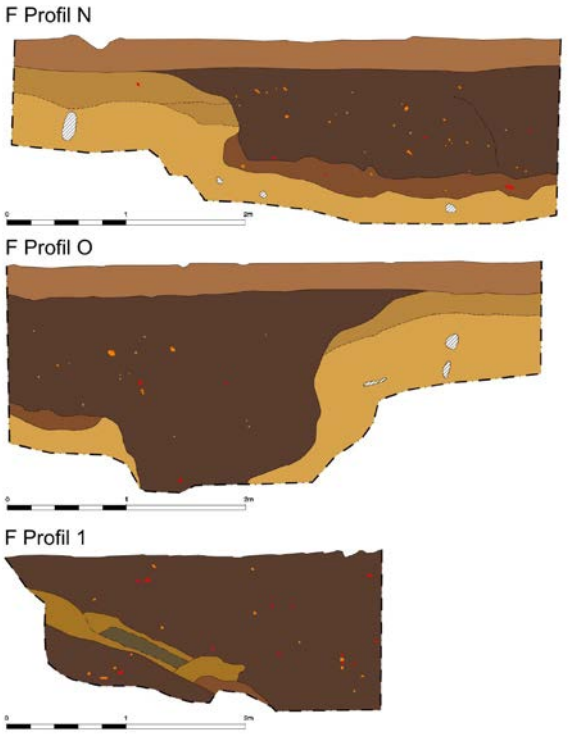


Fig. 16 Main and intermediate profiles in Trench F.

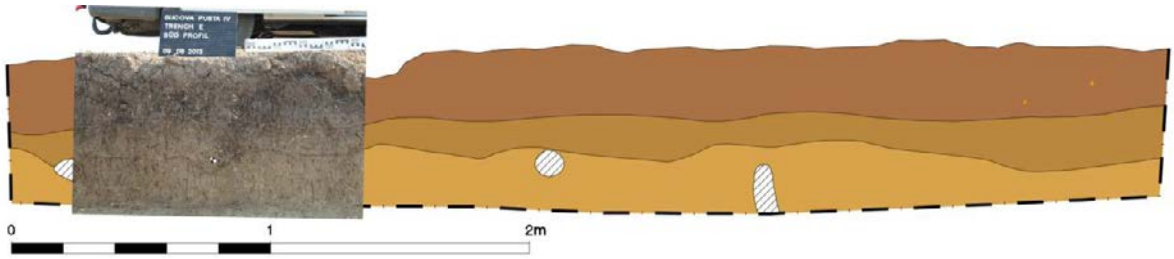


Fig. 17 South profile of Trench E. The zoning of the natural soil horizons of Bucova Pusta IV with pronounced plough horizon is clearly visible.

Fig. 18 Complete storage vessel in situ within the dwelling Feature B9 in Trench B.

Fig. 19 The reconstructed storage vessel from Feature B9.

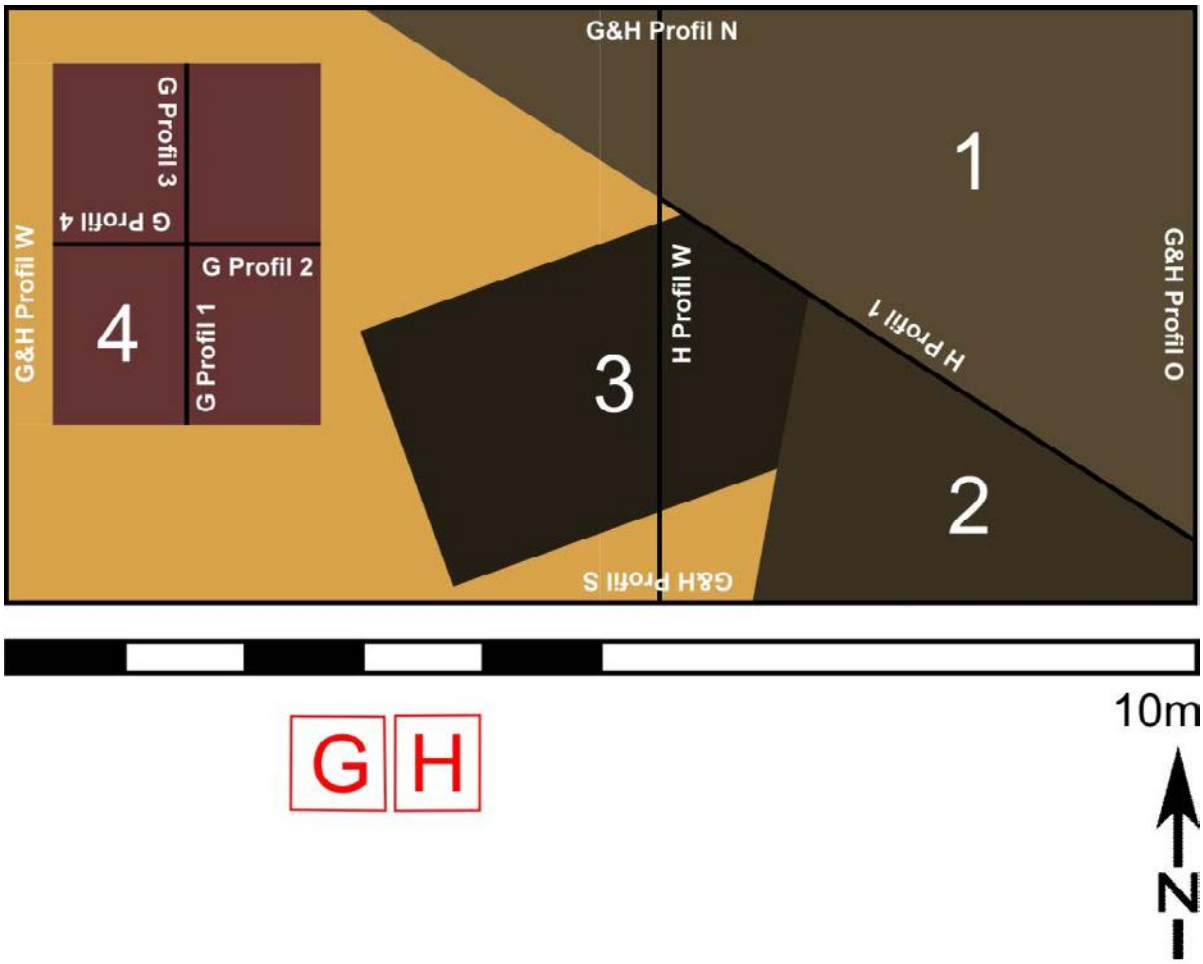


Fig. 20 Sketch of Excavation Trenches G and H with the position of the most important profile sections.

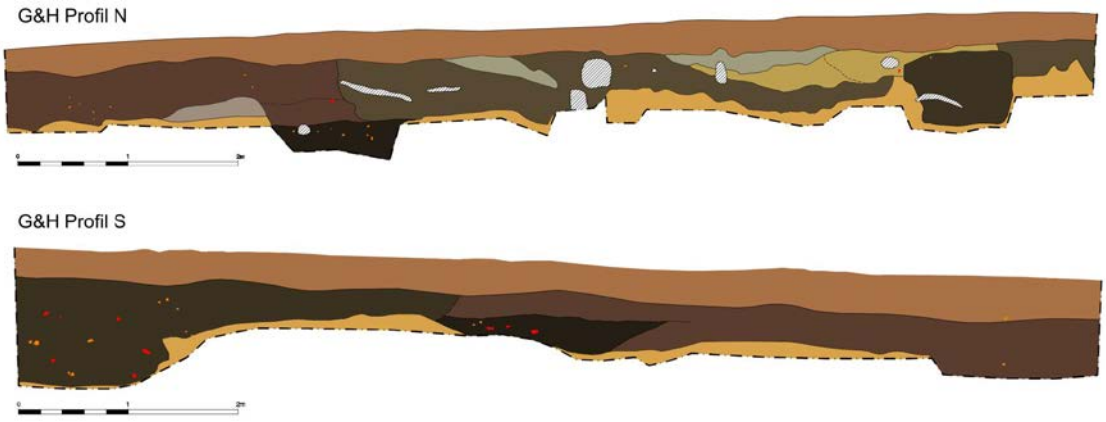


Fig. 21 North and South profile of Trenches G and H.

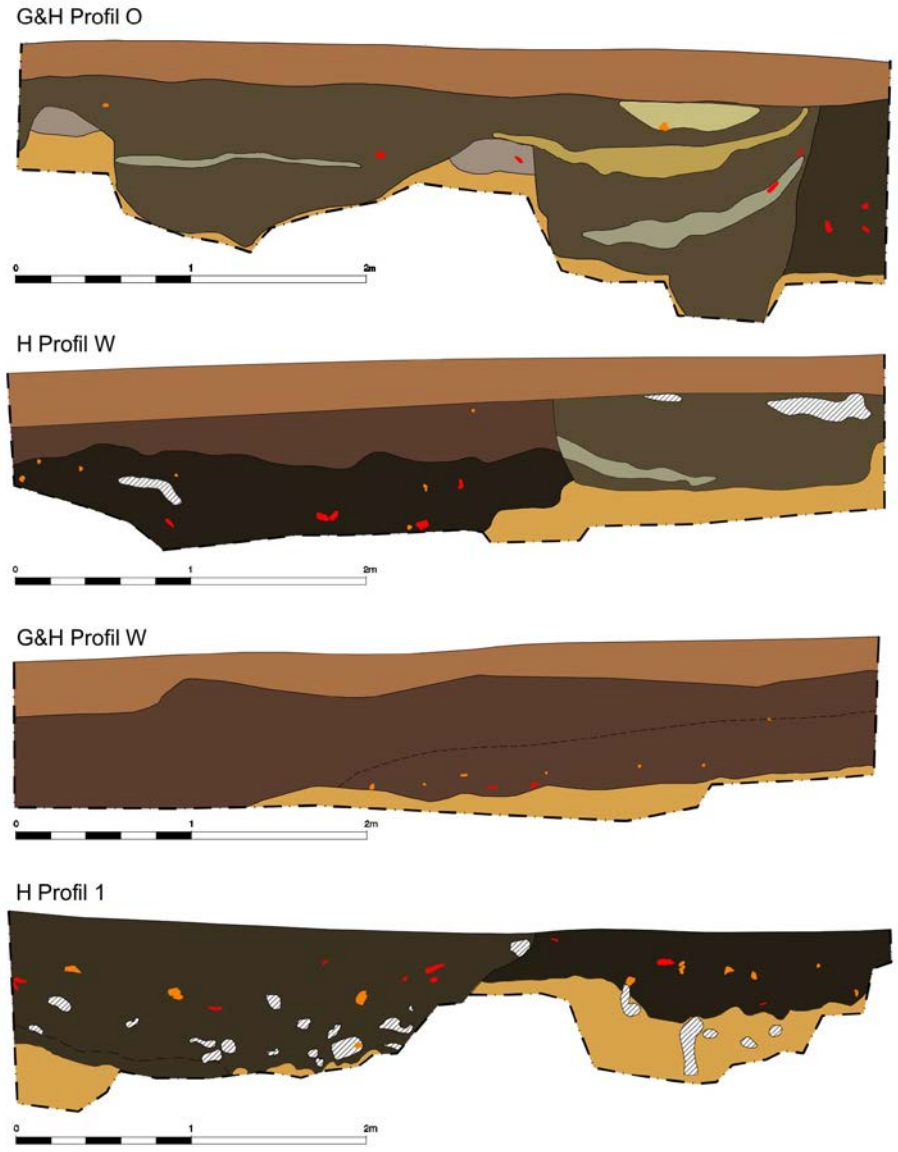


Fig. 22 Main and intermediate profiles of the Trench Complex G–H.

2. Feature B9: pit filled with Neolithic material

Relevant Profiles: Trench B, Profiles 1–3

Together with Feature B12/D14, Feature B9 was visible as a clear, positive anomaly on the geomagnetic diagram, and proved to be a comparatively shallow, almost square pit, filled with an above-average number of ceramic vessels or fragments and fragments of burned clay. Remarkable is the occurrence of an almost completely preserved vessel, documented as Feature B13 (Fig. 18–19). Feature B20 and the small depression Feature B22, which were distinguished in the field, can be understood as subunits of Pit Feature B9. That suggests further differentiation of the backfill.

The interpretation of the feature as a Neolithic pit or wattle-and-daub house is not easily applicable here. Its extension on Planum 3 does not exceed 2 x 2.5 m. Individual structures, which were recognised in profiles and addressed in the field as postholes (B profile 1), cannot be accepted unqueried as evidence for superstructures

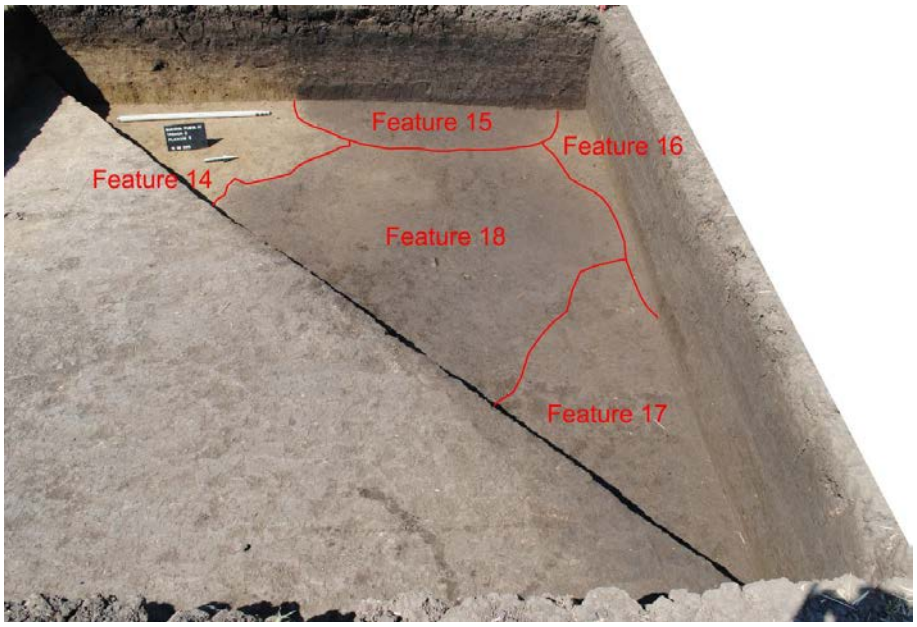


Fig. 23 Planum 5 of the north-western half of Trench G. Individual distinguishable Features are marked.

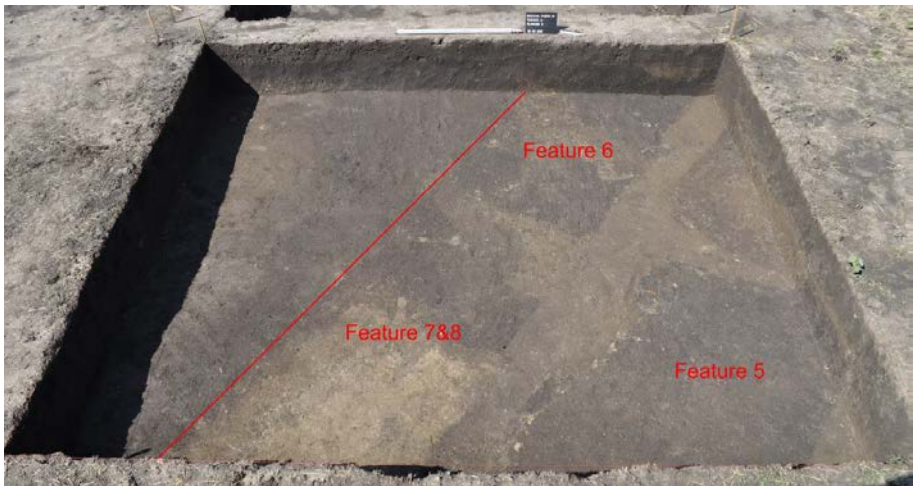


Fig. 24 Planum 2 in Trench H. Marked are the main features in the northern part of the trench, which was disturbed by the old excavation.

Fig. 25 Medieval inhumation burial in Feature H5.

Fig. 26 Deposition of human skeletal remains in Feature H6.

Fig. 27 Complex interlocking of the Neolithic pit (Feature H8), the disturbance of this pit by the old Excavation Feature H7 and a shaft-like probing from the same context.

due to the uncertainty of this interpretation. Nevertheless, the presence of nearly intact pottery vessels is an indicator of a utilitarian structure beyond simple waste pits. It is possible that Features B9 and B12/D14 could have formed a coherent unit. In fact, the two features were not clearly separable in the first spits. Instead, both structures seem to be causally related to each other, as seen on Planum 2 in Trench B. During the excavation, both structures could only be gradually separated from each other in a process of careful removal of adjacent features (B Profile 3). Features B9 and B12/D14 were cut by several profiles, which are not comprehensively presented here. B Profile 3 is representative of other profiles that reflect the same situation. Only on the lower Planum 3 could the two structures be clearly separated.

3. Feature B12/D14, large pit with Neolithic find material

Relevant profiles: Trench B, Profiles S, W, and 2–3; Trench D, Profile N

Feature B12/D14 has not been fully excavated; part of it is beyond the western boundary of Trench B. It is a relatively large pit (at least 3.5 x 2.5 m) with a considerable amount of Neolithic find material recorded in both Trenches B and D. This constellation meant that the feature was cut by several main profiles (B Profile W, B Profile S, and D Profile N), and could be clearly recorded in them. An impression of the find distribution in Trench B can also be obtained from Planum 3. The amount of burned clay found in there is very high. In addition, fragments

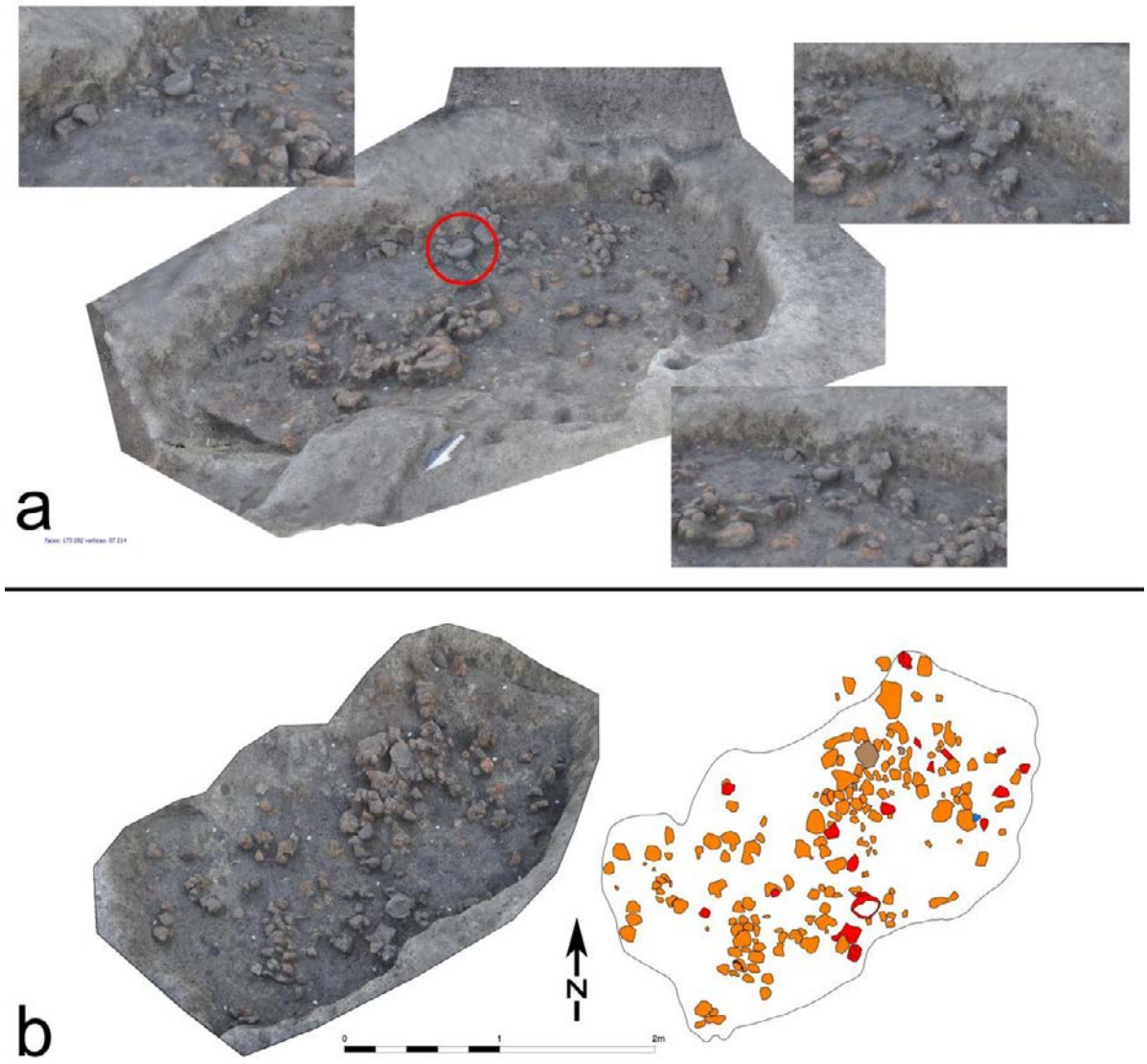


Fig. 28 (a) SFM model of Planum 1 from Feature G/H1. The large quantity of burnt clay and pottery fragments encountered in the pit is clearly visible. Particularly marked is a well-preserved asymmetrical vessel that appears to have been deformed before or during firing. (b) Photogrammetry image and redrawing of the planum (David Kirschenheuter).

with consolidated imprints of wood wattle were recovered in the western area of B12/D14, which make an interpretation as construction clay probable. This is an argument for the interpretation of the complex as a possible settlement feature. Accumulations of aquatic and terrestrial snails (possibly individual meals) and the numerous fragments of household pottery also speak in favour of this.

The complex of structures in Excavation Trenches G and H

On the north-eastern side of the former river course crossing the settlement, the geomagnetics also display very strong signals. For this reason, Sections G and H were initially excavated in 2013.

Sections G and H were connected during the course of the excavation work by removing the

Fig. 29 On the bottom of the large, kidney-shaped pit (Feature G/H1) the complete horn cone of an aurochs was found.

Fig. 30 The large, kidney-shaped pit (Feature G/H1) after its filling has been completely emptied.

separating profile bar (Fig. 20). Two decisive features or complexes of features extend over both sections; accordingly, it is justified to describe both sections together.

The following major entities can be distinguished in this area (Fig. 20 with profiles in Figs. 21–22):

1. Disturbed area in the north-eastern corner of both trenches – old excavation.

2. Feature H8: large pit with Neolithic find material in the south-eastern corner of Trench H.

3. Feature G6/H9/G-H1: kidney-shaped pit with Neolithic find material extending over both trenches.

4. Feature G7/G10: Kiln structure and pit in front of it in the north-western corner of Trench G.

It is noteworthy that no backfilling of any kind could be stratigraphically observed in the burial mound giving the site its name, although Trench H clearly cuts into it. Deep ploughing seems to have destroyed any existing structures here. The alternative explanation, that the mound was not of human origin after all, and came about through natural, geomorphological processes, can be ruled out in Bucova Pusta's environmental context.

1. Disturbed area in the north-east corner of the overall trench – old excavation

Relevant profiles. Trench G/H, Profiles N and S; Trench H, Profiles W and 1

As can already be seen on the geomagnetic mapping, Trenches G and H intersect the flank of a rectangular structure running around the tumulus which is still slightly visible in the terrain. Most likely, this structure is the backfill of the large-scale excavation trench made during the old excavations in 1903.

On Planum 2, immediately below the completely mixed plough horizon, the separation between undisturbed features and the area of the old excavation (Figs. 23–24), which, in turn, can be subdivided into various sub-areas, was marked out in Trench H. Kisléghi's excavation method evidently included exposing an artificial planum and then spooning out visible features within it; the remaining ridges, which stand out as regular structures of brighter soil against dark backfill, may therefore very well

Fig. 31 Furnace and functional pit in Trench G with the applied profile sections.

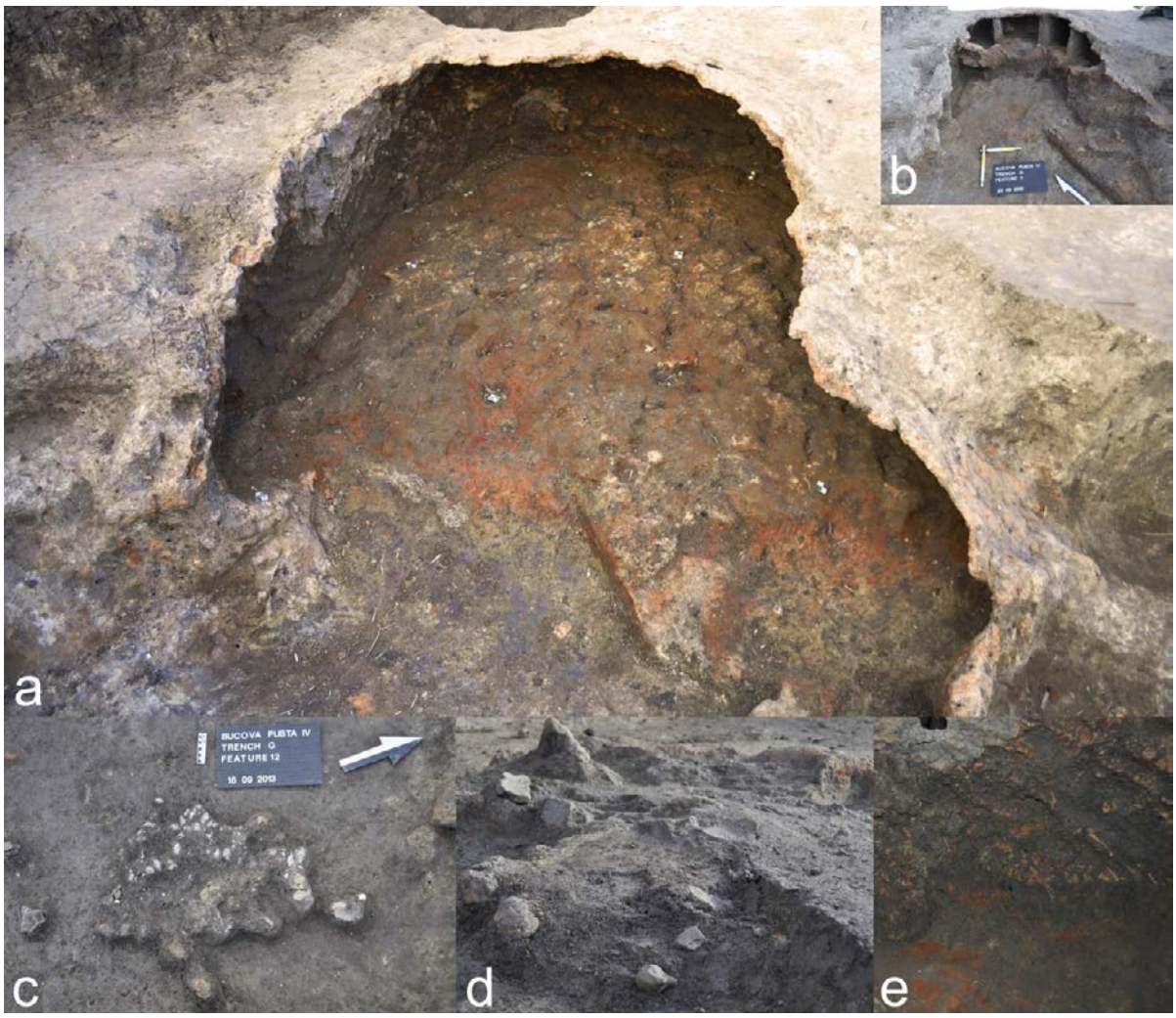


Fig. 32 (a) Earth oven (Feature G7) completely hollowed out. The subsoil is heavily consolidated. (b) Working status of the excavation of the kiln interior filled with burnt clay debris. (c) Accumulation of snail and mussel shells in front of the kiln. (d) Ceramic fragments in front of the kiln. At the bottom of the picture a small fired clay figurine. (e) Excavation marks on the interior wall of the kiln.

Fig. 33 HDR image of the ceiling of the kiln (Feature G7). Fired clay fragments and the kiln dome (orange) as well as ceramic fragments (red) were redrawn.

reflect previously existing dividing lines. A distinction between the originally existing structures and the search trenches of Kiśleghi was only possible for the complex of Features H7/H8, but not for the Burial Pits H5 and H6.

The latter contained burials, though without any Chalcolithic grave goods. The burial in Feature H5 was encountered in 2013 in an anatomically approximately correct position – an east-west oriented supine position (Fig. 25). However, disturbance of this burial by Kiśleghi could neither be explicitly verified, nor ruled out by the stratigraphic observations. The burial in Feature H6 is more difficult. The skeleton was probably uncovered and removed during the old excavation, but then deposited again in the western part of the burial pit (Fig. 26). This scenario seems most likely for explaining the heap-like accumulation of human bones encountered during the 2013 excavation.

2. Feature H8: large pit with Neolithic find material in the south-eastern corner of Trench H

Relevant profiles: Trench G/H, Profiles E and S; Trench H, Profile 1

Feature H8 is a large pit structure with Early Neolithic find material extending across the area of the old excavation and beyond the trench. Part of the pit was recorded and excavated by the old excavation. The resulting depression could be recorded separately from Feature H8 and was designated as Feature H7. This also includes a narrow shaft that was probably made by Kiśleghi as an exploratory trench in Feature H8 and reaches deeper than the Neolithic pit (Fig. 27).

Compared to similar finds such as G/H1, H8 contained little find material. The majority were Neolithic pottery fragments. The small number of fragments of mudbricks recovered and the singular find of a possibly human tooth are striking, though. Almost no finds were recovered in the part of the site disturbed by Kiśleghi.

Interpretations of the purpose and use of the structure must therefore be formulated with caution: Clay extraction and subsequent waste disposal seem more plausible than the assumption that it was a residential structure. The backfilling of the pit probably took place only a short time after it had been created – no evidence could be found for the influence of heavy rainfall events, as for example assumed for the backfilling of the ditch structure in Trenches C and F.

H8 and H9 are clearly separate features, although initially they were still in direct contact. From this contact, it could be deduced that Feature H8 intersects Feature H9; the former thus appears to be younger (trench H, Profile 1).

3. Feature G6/H9/G–H1: kidney-shaped pit with Neolithic find material extending over both trenches

Relevant profiles: Trench G/H, Profile S; Trench H, Profiles W and 1

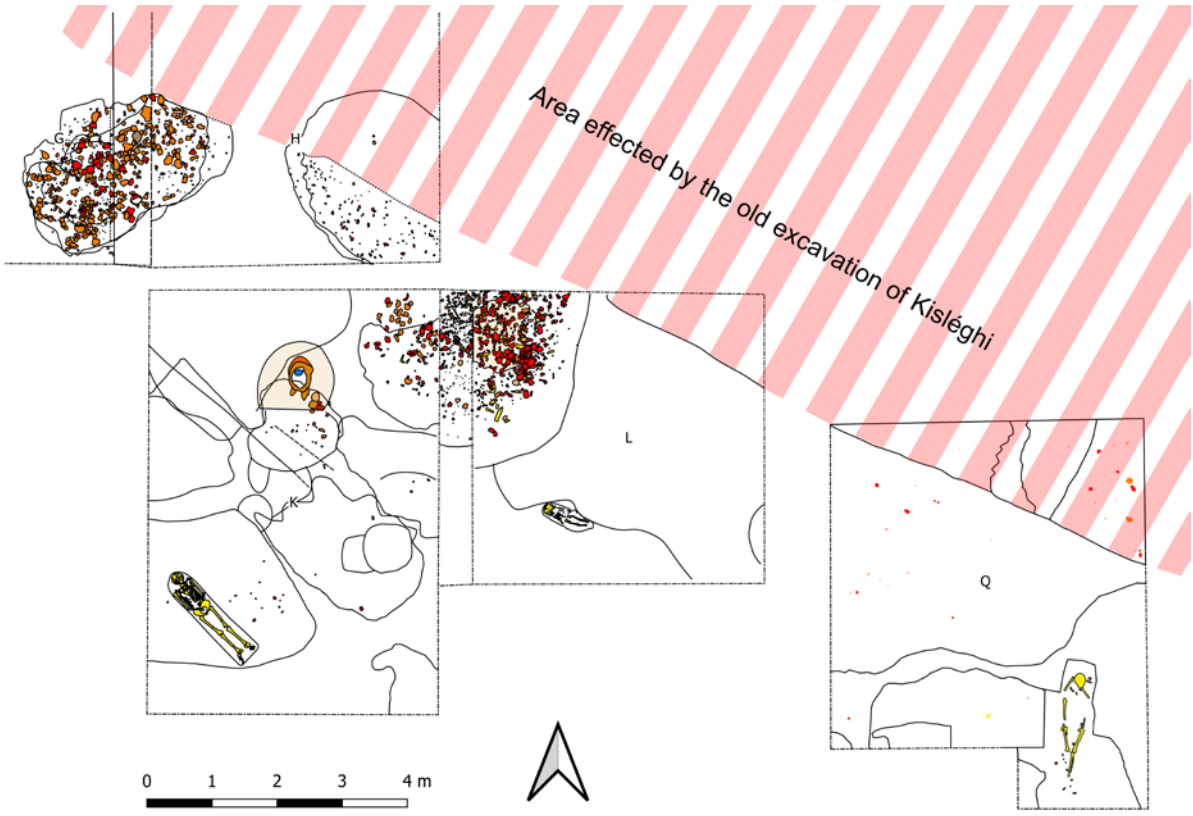


Fig. 34 Location sketch of Excavation Trenches G, H, K, L and Q south of the old Kisléghi excavation with the most important features.

The pit recorded in Trenches G and H is one of the most remarkable features of Bucova Pusta IV. Several hundred individual finds were recovered from the almost 5 m-long and 2 m-wide depression, preserved in a matrix of exceptionally dark and humic soil. During the 2013 excavations, the western half of the feature was first recorded in Trench G, and then the eastern half in Trench H. From observations on the profile between G and H and the independent discovery of two fragments of a burnt clay object which could be joined together, it could be concluded that G6 and H9 belong to one and the same feature. In order to document this feature in its entirety, the profile bar separating the trenches was removed (Fig. 28).

With about 600 individual finds measured, this pit is one of the richest complexes of Bucova Pusta IV. Apart from the large quantities of shattered but also partly well-preserved pottery, the occurrence of fragments of building clay with imprints of wattle-and-daub structures, which identify the fragments as wall plastering, is striking. Admittedly measured against the relatively low total occurrence of these find categories, stones and stone implements, weights, animal bone fragments, and bone implements are numerous and clearly originate from the domestic everyday context of the Early Neolithic. Close to the bottom, the pit contained a singular, well-preserved horn of an aurochs (Fig. 29). In addition, an accumulation of flattened, burnt clay was found in the centre of the structure – possibly fragments of a destroyed kiln slab which could have been used or deposited in the pit. In this context, the comparison with Feature G7/G10 is

Fig. 35 The largely completely preserved earth oven (Feature K12). The wide cylindrical smoke outlet, which could have been used for smoking food, is clearly visible.

interesting: Feature G/H1 also runs out to the north-east in an undercurvature of the in-situ soil horizon – just as the kiln Feature G7 – but without displaying traces of burning. One possible interpretation may be, that this pit was created as a furnace, but then never used for this function, but rather filled in with waste. Use as a housing unit seems to be improbable due to the small extension in relation to the depth (Fig. 30).

Should Feature G/H1 have been a habitation structure beyond a simple clay extraction pit, fulfilling a utilitarian or possibly residential function, then it would have to be assumed that a compacted utilitarian horizon at the bottom of the pit could be distinguished from a looser, thicker filling horizon. No such observation was made. Feature G/H1 has no direct stratigraphic relationship to Feature Complex G7/G10.

This structure has an exact parallel in a similarly kidney-shaped pit from Maroslele-Pana. Even the deposition of aurochs horns is documented there (Paluch 2010, Fig. 5). Chronologically, however, this find should be slightly younger.

4. Feature G7/G10: Kiln structure and pit in front of it in the north-western corner of Trench G

Relevant profiles: Trench G/H, Profile W; Trench G, Profiles 1–4

During the 2013 excavation, the ceiling of Oven Feature G7, which was open to the southwest, was recorded during the removal of Planum 2 (60 cm depth below recent surface) to Planum 3 (80 cm depth) in Trench G. To the southwest, a 2 m-wide and about 3.5 m-long oval pit (Feature G10) adjoined. Both features formed a coherent functional structure, the dimensions of which could be well estimated on Planum 3. Initially, there was a presumption that this was a residential structure, which would have had a kiln attached to the building. Consequently, the decision was made to divide the structure into four quadrants, initially excluding only two of them. In this way, four profiles could be documented (Trench G, Profiles 1–4) (Fig. 31).

The kiln chamber is relatively large and elongated, measuring 1.2 x 2 m (Fig. 32). It seems to have been hollowed out in this form in

Fig. 36 A probable Medieval inhumation burial (Feature K11) in the south of Trench K.

Fig. 37 Medieval child burial (Feature L18) with two glass beads in Trench L.

Fig. 38 Chalcolithic cremation burial with a bowl placed over it in Trench L.

Fig. 39 A partially disturbed Medieval inhumation grave (Feature Q 19) with the remains of iron belt fittings in the south of Trench Q.

the existing floor, starting from the adjoining functional pit; fingers and tool marks can be seen on the wall and ceiling of the oven dome (Fig. 32e), which could be connected with the shaping of the interior before hardening. The solidification of the structure was done by igniting a fire in the interior after a relatively level base had been created in the hollow. Accordingly, the dome consists of reddish, hardened burnt clay. The sediment adjoining the dome is also reddish in colour (very clearly visible in the HDR image, Fig. 33).

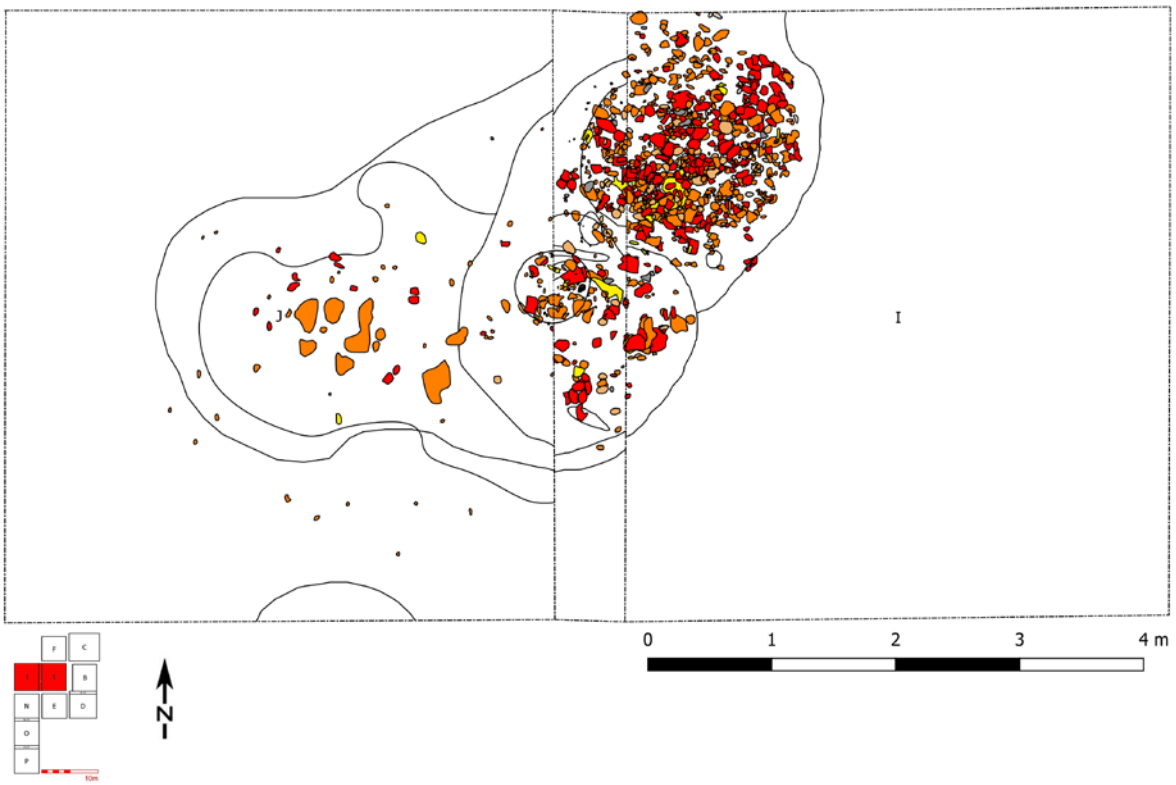


Fig. 40 Location sketch of Excavation Trenches I and J with Early Neolithic features.

The backfill of the kiln initially consisted of large fragments of burnt clay, which had probably been part of the front section of the dome or possible chimney-like superstructures before it collapsed. Additionally, several fragments of pottery and animal bones were found (especially in the pit in front of the kiln) already point to the purpose of the structure (Fig. 32d). Remains of aquatic resources such as fish bones and snail and mussel shells were also found in abundance around the kiln (Fig. 32c). As expected, ash lenses and charcoal fragments were found in its deeper layers, but they were also found in a limited form in the adjacent functional pit to the south. It is possible that the oven was used repeatedly, and swept out several times. From these finds, we conclude that it was most likely used for food preparation. Bánffy et al. (2010) describe similar oven structures from the Alsónyék-Bátaszék site in Hungary (late Starčevo) as fragile baking ovens in need of constant renewal. Yet, they also played a special role in the context of death and burial: Several of the ovens discovered there contained human bone fragments, or even complete inhumations in a crouched position.

Structures in Excavation Trenches K, L, and Q

To the south-east of Excavation Trenches G and H, the complex of Trenches K, L and Q was opened in summer 2014. This area deliberately omits the old excavation of Kisléghi and served to expose further strong signals in the geomagnetic measurement (Fig. 34).

A larger pit complex with rounded edges falls at the transition from Trench K to L, which is why the bulk between the two trenches was also removed during the course of the excavation work. It could be a continuation of the pit complex H8 in the south-east

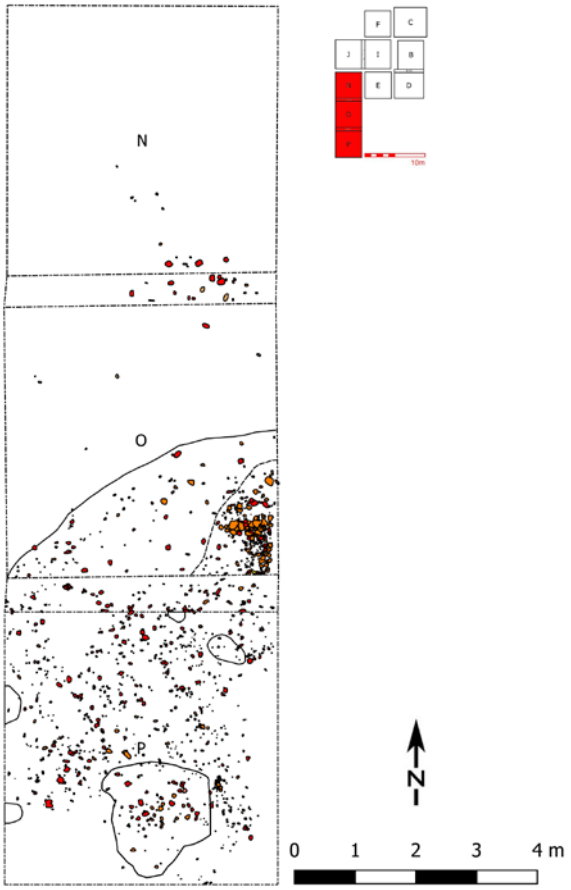


Fig. 41 Location sketch of Excavation Trenches N-O with Early Neolithic features.

corner of section H. The backfill of this feature was heavily interspersed with mudbricks, Early Neolithic pottery fragments, and broken animal bones. It is possible that this was a substructure to a house, the contours of which, however, remain unclear. In any case, the settlement character of this structure is evident.

Another earth oven (K12) was found in the northern area of section K, which is one of the best preserved Early Neolithic structures on Bucova Pusta IV (Fig. 35). This kiln was also negatively carved out of the in-situ soil. A massive chimney served as a smoke outlet, but could also be used as a vent for smoking food. Remarkably, the dome of this oven is completely preserved and was only slightly depressed by the load of the overlying sediment. In the area to the south-west of this earth oven, a subsidence of the old surface in the direction of the old course of the river can be observed. It is possible that the kiln was deliberately built on the slope of this small valley.

Relatively deep in the backfill of this depression an inhumation burial without grave goods was found (K 11), which – with its orientation from NW to SE and with the head in the northwest – corresponds to the vast majority of the Medieval graves from Bucova Pusta IV (Fig. 36). Another grave of an infant, with a similar orientation was also found in the southwest of Excavation Trench L (L18) (Fig. 37).

Slightly north of the centre of Trench L, an upturned Chalcolithic bowl was found covering cremated remains (L7). This find occurred very close to the present surface and no more Early Neolithic finds were found in the wider area (Fig. 38).

Nevertheless, we still investigated the south-easternmost area with our Excavation Trench Q, which was adjacent to the old excavation of Kisléghi. In this section, too, the old surface slopes down towards the old river course. In the very southeast of the trench, another Medieval inhumation occurred (Q 10), which was disturbed in its central part by a later ground intervention. The orientation differs from the other Medieval burials with its clear orientation from north to south, with the head in the north (Fig. 39).

The complex of structures in Excavation Trenches I and J

Trenches I and J were positioned on a very strong northeast-southwesterly trending signal in the geomagnetic mapping. Interestingly, this structure runs roughly parallel to the settlement structure recorded

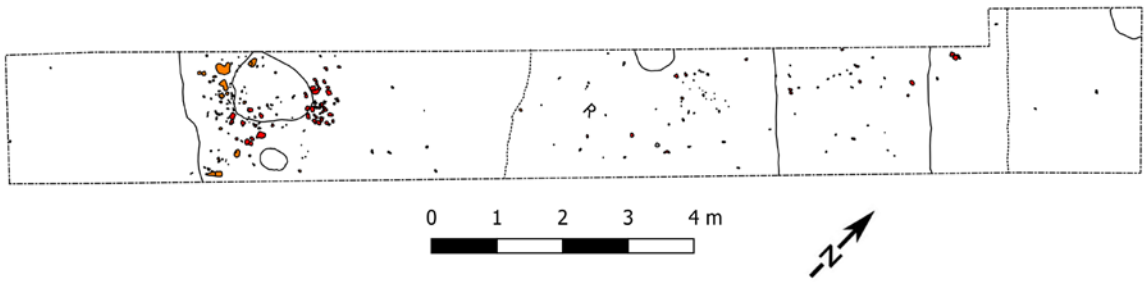


Fig. 42 Redrawing of the main features in the long Planum of Trench R through the former river depression.

Fig. 43 Photogrammetry of the north-west profile of Excavation Trench R with the geomorphological depth sounding. The individual samples of a susceptibility measurement are marked in the depth sounding.

in Trenches B and D. During the 2014 campaign, the excavation work was initially carried out within Trenches I and J. Subsequently, the profile baulk between the two trenches was removed in order to fully record the archaeological features (Fig. 40).

It is a complex pit feature of initially elongated shape, which separates into two larger pit complexes at depth. Towards the west, the feature widens as a shallow pit into the middle of Trench J. There, the contours of the pit are hardly recognisable because of animal burrows. Finds of larger fragments of wall plaster in this area provide indirect evidence of house constructions. The deeper sections of the pit complex between the two excavation trenches were mixed with settlement waste. Due to bad weather in summer 2014, the excavation work had to be stopped in the deeper sections because groundwater was accumulating there. In summer 2015, the area of the baulk between Trenches I and J was reopened and the feature was emptied down to the accumulated earth. The deepest part of the pit was a circular pit (I–J 10), which was sunk into the yellow clay in the manner of a narrow well-shaft.

The pit complex was probably initially created during the extraction of building clay for the construction of a house, which can be assumed to have been built in the open area immediately to the east of it. The well-shaft-like depression could have served to siphon off penetrating groundwater. At the base of this structure, a foot bowl with a secondarily pierced bottom was found, which could have been used as a funnel. Possibly, this vessel is related to the use of groundwater from this area. In the course of the use of the settlement area, the pit complex was then backfilled with further settlement waste.

The complex of structures in Excavation Trenches N, O, and P

The next strong signal in the geomagnetics lies to the south of the described structures and consists of two clearly distinguishable,

Fig. 44 Empty pits of Neolithic and Iron Age deposits (Features R6, R7, R16, and R17) at the bottom of Excavation Trench R which prove that the depression had not yet been filled with sediment during the entire prehistoric period.

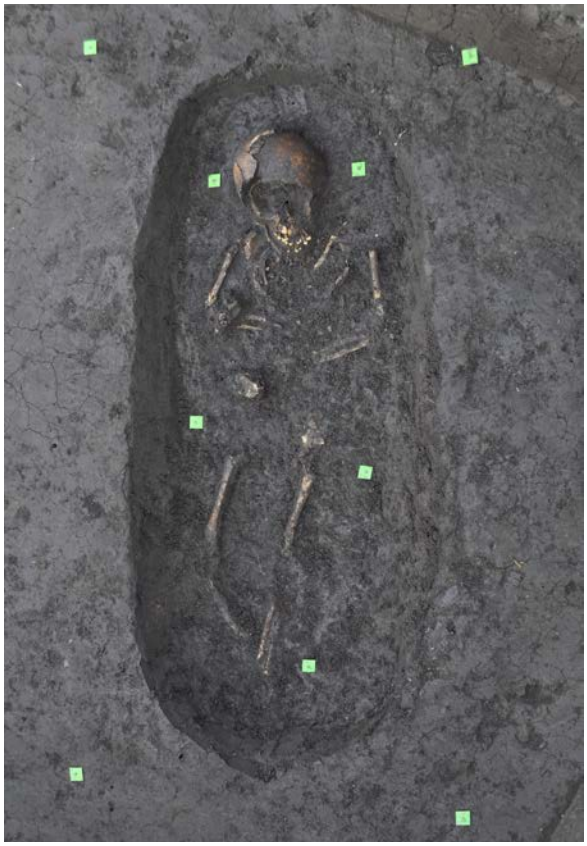


Fig. 45 Medieval child burial (Feature R4) in the north-east of Excavation Trench R.

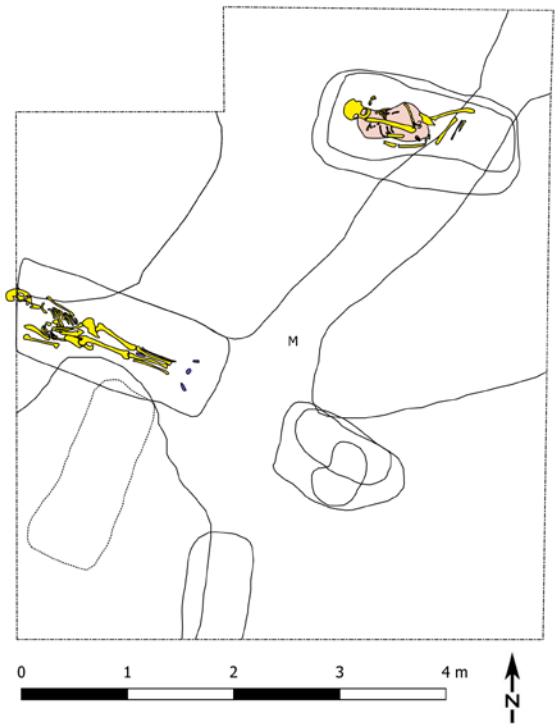


Fig. 46 Redrawing of the complex feature situation in Excavation Trench M. The exploratory sections of the old Kisléghi excavation and the inhumation burials left out by him are clearly visible. The northern grave is the main burial of the Chalcolithic tumulus (Feature M13). The southern grave is the burial of a Medieval warrior (Feature M20).

Fig. 47 Excavation situation of the Medieval burial (Feature M20).

roundish structures. In this area, Excavation Trenches N, O, and P were laid out (Fig. 41).

During the excavation work in the summer of 2015, it became apparent that the terrain sloped slightly towards the south in Neolithic times. We interpret that as a settlement edge bordered by a former river course.

The features in the area of Trenches N and O proved to be comparatively shallow.

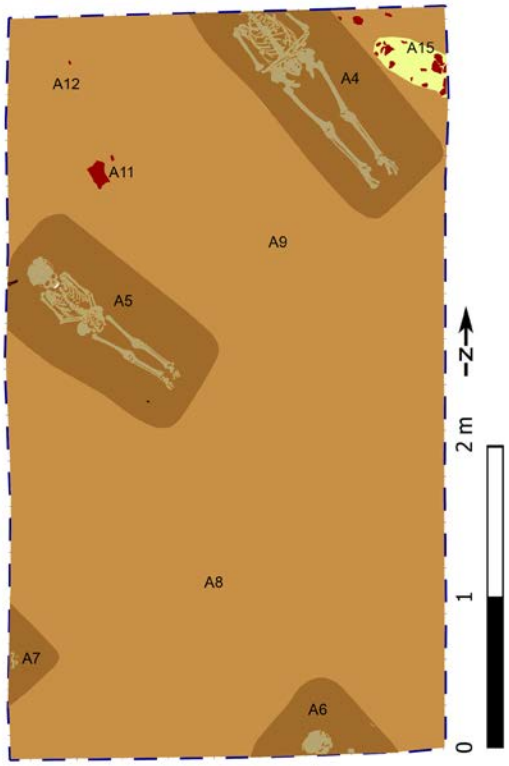


Fig. 48 Redrawing of the find situation in Excavation Trench A. Clearly recognisable are four Medieval inhumations, which are deepened into the Early Neolithic and Bronze Age find horizon.

Numerous pottery fragments and pieces of settlement clay were found in their backfill, producing the strong signal in the geomagnetics.

The southernmost structure in the area of Trench P was apparently already in the immediate bank area of the former river course. The contours of the features in this area are extremely irregular; they show no clear boundaries, and seem to merge into each other. The numerous finds are heavily fragmented and look as if they had sunk into the damp subsoil. Apart from heavily rolled pottery sherds and finely divided mudbricks, by far the most flint artifacts of the settlement were found in this area. We explain this situation in such a way that numerous activities took place in the shore area, during which settlement waste was accumulated and stone implements were repeatedly lost and proved difficult to find again in the mud. There are no signs of buildings in this area; rather, it seems to have been an outdoor activity area.

Trench R

Trench R had a special function in the context of the excavation work (Fig. 42). This elongated sondage was intended to clarify what the low-signal linear structure on the geomagnetic mapping, which runs right through the Neolithic settlement, is all about. As a result of the geomorphological evaluation, it became clear that this was another old river bed (Fig. 43). However, during the Early Neolithic settlement and apparently until well after, this small valley did not carry any water (see Chapter 4). The micro-relief formed by this incision did, however, play a role in the layout of the settlement, for example for the positioning of the large ovens in Excavation Trenches G and K, the openings of which are aligned with this valley. The situation on the opposite side of the valley, which we investigated with Trenches F, C, and B, is obscured by a later ditch associated with the Early Iron Age settlement. To clarify this context, we decided to cut the former river bed in its entirety with Trench R.

In the south-western section of the excavation trench, two features were found which are of crucial importance for understanding the history of the backfilling of this depression. These are an Early Neolithic sherd concentration (R6) and a concentration of Late Bronze Age/ Early Iron Age sherds (R7) uncovered immediately next to each other (Fig. 44). Both lie directly on the natural earth of the former river course (R3; R9; R10). From this, it can only be concluded that this depression was open from the Early Neolithic settlement until at least the Late

Bronze/Early Iron Age. At some point thereafter, the depression was filled with a homogeneous, deep black sediment (R2; R5), probably during a single flood event. Since then, this former river valley was no longer visible on the surface. However, this also means that during the Early Neolithic a linear depression existed in this area, across which the Early Neolithic settlement developed. A Medieval child's grave (R4) was encountered in the north-east of the excavation trench, which appears to have been sunk into the fill sediment of the former river bed (Fig. 45). The backfilling of this depression therefore occurred at a time between the Late Bronze/Early Iron Age and the Middle Ages.

Trench M

Excavation Trench M was laid out in the presumed centre of the Chalcolithic tumulus. The primary aim was to obtain more precise information about the excavation methods of Gyula Kisléghi Nagy, whose sondages were quite clearly visible in the geomagnetic mapping (Fig. 46). On account of the clearly visible traces of this old excavation, there was initially little hope of finding the primary burial of the tumulus.

However, an important result was the uncovering of the Chalcolithic grave (M 13) in this tumulus (see Chapter 17), which was only superficially affected by the old excavation. The grave architecture can be reconstructed on the basis of the excavation results as follows. In the north-eastern bank area of the former river course cut by Trench R, a WNW-ESE oriented longitudinal rectangular burial pit with rounded corners and dimensions of 2.20 x 0.90 m was excavated (M50). On the narrow sides of this pit, three small posts were sunk (M48), which served as supports for a kind of burial chamber. The bottom of this chamber was then either covered with wooden boards, or the corpse was buried on a mat, as traces of a brown organic matter were found under the skeleton in the entire area of the grave. The buried person could be identified as an elderly woman. She was buried in a supine position with her head facing west, and with her knees crouched and tilted to the left. The only grave good, found above her right shoulder, was a massive chunk of haematite (red ochre).

Structures of the Early Neolithic occupation were obviously cleared away during the construction of the tumulus. Nevertheless, several larger pits were found in Trench M, which contained exclusively Neolithic material in their fill. Pits M21 and M23 were untouched by the old excavation, while Pit M38 was already partially uncovered by Kisléghi.

The area of the tumulus probably served the Medieval population as a landmark, into which they then dug further graves. The elongated Pits M8 and M9, which had already been cleared by Kisléghi, are Medieval burial pits judging by their orientation. Only Grave M20 had been left untouched by the old excavation (Fig. 47). In it, an adult man in a stretched supine position was recovered; apart from a small bronze ear pendant, other iron parts were found in the area of his feet, which could be interpreted as grave goods or coffin fragments. The larger Areas M3, M4, M5, and M6 could be identified as excavation trenches from Kisléghi.

Trench A

The very first excavation trench was made in an area on the edge of the Early Neolithic

settlement in the vicinity of the Chalcolithic tumulus. The upper soil layers A1 and A2, which were repeatedly ploughed and worked through by agricultural activity, were generally supposed to originate from the colluvium of the tumulus. The old surface of the Early Neolithic settlement could not be detected there. The underlying Sediment A3 is heavily interspersed with Early Neolithic, but also Late Bronze/Early Iron Age finds, albeit all of them were in secondary positions. There are no structures dating from this period. Rather, this was an area marginal to both the Early Neolithic and Late Bronze/Early Iron Age settlements, with scattered finds from both. Four Medieval inhumations (A4–A7) were placed in this substrate (Fig. 48). The uniform orientation of the burial pits and the position of the skeletons indicate that they belong to one and the same cemetery.

Concluding remarks on the backfilling history of the features

The negative excavation technique used in our excavation made it possible to reconstruct the sometimes very complex backfilling history of the individual pits. A distinction must be made here between primary traces of the utilisation of these features, which are mainly reflected in their lowest backfill layer and their final infill. After the end of the Neolithic settlement, it was mainly the remains of the buildings that ended up in the upper layers of those pits that were still partially open. This will be explained more clearly in the following Chapter 8. Of course, the post-Neolithic pits also contain a great deal of Neolithic settlement material, which must be regarded as having been relocated. Often enough, the Early Neolithic settlement material also represents the majority in these features. However, the most recent finds generally allow them to be clearly assigned to a younger period.

feature	type of feature	assignment	explanation	matching finds
A1		mixed	ploughing horizon	
A2		mixed	lower ploughing	
A3			sediment between the graves	
A4	grave	Medieval	medieval grave with inhumation	
A5	grave	Medieval	medieval grave with inhumation	
A6	grave	Medieval	medieval grave with inhumation	
A7	grave	Medieval	medieval grave with inhumation	
A8			deepened area arround graves A7 and A6, continuation of A3	
A9			fused with A8	
A10			lower part of area between the graves	
A11		(LBA/EIA)	area between graves A4 and A5 with many bones and sherds	
A12		(LBA/EIA)	nw-area between graves A4 and A5 with many bones and sherds	
A13			lower part of area between the graves, same as A14	

feature	type of feature	assignment	explanation	matching finds
A14			lower part of area between the graves, same as A13	
A15		LBA/EIA	LBA/EIA feature in the nw-corner of the thrench, behind grave A4	
A16			lower part of the sediment, below graves A6 and A7	
A17			lower part of area between graves A4 and A5, same as A14	
A18			lower part of A12	
A19		(NL)	lower part of the sediment, below graves A6 and A7 and below A16	
A20		(NL)	same as A19	
A21			continuation of A17 and A18	
A22			described as sterile; assumption of natural post-depositional transport of sherds	
A23			loughing horizon at the extension for the complete recovery of burial A4	
A24			loughing horizon at the extension for the complete recovery of burial A5	
A25			extension into the west profile to fully document the grave pit of A5	
A26			extension into the north profile to fully document the grave pit of A4	
A27			fill sediment of grave pit A5	
B1		mixed	ploughing horizon	
B2		mixed	lower ploughing	
B3		(NL)	upper part of NL feature	
B4			nw-area arround B3	
B5			no-area arround B3	
B6			w-area arround B3	
B7		NL	lower part of B3	
B8			intermediate feature between B4 and B7	
B9	dwelling structure	NL	NL feature, northern part	
B10		(NL)	intermediate feature between B4 and B7	
B11		(NL)	intermediate feature between B9 and B6	
B12	dwelling structure	NL	NL feature, southern part	
B13	NL storage vessel	NL	single pot in B9	
B14	post NL ditch		lower part of B4, upper filling	
B15			working feature, part of B6	
B16			working feature, part of B14	
B17			working feature, as B15 and B16	
B18	post NL ditch		lower part of B14, ditch filling	
B19			working feature below B5	
B20	dwelling structure	NL	lower part of B9	

feature	type of feature	assignment	explanation	matching finds
B21		(NL)	transition	
B22	dwelling structure	NL	lower part of B12	
B23	pit filling		post excavation feature	
B24	posthole		post excavation feature	
B25	posthole		post excavation feature	
B26	pit filling		two small holes; ceramic fragments reported but not listed	
B7_14		NL	part of B7	
B-D1	ploughing horizon			
B-D2	dwelling structure	NL	connecting B12 and D3; uppermost	
B-D3	dwelling structure	NL	connecting B12 and D3	
B-D4			area in the nw	
B-D5			area in the nw, continuation of B-D4	
C1		mixed	ploughing horizon	
C2		mixed	lower ploughing	
C3			sounding of the northern half of the trench	
C4			sounding of the southern half of the trench	
C5			working feature in the northeast of the trench	
C6			working feature in the east of the trench	
C7			working feature in the southeast of the trench	
C8			continuation of C5 and C6; same as C10, C13, C18	
C9			continuation of C7; same as C11, C14	
C10	ditch	LBA/EIA	uppermost filling of a ditch	
C11			area southwest of the ditch	
C12		(LIA)	area northeast of the ditch	
C13	ditch	LBA/EIA	continuation of C10: ditch filling	
C14			continuation of C11	
C15	pit filling		isolated feature in the north of the trench	
C16			spot of yellowish soil in the nw-corner	
C17		LBA/EIA	continuation of C12; intire LBA/EIA vessel	
C17_SO			part of C17; continuation of C12	
C18	ditch	LBA/EIA	continuation of C10 and C13	
C19			smaler pit between C18 and C14	
C20			structure below C18	
C21			structure below C18	
C22			post excavation feature	
CExtension_N		mixed		
CExtension_O		mixed		

feature	type of feature	assignment	explanation	matching finds
D1	ploughing horizon	mixed	ploughing horizon	
D2	ploughing horizon	mixed	lower ploughing	
D3	dwelling structure	NL	upper part of southern continuation of B12	
D4			concentration of sherds in the northeastern corner	
D5			darker spot in the southeastern corner	
D6			lighter spot in the southwest	
D7			filling of the slope in the south of the trench	
D8			almost empty zone in the middle of trench	
D9	posthole (?)		isolated feature in the northwest of the trench	
D10			continuation of D7	
D11			continuation of D5	
D12			continuation of D4; possibly same as D13 and D11	
D13			possibly same as D12 and D11	
D14	dwelling structure	NL	southern continuation of B12	
D15		NL	periphery of D14	
D16			almost empty zone in the middle of trench, see D8 and D21	
D17			lower filling of D3 and D14, cut by working profile; pottery mixed up after excatavion!	
D18			smal lighter spot in the east	
D19			under D11, D12 and D13	
D20	pit filling		feature in the southeastern corner	
D21			almost empty zone in the middle of trench, see D8 and D16	
E1		mixed	ploughing horizon	
E2		mixed	lower ploughing; iron chain	
E3			almost sterile	
F1		mixed	ploughing horizon	
F2	ditch	LBA/EIA	continuation to the west of C10, C13 and C17	
F2N	ditch	LBA/EIA	part of F2	
F3			already sterile	
F4	ditch	LBA/EIA	continuation of F2	
F4N	ditch	LBA/EIA	northern part of F4	
F5			lowest archaeological layer, cut by the ditch	
F6			lower filling of the ditch	
F6N			northern part of F6	
G1		mixed	ploughing horizon	
G2		mixed	lower ploughing	

feature	type of feature	assignment	explanation	matching finds
G3		Kisléghi Nagy		
G4			already sterile	
G5		NL	surrounding area of the oven G7	
G6	kidney shaped pit	NL	uppermost part of the big NL pit G-H1 etc.	
G7	oven	NL		
G7 NW	oven	(NL)	northwestern part of G7	
G7 NE	oven	NL	northeastern part of G7	
G8	pit filling		small pit north of the oven G7	
G9			artificial working feature from the area arround the oven G7	
G10		NL	Working area in front of the oven G7	vessel Z:230 [H8]
G10 NO		NL	northeastern part of G10	
G10 NW		NL	northwestern part of G10	
G10 SW		NL	southwestern part of G10	
G11		NL	area south of G10	
G12		NL	concentration of shells, part of G10	
G13	pit filling		smal pit in the southwestern corner	
G-H1	kidney shaped pit	NL	connection between G6 and H9	
G-H1 FPL1	kidney shaped pit	NL	part of G-H1	
G-H1 FPL2	kidney shaped pit	NL	part of G-H1	
G-H2		NL	profile removing north of G-H1	
G-H3		NL	profile removing north of G-H1	
G-H5				
G-H6				
G-H9		NL	same as H9	
H1		mixed	ploughing horizon	
H2		Kisléghi Nagy		
H3		Kisléghi Nagy	rest of NL culturalk layer, not excavated by Kisléghi	
H4		Kisléghi Nagy	bottom of Kisléghis excavation-> sterile	
H5	grave	Kisléghi Nagy	upper skeletal half presumably disturbed, lower half undisturbed	
H6	grave	Kisléghi Nagy	grave pit with collected from Kisléghi bones in the western corner	
H7	grave?	Kisléghi Nagy	empty grave ? Pit	
H8	big pit	NL	partialy from Kisléghi excavated NL feature in the southeast	vessel Z:230 [G10]
H9	kidney shaped pit	NL	uppermost part of the big NL pit G-H1 etc.	

feature	type of feature	assignment	explanation	matching finds
H10			almost sterile between H9 and H8	
H11			area south of H10 with almost no finds	
H18				
I1		mixed	ploughing horizon	
I2		mixed	lower ploughing	
I3			area arround I4 and I5	
I4	big pit structure	NL	uppermost filling, partially affected by ploughing	
I5	big pit structure	NL	uppermost filling of the structure between trechnes I and J	
I6		NL	area arround the pit structure, continuation of I3	
I7	big pit structure	NL	continuation of I4	four-legged vessel [I-J3]
I8	big pit structure	NL	deeper continuation of I5	
I9	big pit structure	NL	separated part of I7	
I10	well inside the pit structure	NL	starting from I8; same as I-J8	
I11	big pit structure	NL	continuation of I7	
I12	big pit structure	NL	continuation of I4, I7, I9, I11	
I13	big pit structure	NL	surrounding of I5, I8	
I-J1		mixed	ploughing horizon	
I-J2		NL	uppermost filling, connection between I5 and J4	
I-J3			surrounding area of I-J2	four-legged vessel [I7]
I-J4	big pit structure	NL	dug into I-J09; part of I-J11	vessel Z:457 [I-J5][J4] [J8]
I-J5	big pit structure	NL	filling, younger than I-J6; part of I-J12	four-legged vessel [I-J8]; vessel Z:457 [J8][I-J4] [J4]
I-J6	big pit structure	NL	part of I-J11	
I-J7	big pit structure	NL	separated part of J4	
I-J8	big pit structure	NL	continuation of I-J5; covering I-J10; part of I-J12	four-legged vessel [I-J5]; four legged vessel [J8]
I-J9	big pit structure	NL	part of I-J11; dug into I-J06	
I-J10	well inside the pit structure	NL	starting from I8; same as I-J8	
I-J11	big pit structure		containing I-J4, I-J6, I-J9	
I-J12	big pit structure		containing I-J5, I-J8	
I-J13	big pit structure	NL	part of I-J10	
J1		mixed	ploughing horizon	

feature	type of feature	assignment	explanation	matching finds
J2		mixed	lower ploughing	
J3			area surrounding J4	
J4	big pit structure	NL	uppermost filling, same as I5 and I-J2	vessel Z:457 [I-J5][I-J4] [J8]
J5			feature in the south	
J6			area surrounding J4, continuation of J3	
J7	big pit structure	NL	continuation of J4	
J8	big pit structure	NL	continuing into I-J	four-legged vessel [I-J8]; vessel Z:457 [I-J5][I-J4] [J4]
K1		mixed	ploughing horizon	
K2			lower ploughing	
K3			area surrounding K4	
K4	big pit	NL	uppermost filling of a pit between trenches K and L	
K5	big pit	NL	continuation of K4	
K6	big pit	NL	continuation of K4 and K5	
K7	ditch	Copper Age	linear structure comming from the northwestern edge of the trench (surrounding the tumulus?)	
K8		Later Pre-history	darker spot in the southeastern corner	
K9		Later Pre-history	darker area in the SW	
K10		Later Pre-history	area between K8 and K9	
K11	grave	Later Pre-history	inhumation in the dark spot K9	
K12	oven	NL	oven and its surrounding area	
K13		mixed	ploughing horizon of southern extention	
K14		mixed	lower ploughing of southern extention	
K15		Later Pre-history	black sediment, same as K9	
K16		Later Pre-history	continuation of K15	
K17			separated working feature in the east of the trench	
K18		Later Pre-history	continuation of K16	
K19		Later Pre-history	continuation of K17	
K20		Later Pre-history	sediment immediately over the grave K11	
K21		Later Pre-history	separated area within the darker structure K15, K16, K18, K19	
K22			almost sterile	

feature	type of feature	assignment	explanation	matching finds
K23	pit		separate pit beneeth K21 etc.	
K24	pit		separate pit next to K23	
K25			same as K24	
K26			lowest filling of the dark structure in the south of the trench	
K27	grave	Later Prehistory	burial pit	
K28	pit		smal pit south of the oven K12	
K29			lowest level of the diffuse situation in the SE of the trench	
L1		mixed	ploughing horizon	
L2		mixed	lower ploughing	
L3			concentration of channeled sherds	
L4			sherd concentraion in the SE	
L5			sherd concentraion in the E	
L6			sherd concentraion in the E	
L7	cremation	Copper Age	cremated human bones, covered with a Cotofeni bowl	
L8			sherd concentration W of L7	
L9			sherd concentration W of L8	
L10		Kisléghi Nagy	trench of Kisléghis of excavation in the NE	
L11	big pit	NL	same as K4, K5, K6	
L12			almost empty area in the south of the trench	
L13	posthole		posthole cut partialy by Kisléghis trench	
L14	pit		pit cut partialy by Kisléghis trench	
L15	pit		pit next to the E profile	
L16		Later Prehistory	dark sediment in the south of the trench	
L17		Later Prehistory	part of L16	
L18	grave	Medieval		
L19	pit filling		same as L-K6 and K24	
L-K1		mixed	ploughing horizon	
L-K2		mixed	lower ploughing	
L-K3			surrounding sediment of L-K4	
L-K4	big pit	NL	same as K4, K5, K6, L11	
L-K5			pit inside L-K4	
L-K6			pit inside L-K4; same as L19 and K24	
L-K7		NL	find concentration within L-K4	
L-K8		NL	lowest filling of L-K4	
L-K9		NL	separated working feature within L-K4	
L-K10		NL	separated working feature within L-K4	

feature	type of feature	assignment	explanation	matching finds
L-K11		NL	lowest filling of K9	
L-K12			smal feature within K10	
L-K13			feature within K11	
M1		mixed	ploughing horizon	
M2		mixed	lower ploughing	
M3		Kisléghi Nagy	trench of Kisléghis of excavation in the NW	
M4		Kisléghi Nagy	trench of Kisléghis of excavation in the N	
M5		Kisléghi Nagy	trench of Kisléghis of excavation in the E	
M6		Kisléghi Nagy	trench of Kisléghis of excavation in the SW	
M7		Kisléghi Nagy	lowest part of Kisléghis excavation between M3, M4, M5, M6	
M8		Kisléghi Nagy	long pit (grave?) emptied by Kisléghi	
M9		Kisléghi Nagy	long pit (grave?) emptied by Kisléghi	
M10		Kisléghi Nagy	separated working feature within M7	
M11		Kisléghi Nagy	separated working feature within M7	
M12	gravepit	Medieval ?	two femora found in soil parts undisturbed by Kisléghi	
M13	ocher grave	Copper Age	ocher grave, untouched by old excavation	
M14		mixed	ploughing horizon of northern extention	
M15		Kisléghi Nagy	filling of Kisléghis excavation	
M16		Kisléghi Nagy	part of K7	
M17		Kisléghi Nagy	filling of Kisléghis excavation	
M18		Kisléghi Nagy	filling of Kisléghis excavation	
M19		Kisléghi Nagy	filling of Kisléghis excavation	
M20	grave	Medieval	untouched by old excavation	
M21	pit	NL	unexcavated by Kisléghi pit	
M22			deleted feature	
M23	pit	NL	same as M21	
M24			lowest filling of Kisléghis excavation in the SW of the trench	
M25			sediment unexcavated by Kisléghi	
M26	pit		posthole like pit	
M27	pit		pitlike feature	
M28			pit filling, part of M27	

feature	type of feature	assignment	explanation	matching finds
M29			pit filling, part of M27	
M30			round pit	
M31			surrounding structure of M27, M28, M29	
M32			deeper continuation of M41; part of M26	
M33		Kisléghi Nagy	filling of Kisléghis excavation	
M34			posthole like feature	
M35			posthole like feature	
M36			find concentration	
M37		Kisléghi Nagy	filling of Kisléghis excavation	
M38	pit	NL	partially excavated by Kisléghi pit	
M39			pitlike feature next to M35	
M40	grave pit	Copper Age	sediment under M13	
M41			part of M26	
M42			containing M27	
M43			part of M30	
M44			deleted feature	
M45			posthole	
M46			posthole	
M47			posthole	
M48		Copper Age	part of M13; 6 micro-postholes from grave construction	
M49			round pit	
M50		Copper Age	bottom of grave M13	
M51			structure nex to W profile	
M52		Kisléghi Nagy	filling of Kisléghis excavation	
N1		mixed	ploughing horizon	
N2		mixed	lower ploughing	
N3		NL	filling of a slope to the south	
N4			second half of N-O5	
N5		NL	find concentration in the SE	
N-O1		mixed	ploughing horizon	
N-O2		NL	filling of a slope to the south	
N-O3			intermediate layer between N-O2 and the sterile	
N-O4		NL	part of N-O2	
N-O5		NL	second half of N4	
O1		mixed	ploughing horizon	
O2		NL	filling of a slope to the south, same as N3, N-O2	
O3		NL	lowest filling of O2	

feature	type of feature	assignment	explanation	matching finds
O4		NL	almost sterile under O2	
O5		NL	part of O2	
O7				
O-P1		mixed	ploughing horizon	
O-P2		mixed	lower ploughing	
O-P3		NL	same as P3	
O-P4		NL	part of P5	
O-P5		NL	same as P10	
O-P6			sterile	
P1		mixed	ploughing horizon	
P2		mixed	lower ploughing	
P3		mixed	still ploughing	
P4		NL	filling of a depression	
P5		mixed?	filling of the area in the SW	
P6		NL	uneven pit in the E	
P7		NL	continuation of P4	vessel ID 16395 & 22462 [S11]
P8		NL	smal pit in P7	
P9			sterile	
P10		NL	lowest filling of a depression in the NE	
P11		NL	bottom of the depression	
P12			part of P11	
P13		NL	dug into P6	
Q1		mixed	ploughing horizon	
Q2		Kisléghi Nagy	part of filling of Kisléghis excavation	
Q3		mixed	next level of area under ploughing	
Q4			find concentration	
Q5		Kisléghi Nagy	part of filling of Kisléghis excavation	
Q6		Kisléghi Nagy	part of filling of Kisléghis excavation	
Q7			pit cutting into Kisléghis excavation	
Q8			bottom of C7	
Q9			area under Q3	
Q10	grave	Medieval		
Q11			pit	
Q12			pit	
Q13			pit	

feature	type of feature	assignment	explanation	matching finds
Q14			part of dark filling Q3, Q9	
Q15			part of dark filling Q3, Q9	
Q16			part of dark filling Q3, Q9	
Q17		LBA/EIA	sounding into Q3	
Q17+19			bottom of the grave Q10	
R1		mixed	ploughing horizon	
R2		post EIA	dark filling of the depression	
R3			sterile	
R4	grave	Medieval		
R5		post EIA	part of R2	
R6		(NL)	concentration of NL sherds	
R7		LBA/EIA	concentration of LBA/EIA sherds	
R8			part of R2	
R9			sterile	
R10			sterile	
R11			deleted feature	
R12			deleted feature	
R13			deleted feature	
R14			deleted feature	
R15		post EIA	continuation of R2	
R16			smal feature withinR7	
R17			smal feature within R6	
R18			deleted feature	
R19			smal pit in R15	
R20			deleted feature	
S1		mixed	ploughing horizon	
S2		mixed	lower ploughing	
S3		mixed	northern half of the trench, still in lower ploughing	
S4	dwelling structure	NL	uppermost filling of dwelling structure	
S5		NL	dark spot in the SE corner	
S6	oven	NL		
S7	oven	NL		
S8			posthole in S5	
S9			posthole in S5	
S10			sterile	
S11	dwelling structure	NL	access pit for S6, S7; east dwelling	vessel ID 16395 & 22462 [P7]
S12	dwelling structure	NL	dwelling in the west	

feature	type of feature	assignment	explanation	matching finds
S13	dwelling structure	NL	part of S12	stone tool [T4]
S14	grave	NL	dug into S13	
S15	oven	NL		
S16		NL	pit	
S17	oven	NL	lower part of S15	
S18		mixed	poughing horizon of extention to the west	
S19		mixed	lower ploughing of extention to the west	
S20			posthole	
S21	oven	NL	artificial step in connection with S7	
S22	big pit	NL	huge pit in the SW corner of the trench extention	
S23			smal pit	
S24	big pit	NL	pit with clay weights under the grave S14	
S25	oven	NL	concentration of mudbricks within S12	
S26		NL	filling of a pit south of the oven S15	
S27		NL	working pit belonging to S29	
S28	dwelling structure	NL	lowest part of the western dwelling	
S29		NL	lower part of oven S15	
S30		NL	interlayer between older oven (S29) and renewed one (S15)	
S31		NL	area arround S6	
S32		NL	part of S31	
S33		NL	perhaps part of working pit belonging to S29, but missing definite indications	
S34		NL	pit on the northern profile	
T1		mixed	ploughing horizon	
T2			sterile	
T3	dwelling structure	NL	uppermost filling of the eastern dwelling	
T4	dwelling structure	NL	continuation of T3	stone tool [S13]
T5		NL	pit in NE corner	
T6	dwelling structure	NL	central part of eastern dwelling	
T7		NL	eastern periphery of T6	
T8		NL	pit in T7	
T9		NL	pit in T7	
T10		NL	lower part of pit T5	
T11			pit on eastern profile	

Tab. 1 List of the main features with their interpretation and date. NL=Neolithic; LBA=Late Bronze Age; EIA= Early Iron Age. The last column lists matching fragments of finds.

Notes on the construction of the dwellings

Petru Ciocani

1. General overview

At the end of the 7th millennium BC, when farmers from Anatolia settled south-eastern Europe (Hofmanová et al. 2016; Mathieson et al. 2018), they brought with them a new architectural tradition, namely the construction of rectangular surface houses with domed ovens inside (Тодорова/Вайсов 1993, 151–152). This tradition differed considerably from the local Mesolithic traditions, such as the building of circular huts with stone-paved floors attested on the Aegean Islands (Sampson et al. 2002, 49–50), oval or trapezoidal pit-houses with stone-lined hearths in the Iron Gates region (Boroneanț 2012, 30–31)[1], or round huts made of branches in the Carpathian Basin (Kertész 2002, 288). The introduction of the new building tradition led to the displacement of the circular hut, but the pit-house continued to be used, often alongside the surface house, and regional preferences for one or the other emerged.

In the southern part of south-eastern Europe, where the farmers first arrived, the rectangular surface house immediately became the dominant architectural type, while the pit-house was only rarely employed (Тодорова/Вайсов 1993, 151; Bailey 2002, 41; Perlès 2004, 184–185). The surface house was constructed using three different techniques: mudbrick, pisé, and wattle-and-daub. The wattle-and-daub technique was only applied for houses with a frame of heavy posts, while the pisé and mudbrick houses did not necessarily possess such a frame. The walls of the houses were either built directly on the ground, or set in shallow trenches. In certain cases, the walls were constructed over stone foundations, which were themselves either erected on the ground or set within trenches (Gimbutas 1974, 41; Perlès 2004, 188–190).

By contrast, in the northern part of south-eastern Europe, which was neolithised somewhat later, the pit-house remained the main architectural type throughout the Early Neolithic, while the rectangular surface house was rather seldomly constructed (Тодорова/Вайсов 1993, 151; Bailey 2002, 41; Lazarovici/Lazarovici 2006, 82–106). Furthermore, of the three construction techniques used in the south, only the wattle-and-daub technique

1 In the later Mesolithic phases, the trapezoidal pit-houses on the right bank of the Danube also had stone foundations and red-plastered floors (Srejović 1972, 50; Срејовић/Летица 1978, 16–46; Borić et al. 2008, 279; Borić 2011, 169–170).

Fig. 1 Daub with impressions of organic temper found in Features B–D2 and M29.

was adopted (Lazarovici/Lazarovici 2006, 102–103), and, as discussed below, adapted to the local resources. Moreover, stone was extremely rarely employed as a building material, even in regions where it was widely available; in the cases where stone was used, it was employed for building floors rather than foundations (Lazarovici/Lazarovici 2006, 103–104).

These architectural differences are directly related to the two lifestyles which emerged in south-eastern Europe after the neolithisation. On the one hand, the Early Neolithic communities in the southern part of the region, where the climate was more similar to that of Anatolia, adopted a more sedentary way of life and established permanent settlements with sturdy and long-lasting architecture (Perlès 2004, 173–175; Nikolov 1989; Pernicheva-Perets et al. 2011, 69–106). On the other hand, in the northern part of the region, where the more pronounced climatic differences had a greater impact on subsistence, people developed a more mobile lifestyle and built more ephemeral structures (Horváth 1989, 86; Lazarovici/Lazarovici 2006, 87–106; Carneiro/Mateiciucová 2007, 273–279; Ciocani 2021, 12–13). These differences in lifestyles are also the main reason for the wide distribution of Early Neolithic tell settlements in the southern part of south-eastern Europe, and their severe rarity in the northern part of the region (Horváth 1989, 86; Тодорова/Вайсов 1993, 150; Ciocani 2021, 13).

Archaeological investigation of the two main types of dwellings yields contrasting amounts of qualitative evidence. The surface house, especially if destroyed by a conflagration, provides a substantial body of evidence allowing its reconstruction. On the contrary, the pit-house usually leaves scanty traces of habitation, and in the absence of features such as a fire installation, post-holes, or a stepped entrance, it is virtually indistinguishable from a pit of considerable size used for other purposes. The main difficulty in discriminating between pit-houses and large pits arises from the fact that both usually served as waste pits in their final phase of use, and therefore both contain the same type of backfill.

The difficulty in distinguishing between the two is particularly evident at the site of Bucova Pusta IV, where numerous large pits have been uncovered, but only two of them can be unequivocally identified as pit-houses, since they possess interior ovens (see

Fig. 2 Organic-tempered daub fragments with an even surface (outer wall surface) found in Features S25 and S28.

Chapter 7). Considering the limited number of architectural structures uncovered there and the difficulty in interpreting most of them, the daub proves to be an important source of information on the Early Neolithic construction techniques and architecture. Daub is the most common type of find in Early Neolithic settlements, usually discovered burnt and heavily fragmented. It constitutes a plaster of tempered clay, applied either on both sides of a framework (armature) of vegetal origin to form the walls, ceiling, and interior installations of a house, or in horizontal layers on the ground to form the floor of a house or that of a fire installation (heart or oven).

In a conflagration, the daub is exposed to high temperatures, which transform it into a ceramic item. In this way, it remains preserved, while the framework to which it adheres and the organic temper are completely carbonised, leaving impressions in the daub. On the other hand, if a house is abandoned unburnt, then the daub is exposed to erosion factors such as rain and frost, and disintegrates over time, usually leaving no traces. In regions with temperate climatic conditions, such as the Banat, erosion is particularly severe, and unburnt daub is rarely preserved.

Fig. 3 Organic-tempered daub fragment with impressions of reeds found in Feature I–J8.

2. Analyses on daub

In the present study, qualitative and quantitative analyses are carried out on 592 kg of burnt daub recovered in the 2010–2015 archaeological campaigns at Bucova Pusta IV. All the daub derives from secondary contexts[2], primarily from the backfill of pits, pit-houses, and depressions.

On the basis of texture, two main categories of daub can be distinguished:

a) Organic-tempered daub. This daub is usually friable, porous, and lighter than the second category of daub. The porosity results from the combustion of the vegetal temper when the daub is exposed to fire. Macroscopic examination of the impressions reveals that the daub is tempered primarily with cereal chaff and, to a lesser extent, small pieces of straw (Fig. 1, 2.2). No traces of reed chaff temper was attested, as in the case of Ecsegfalva 23 (Carneiro/Mateiciucová 2007,

2 This study does not include daub from structures found *in situ* (the ovens).

Fig. 4 Organic-tempered daub fragments with impressions of reeds found in Feature G–H1.

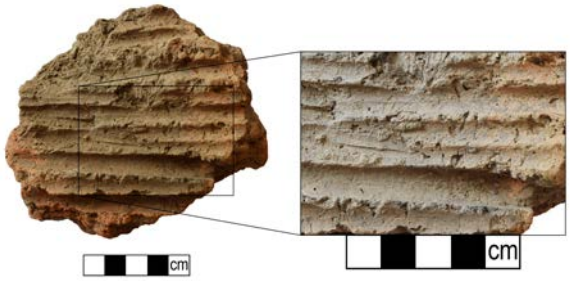


Fig. 5 Organic-tempered daub fragment with impressions of reeds found in Feature M27.

266). The burning is usually thorough, and produced in an oxidising atmosphere so that the colour spectrum of the daub ranges from orange to brick-red. There are, however, rare cases where the daub is heavily burnt, and its colour varies from dark-red through tan and grey to black with traces of vitrification, or it is very poorly burnt and has a pale buff nuance.

This category of daub and the pottery constitutes the most common finds at the site; however, with the exception of four ovens, all organic-tempered daub was found in secondary contexts, and strongly fragmented. Only in rare cases are larger chunks found, which can be up to 40cm long. This strongly suggests that the dwellings were deliberately demolished after being abandoned, and the ruins discarded in pits.

Of the numerous daub fragments recovered, only a handful provide qualitative information allowing us to determine the architectural feature to which they belonged or the construction technique employed. These are fragments with an evened surface (Fig. 2), or with impressions of the framework (Fig. 3–6). Very rare fragments possess both on two opposite sides, and can be unambiguously identified as wall daub, since burnt walls tend to break in the middle where the armature is located. The half-wall fragments are usually 5–6 cm thick, but values between 3.5 and 7.5 cm have also been recorded. Assuming that the walls were plastered on both sides, it can be estimated that the walls had a total of about 10–12 cm thick plastering. The actual thickness of the walls, however, cannot be estimated as the thickness of the framework is unknown.

The framework impressions consist primarily of common reeds (*Phragmites*), and rarely of wooden posts, rods, and split tree trunks. It is surprising that impressions of wattle (woven green twigs of a flexible hardwood) do not occur at all. The impressions of reed stems are easily recognisable by their straightness and the presence of nodes and fine parallel lines (Fig. 3–5). The reeds had a thickness between 0.7 and 1.5 cm (on average ca. 1 cm)[3], and were usually arranged parallel to each other, probably organised in bundles or

3 These measurements are likely slightly biased, since the impressions do not always cover the complete diameter of the reed cane, and therefore the original thickness of the canes, in some cases, could have been slightly larger.

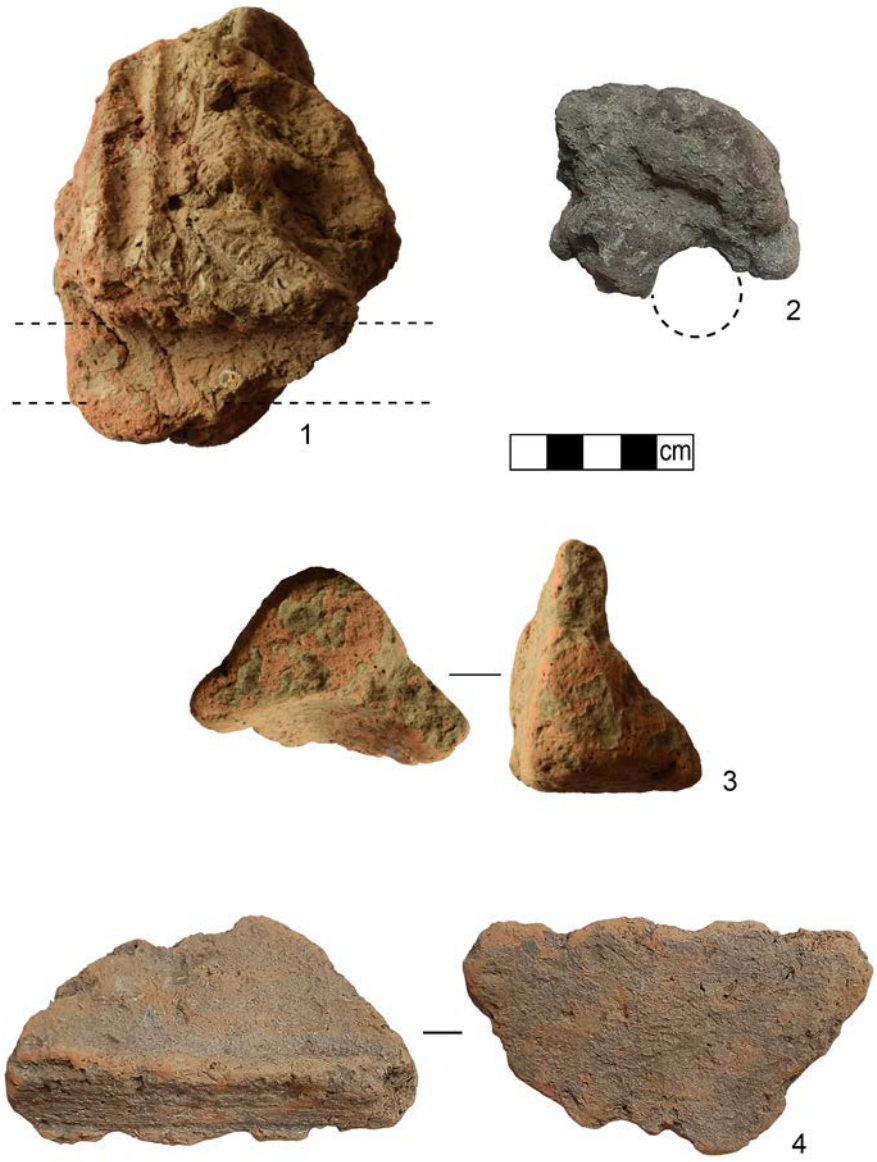


Fig. 6 Daub fragments with impressions of wooden elements of the framework found in Features M41, D17, B9 and I7.

mats[4]. The distance between the sticks varied from 0.1 to 2.5 cm; however, in most cases, the interval was of 0.1–0.5 cm. Arrangements in the form of "X" are also attested.

Given the fact that Bucova Pusta IV is situated on the left bank of an old course of the Mureşan Stream (formerly known as Gorn[y]a Aranka), which was most probably active already in the Early Neolithic (Ciocani 2021, 8), reeds must have been available in abundance in the vicinity of the settlement. Therefore, the reason for choosing reeds instead of twigs for the wall armature is probably the greater availability of reeds, and can be understood as an adaptation strategy to local resources (see Chapter 16).

The employment of reeds as a building material has also been attested at other Early Neolithic sites in south-eastern Europe, such as Nea Nikomedeia (Rodden 1965, 84;

4 At the site of Ecsegfalva 23, traces of reeds tied with cords were attested, which suggests that they were tied together in bundles or mats (Carneiro/Mateiciucová 2007, 270).

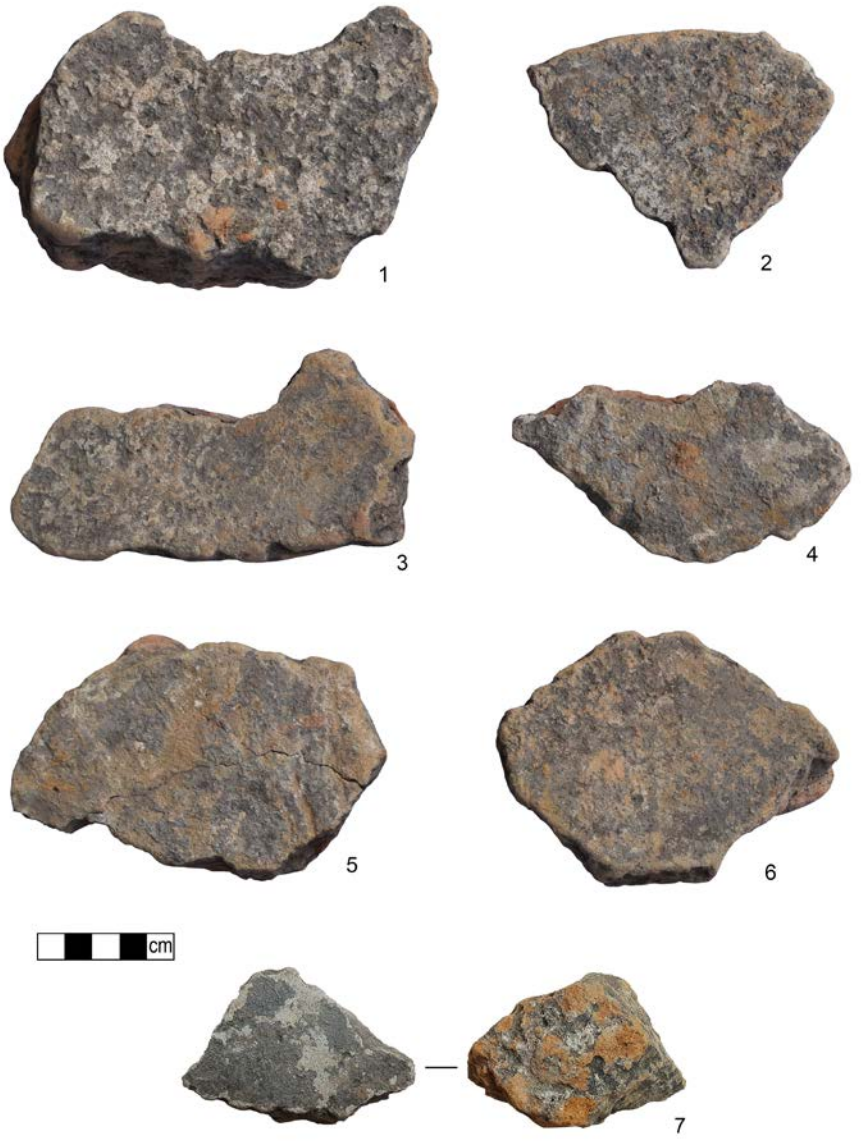


Fig. 7 Fragments of inorganic-tempered daub found in Features G–H1 and L11.

Rodden et al. 1996, 42), Hódmezővásárhely-Kotacpart, Vata-tanya (Banner 1934, 74), Szolnok-Szanda (Kalicz/Raczky 1980–1981, 15), Szajol-Felsőföld (Raczky 2006, 381), Ecsegfalva 23 (Carneiro/Mateiciucová 2007, 258; Whittle 2012, 70–71), Dévaványa-Katonaföldek (Ecsedy 1972, 59), Maroslele-Pana (Sümegi et al. 2011, 229), and Szakmár-Kisülés (Bánffy 2012, 58). At the latter three sites, the reeds were used alongside twig wattle. However, the rarity of such cases suggests that reeds were seldom employed as a building material in the Early Neolithic, although this rarity may be unwarranted considering that daub is rarely subjected to detailed investigation, leading to reed impressions being overlooked.

The rarest impressions are those of wooden elements of the framework. Two fragments possess rod impressions with a thickness of about 3 cm (Fig. 6.1–2). The first fragment also has several impressions of reed sticks arranged perpendicularly to the rod impression. A daub fragment forming the corner of a structure (most likely a dwelling) has a post impression on the inner side (Fig. 6.3). The post was more than 6 cm thick, but its exact dimensions cannot be determined because the impression does

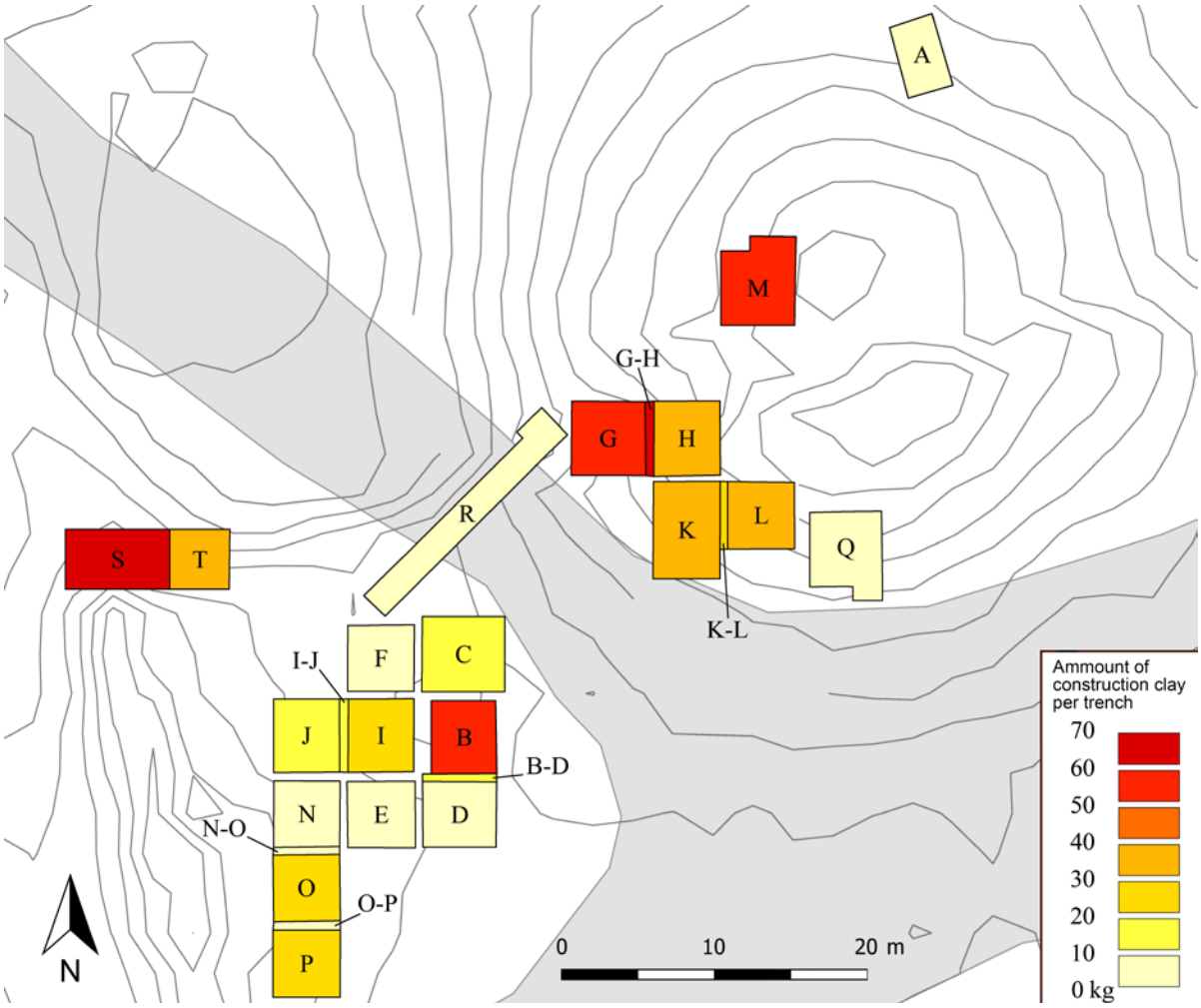


Fig. 8 Distribution of construction doub at the Bucova Pusta IV site.

not cover its entire diameter. In light of this, it can be inferred that the dwellings had a framework of wooden posts and rods, probably placed at regular intervals, and the area between them was filled with reed canes, likely organised in bundles or mats. A fragment with impressions of two wooden planks forming a right angle on one side and a smoothed surface on the other side (Fig. 6.4) indicates that the technique of splitting wooden trunks was also employed. As of yet, however, no clear evidence exists as to whether these daub walls belonged to surface houses or semi-subterranean pit-houses with short above-ground walls. The entire area of the settlement of Bucova Pusta IV was geomagnetically surveyed, but no rectangular anomalies were detected; in addition, a large part of the site was also archaeologically investigated, and no clear evidence of any surface house was found.

On the other hand, in the eastern part of the Carpathian Basin, remains of Early Neolithic surface houses have been attested at Hódmezővásárhely-Kotacpart, Vata-tanya (Banner 1934, 74–76), Nosa-Biserna Obala (Garašanain 1961), Tiszajenő-Szárazérpart (Selmeczi 1969), Dévaványa-Katonaföldek (Ecsedy 1972, 60–61), Ludoš-Budžak (Brukner 1974, 54), Szolnok-Szanda (Kalicz/Raczky 1980–1981, 14; Raczky 2012, 87), Endrőd-Öregszőlők 119 (Makkay 1992), Szajol-Felsőföld (Raczky 2006, 381–

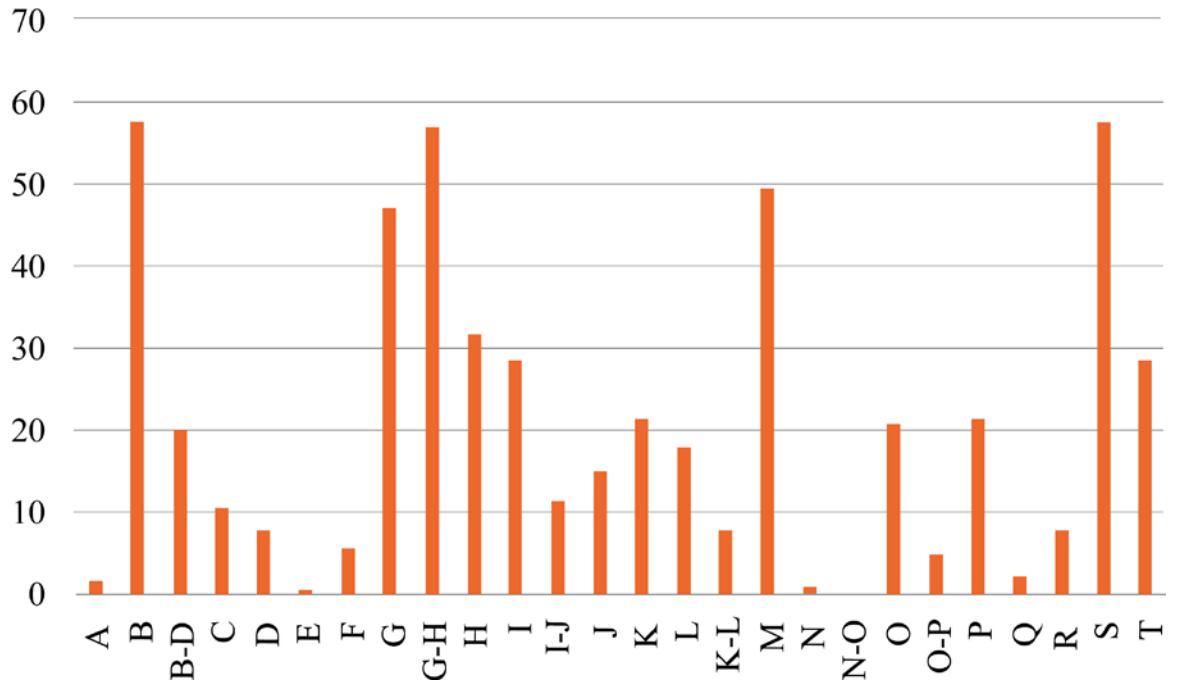


Fig. 9 Distribution of organic-tempered daub according to trenches (values in kilograms).

382; Raczky 2012, 85), and most recently at Dudeștii Vechi-Movila lui Deciov[5]. In addition to this, a fragment of a ceramic house model with a gable roof was discovered at the site of Röszke-Lúdvár (Trogmayer 1966), located only ca. 40 km northwest of Bucova Pusta IV. All this evidence proves that the surface house would not have been an unknown phenomenon to the inhabitants of Bucova Pusta IV. It can therefore be assumed that such houses were also constructed at the site, but are not yet attested because: (a) they were deliberately dismantled immediately after abandonment, (b) their remains were very close to the modern surface and were destroyed by the modern ploughing[6], and/or (c) surface houses were not the characteristic dwelling type at the site, and the few that were built are outside of the archaeologically investigated area. This question remains open until new evidence becomes available.

As already mentioned, the organic-tempered daub was also used for the construction of ovens, as evidenced by the four ovens that were unearthed. The oven daub is generally better burnt, plastered in thinner layers[7], and usually contains a smaller amount of organic temper. When uncovered in a fragmented state, however, it is virtually impossible to distinguish it from the wall daub.

b) Inorganic-tempered daub. This category of daub is tempered with silt or fine sand[8], for which reason it is hard, compact, and heavy. The fragments of inorganic-tempered

5 At Dudeștii Vechi-Movila lui Deciov, burnt remains of surface houses as well as foundation trenches with rows of postholes were identified.

6 For instance, the remains of burnt houses at Szolnok-Szanda lay only 15–30 cm below the modern surface (Raczky 2012, 87).

7 One of the investigated ovens (Feature G7) had the dome made of several thin layers of plaster added to the walls of the cavity dug into the sterile soil.

8 An alternative explanation is that the soil from which the daub was made already contained silt or fine sand.

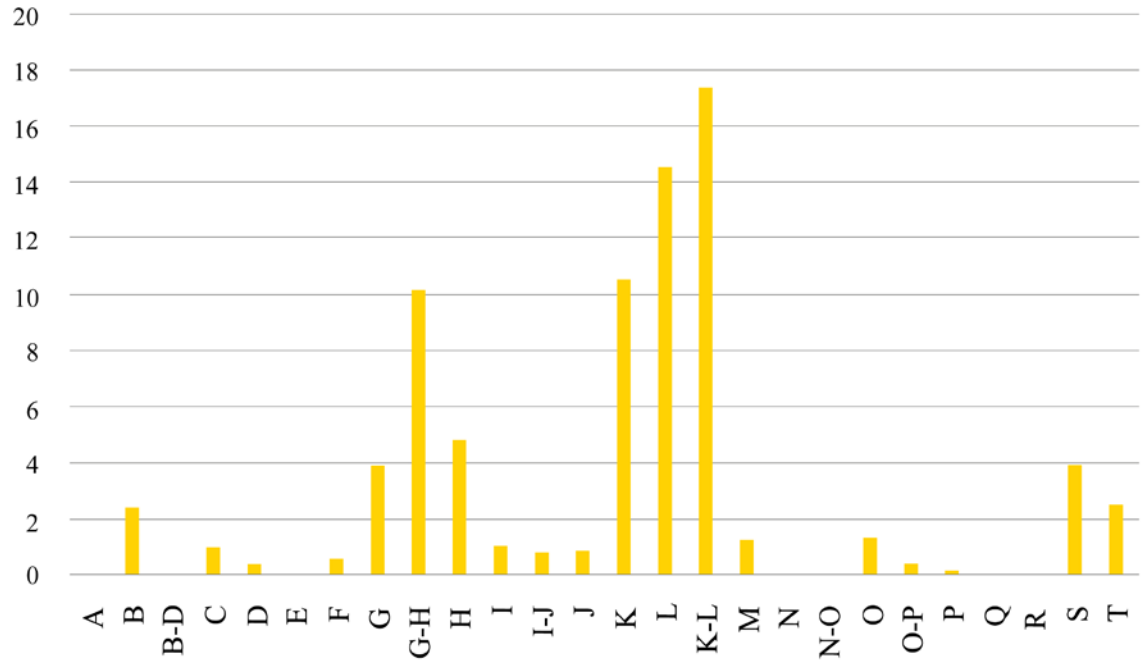


Fig. 10 Distribution of inorganic-tempered daub according to trenches (values in kilograms).

daub have two opposing surfaces. One is even and well-smoothed (Fig. 7), while the other is irregular, and bears impressions of a surface on which it lay. These features clearly indicate that it was employed in the construction of some kind of platforms on the ground. The daub fragments usually have a thickness of 3–4 cm (measured between the two surfaces), are well-burnt, and their colour ranges from beige to orange. Generally, the upper part of the fragments is beige, while the lower part is orange (Fig. 7.7). Micromorphological analysis at Ecsegfalva 23 revealed that the upper smooth surface contains a high quantity of Potassium (K), suggesting that dung might have been employed in smoothing the surface (Carneiro/Mateiciucová 2007, 268).

No structure from inorganic-tempered daub was found at Bucova Pusta IV. This type of daub was discovered only in relatively small pieces and in secondary contexts, again pointing to a deliberate destruction of the structures. Evidence from other Early Neolithic sites indicates that it was used for the construction of hearths (Lazarovici/Lazarovici 2006, 108), and it is assumed that it was also employed for the erection of ovens, house floors, or other interior structures (Carneiro/Mateiciucová 2007, 271–272). However, none of the ovens investigated at Bucova Pusta IV had a floor of well-smoothed inorganic-tempered daub, and no hearths of any kind were found, so the question of what it was used for there remains open.

3. Spatial distribution of the daub

As aforementioned, most of the daub is found in secondary contexts, primarily in pits and depressions where it was disposed of after the burnt architectural structures were dismantled. Assuming that the original location of a structure was usually not very far from the disposal pits, its original location can be approximated by analysing the spatial distribution of

Trench	Organic-tempered daub	Percentage	Inorganic-tempered daub	Percentage	All daub	Percentage
A	1.42	0.27 %	0	0.00 %	1.42	0.23 %
B	57.3	10.83 %	2.38	3.06 %	59.68	9.83 %
B–D	19.81	3.74 %	0.04	0.05 %	19.85	3.27 %
C	10.34	1.95 %	0.98	1.26 %	11.32	1.86 %
D	7.65	1.45 %	0.37	0.48 %	8.02	1.32 %
E	0.65	0.12 %	0	0.00 %	0.65	0.11 %
F	5.41	1.02 %	0.59	0.76 %	6	0.99 %
G	46.84	8.85 %	3.87	4.97 %	50.71	8.35 %
G–H	56.62	10.70 %	10.15	13.04 %	66.77	11.00 %
H	31.44	5.94 %	4.81	6.18 %	36.25	5.97 %
I	28.21	5.33 %	1.04	1.34 %	29.25	4.82 %
I–J	11.14	2.10 %	0.8	1.03 %	11.94	1.97 %
J	14.69	2.78 %	0.87	1.12 %	15.56	2.56 %
K	21.2	4.01 %	10.52	13.52 %	31.72	5.23 %
L	17.55	3.32 %	14.54	18.68 %	32.09	5.29 %
K–L	7.58	1.43 %	17.37	22.32 %	24.95	4.11 %
M	49.18	9.29 %	1.24	1.59 %	50.42	8.31 %
N	0.76	0.14 %	0	0.00 %	0.76	0.13 %
N–O	0	0.00 %	0	0.00 %	0	0.00 %
O	20.53	3.88 %	1.32	1.70 %	21.85	3.60 %
O–P	4.71	0.89 %	0.39	0.50 %	5.1	0.84 %
P	21.16	4.00 %	0.15	0.19 %	21.31	3.51 %
Q	1.96	0.37 %	0	0.00 %	1.96	0.32 %
R	7.65	1.45 %	0	0.00 %	7.65	1.26 %
S	57.15	10.80 %	3.9	5.01 %	61.05	10.06 %
T	28.3	5.35 %	2.5	3.21 %	30.8	5.07 %
Grand Total	**514.09**	**100.00 %**	**77.83**	**100.00 %**	**591.92**	**100.00 %**

Tab. 1 Distribution of organic-tempered daub according to trenches (values in kilograms).

the daub. The analysis shows that daub fragments are found in all areas of the site investigated, and that their amount does not vary from area to area, but rather from trench to trench within the areas, with the greatest quantities recovered from trenches containing large Early Neolithic pits (Fig. 8, 11)[9].

9 In the northeastern area, only Trench A was excavated, and it remains unclear as to whether the low frequency of daub is characteristic for the whole area, or whether it is mere chance that no large Early Neolithic pit was found in this trench.

Organic-tempered daub is recovered in large quantities from all investigated areas (Fig. 9), indicating that structures were built with this category of daub throughout the settlement. The inorganic-tempered daub, however, shows a different pattern of distribution (Fig. 10). Its frequency is high only in the trenches located on the northern bank of the paleochannel[10] crossing the site, which suggests that the structures built with this type of daub were concentrated there.

4. Conclusions

Daub constitutes a plaster of tempered clay employed in construction, which usually only remains preserved when it burns. Burned daub is one of the most common archaeological finds at Bucova Pusta IV, indicating that clay was an essential building material there. The daub is primarily recovered from pits and in a state of increased fragmentation, which suggests that the dwellings were dismantled after abandonment and the rubble then discarded.

Two main categories of daub are attested: organic-tempered and inorganic-tempered. The former category was much more common. It was tempered with cereal chaff and rarely with small pieces of straw, and was used for the construction of dwelling walls and ovens. The walls consisted of a framework of wooden posts, rods, and reed canes (probably tied in bundles), plastered on both sides with about 5–6 cm of daub. The extensive employment of reeds as armature instead of the wattle made of twigs, which was more common in the broader area, represents an adaptation to the locally available resources. Since no house walls were found *in situ,* it can only be speculated as to whether the wall daub belonged to surface houses or semi-subterranean pit-houses.

The second category of daub contains a considerable amount of silt or fine sand. This daub was employed for the construction of well-smoothed horizontal platforms, which probably constituted the floor of architectural structures such as hearths or dwellings. These interpretations, however, remain hypothetical since no structure made of this kind of daub has yet been discovered at the site.

The organic-tempered daub is present in large quantities in all areas of the site investigated, suggesting that structures made of this category of daub were likely erected all over the site, while the inorganic-tempered daub was found primarily on the northern bank of the old river bed crossing the site, indicating that structures of this type of daub were built in that area.

10 The paleochannel was already inactive in the Early Neolithic.

The Early Neolithic Child Burial, Feature S14

Raiko Krauß, Lea Valcov, Laura Winkelbach, Joachim Burger, Jens Blöcher, Yoan Diekmann

1. Find situation and anthropological observations

(Raiko Krauß, Lea Valcov)

In the west of our Excavation Trench S, an Early Neolithic child's burial was uncovered and documented, which is significant in several respects for the interpretation of the Early Neolithic settlement at Bucova Pusta IV. The burial was discovered in September 2015, block recovered, and is located in the Dudeştii Vechi Museum. After the removal of the block with the burial, the underlying structure (Feature S24) was further excavated and documented in the field.

Feature S24 is an elongated, north-south aligned pit continuing into the northern profile of Trench S (Fig. 1). At its bottom, there was a high find concentration of broken Early Neolithic vessels and numerous clay weights in various stages of manufacture. 43 complete clay weights were found, a further 19 fragments of such and three larger, secondarily fired shapeless lumps of clay (Fig. 2). The complete specimens are predominantly simply pierced; they are either slightly cylindrically elongated or round in shape. The fingerprints of their producers are recognisable on all pieces. Notable is the spherically shaped piece 7634 with very deep finger impressions, but no piercing. The piece numbered 7556 is also unpierced, and is flattened on one side. It is possible that the weights were also used in an unfired state. This is also indicated by the unformed clay remains, which are only secondarily fired. The position of the pieces on the floor of Pit S24 suggests that some of the pieces were strung on a rope. Conceivable here would be a fish net, the lower end of which was weighed down with these weights. Numerous fragments of Neolithic pottery, some of them sizeable, were found between these weights and in the pit fill (Fig. 3). These finds emphasise the waste character of this structure.

The child was buried just above this find concentration, in the south of the pit. It lies parallel to the orientation of the pit in a north-southerly direction, on its left side, with its head to the south and facing west. As far as was still observable, the legs are markedly crouched, and the arms are folded in front of the chest. The grave's fill sediment contained numerous pottery fragments and animal bones, which cannot be regarded as regular grave goods. Rather, they were reburied finds from the settlement context in which the burial was sunk. Only the skull fragment of a young sheep or goat, which was found about

Fig. 1 Finding situation of the Early Neolithic child skeleton in Excavation Trench S of Bucova Pusta IV, above a pit with numerous burnt clay weights. The area with the grave has already been prepared for block recovery.

Fig. 2 The clay weights found below burial S24 in the Dudeştii Vechi Museum. The various stages of production from the portioned clay bale to the finished weight are clearly visible. In the upper edge of the picture some broken pieces. The otherwise very good state of preservation of the pieces is remarkable.

30 cm in front of the child's face, could be an intentional addition. This skeletal element was dated, and its radiocarbon age corresponds to the date obtained from the child's skeleton.

The skeleton is almost complete, and more than 75 % preserved (Fig. 4). Since the block salvage has only been partially excavated so far, anthropological analysis is only possible for about 2/3 of the bones. The skull is almost complete and possesses an intact surface, but is heavily fragmented due to the pressure of the earth. On account of the location in the sediment block, it has been preserved almost anatomically correctly, and is easy to assess, although metric analyses were not possible. The left half of the skull is less badly crushed than the right. On the right side, new excavation-related fractures and injuries can also be observed. The upper jaw is the most fragmented, although the teeth are complete and undamaged. The lower jaw, on the other hand, is excellently preserved. The teeth can only be completely analysed on the right side. The canines in the maxilla and mandible have fallen out post-mortem on the right side.

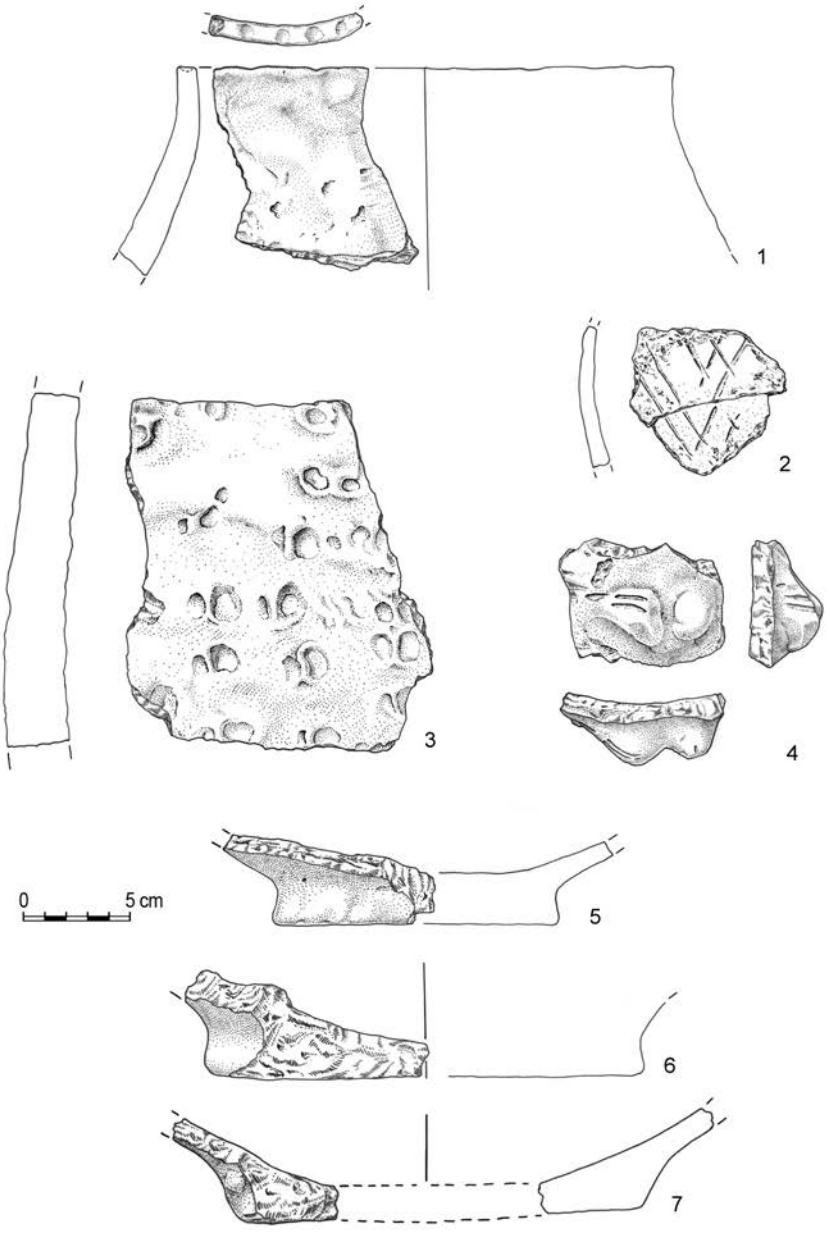


Fig. 3 Early Neolithic vessel fragments from the backfill of Grave S24 and the pit below.

The proximal ends of both femurs are missing on the postcranial skeleton. The right tibia and fibula are present. The right humerus is only partially visible, and the sacral vertebrae are only partially present. However, their exact number cannot be determined due to their location in the sediment block. The area above the lumbar vertebrae appears to be disturbed. Some thoracic vertebrae are missing, and the lowest right rib is displaced. This could be due to bioturbation. All visible long bones were broken post-mortem in the course of recovery or by taphonomic processes. In addition, the epiphyses are missing in many of them, which clearly complicates a metric analysis. The right pelvic scoop is present, while the left one is still hidden in the sediment. On the right side, all ribs are complete, while the situation is again not assessable on the left side. The cervical vertebrae are complete, and some thoracic vertebrae are missing in the lower back.

The dentition is mixed. Except for M1 in the maxilla and mandible, all teeth were still deciduous, and in some of them the root was

Fig. 4 Orthophoto of the en bloc recovered Early Neolithic child burial from Bucova Pusta IV site in the Dudeştii Vechi Museum.

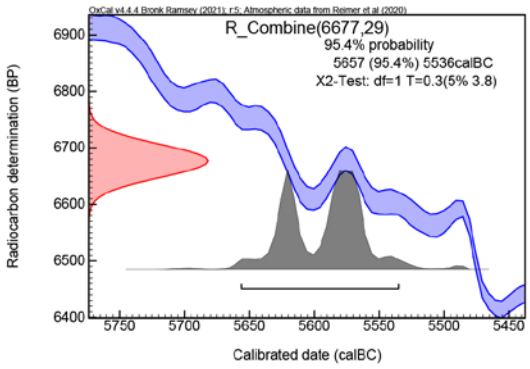


Fig. 5 Joint calibration with the OxCal program of the two radiocarbon dates from the grave context.

already decaying. The incisivi as well as the canini partly showed very slight abrasions of their dental crowns. The remaining teeth were in very good condition. Caries could not be detected. No tartar was observed either. Absence of linear enamel hypoplasia indicates adequate nutrition.

For subadult individuals up to 13 years of age, dental status is the most important feature for age determination. The scheme of Douglas Ubelaker (1978) is usually used as a standard. In addition, the maturity characteristics of the skeleton were assessed. An overview of the bone maturation process and the associated reference data for age determination is given by Louise Scheuer and Sue Black (2000), Maureen Schaefer et al. (2009), and Brenda J. Baker et al. (2005). The dental status revealed a child's age at death of 7 years ± 24 months[1].

No unnatural discolouration was observed on the bone surface or joints. The slight abrasions and porous structures are due to the storage conditions in a sandy soil environment. No pathologies or traumas were found.

Anthropologically, the sex could not be determined. Based on the genetic analysis, it is a girl.

Two radiocarbon dates were measured from this burial. The skull fragment of an ovicaprid (Poz-76963: 6665±35 BP) and a bone fragment of the infant skeleton (Poz-77263: 6700±50 BP) are statistically identical with their calibrated values. The combined calibration on the INTCAL20 calibration curve gives a date (R-Combine: 6677±29 BP) of 5657–5536 calBC in the 2-sigma range (Fig. 5). Thus, it is one of the latest contexts of the Early Neolithic settlement.

In general, burials are underrepresented in the entire South-eastern European

1 Since all cranial fontanelles are already closed, it must be an individual over 2 years of age. The vertebral body status also indicates a complete fusion of the vertebral bodies, and suggests an individual over 5 years of age (Scheuer et al. 2010). All other epiphyses and apophyses are not fused, indicating that the child must have been under 14 years of age at the time of death (Schaefer et al. 2009).

Neolithic (cf. Lichter 2001). In many cases, however, isolated human bones are found in settlement contexts, which indicate that the dead were somehow handled within the settlements. The Early Neolithic child burial at Bucova Pusta IV can be considered a special case. It may have survived only because the child was buried as the settlement was abandoned.

2. Palaeogenomic analysis of the Neolithic child skeleton

(Laura Winkelbach, Joachim Burger, Jens Blöcher, Yoan Diekmann)

The petrous bone of the human Neolithic skeleton S14 (5657–5536 calBC) from the site Bucova Pusta IV (Romania) contained 40 % endogenous human DNA. The genome was sequenced to a genomic coverage of 0.76X.

The individual's genetic sex is XX, female; her mitochondrial haplogroup is T2b23, which is common in the Early Neolithic period of Europe. She very likely had a dark hair shade of brown to black and an intermediate skin colour. The eye pigmentation could not be determined due to missing data. The determination of several hundred additional phenotypic traits did not reveal any unexpected findings for an European individual of the Early Neolithic period.

With regard to her ancestors, the individual displays allele frequencies typically found in Early Neolithic populations throughout Europe. These, in turn, go back to ancestors who lived in the Early Neolithic in the Aegean region, possibly also on the Turkish south coast and in central Anatolia. The genome shows no signals of admixture with local European hunter-gatherers.

Sequencing the Bucova Pusta IV S14 genome

We extracted DNA from the right *Pars petrosa* of the human Neolithic sample S14 from the site Bucova Pusta IV (Romania) following established ancient DNA protocols. Screening (sequencing on the Illumina MiSeq) of double-indexed libraries generated from the extracted DNA demonstrated that the skeleton contained 40 % endogenous human DNA. This means that the skeleton is better preserved from a biomolecular point of view than the average of other skeletons of similar chronology and geographical origin. Following screening, the genome was sequenced to a genomic coverage of 0.76X on the Illumina HiSeq3000.

Ancestry

The female child's mitochondrial DNA haplogroup is T2b23 (classified with HaploGrep 2 (Weissensteiner et al. 2016). The Bucova Pusta IV genome falls within the variation on the PCA known from other Early Neolithic individuals from the Aegean (Greek and Turkish sides including the Marmara region), and from all over Europe, including LBK individuals (Fig. 6).

Admixture

We modelled the Bucova Pusta IV sample as a mixture of early Aegean farming-related and Iron Gates hunter-gatherer ancestry with qpAdm (Patterson et al. 2012), and found it to be best represented by 100 % early Aegean farming-related ancestry (p=0.67; Fig. 7).

This result, in the light of the current palaeogenomic interpretations, indicates that the ancestors of the individual come from the Aegean region, possibly also from central Anatolia. Ultimately, these genomes arose towards the end of the last Ice Age from the mixing of south-eastern European/

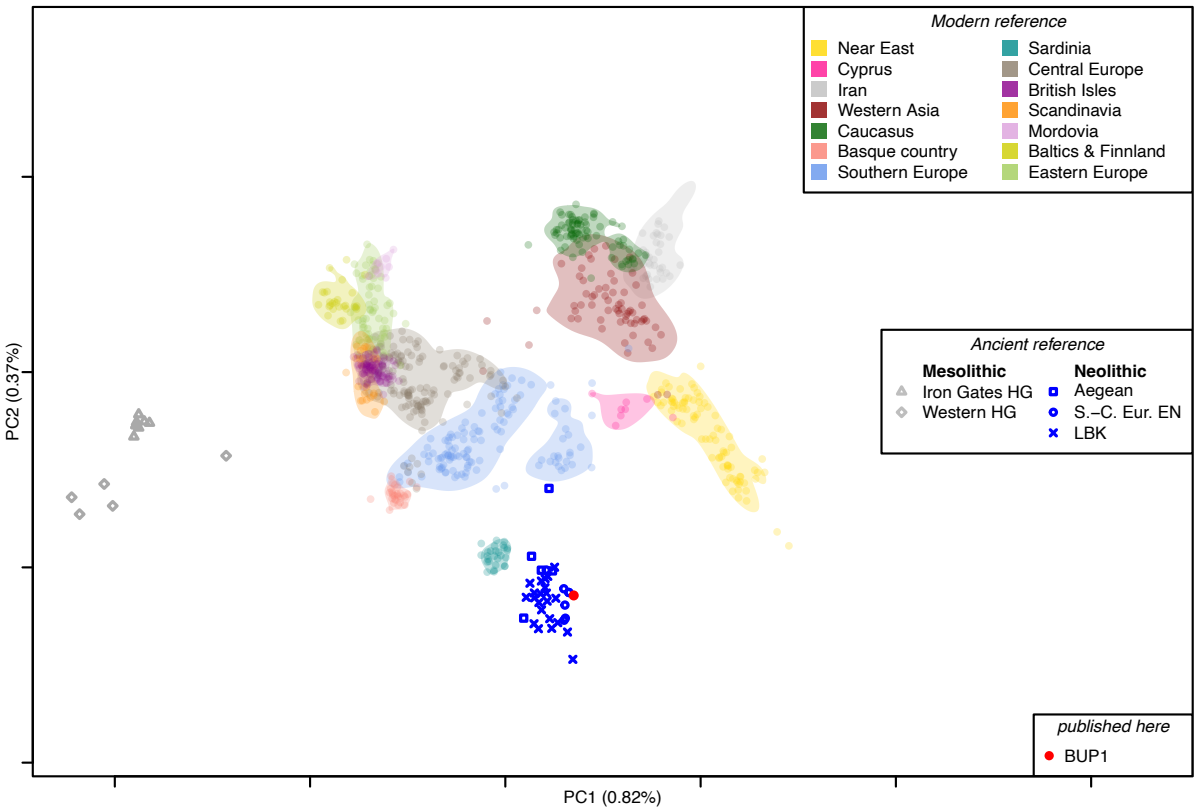


Fig. 6 Principal Component analysis (PCA) of palaeogenetically analysed Neolithic individuals. The Bucova Pusta IV sample is marked with a red dot (BUP1). Its genome lies within the range of the majority of early Neolithic genomes from western Anatolia and Europe between 6400 and 5000 BC.

western Anatolian Epigravettian populations and those from the Near East (Marchi et al. 2022). After this mixing, about 14,000 years ago, the hybrid population underwent an intense period of genetic drift, possibly related to its spatial expansion from the Near East through Central Anatolia to the Aegean region. From there, Neolithic groups migrated across the Balkans to Europe from about 6200 BC onwards.

Most other European genomes with a ^{14}C date like Bucova Pusta IV already show minor admixture signals with European hunter-gatherers (ca. 3 %) by this time. We do not know where and when these admixture processes took place, but we see the result at the genomic level. Recently, it was hypothesised that a site like Lepenski Vir at the Iron Gate could be an example of an interaction zone between Neolithic newcomers and local foragers (Hofmanová et al. 2022). The child does not display this admixture with European hunter-gatherers, so it has an unmixed genetic signal, e.g. as we know it from Neolithic genomes from the Marmara region or Northern Greece (Fig. 7).

Outgroup f3 statistics

The outgroup f3 statistic confirms the other findings, and demonstrates that the Bucova Pusta IV sample displays the greatest genomic similarity to other Neolithic genomes between the Aegean region and Central Europe (Fig. 8). The two individuals who are genetically most similar to the Bucova Pusta IV genome are Törökszentmiklós, road 4, site 3; 4442–4250 calBC; Tiszapolgár-Bodrogkeresztúr

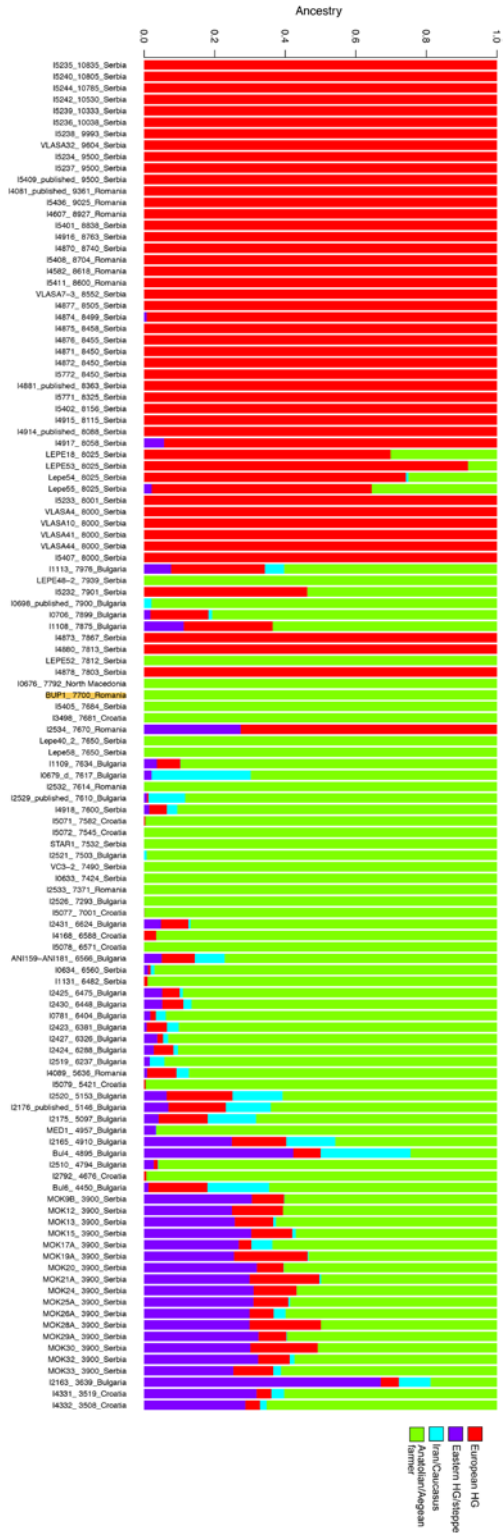


Fig. 7 Result of DyStruct (Joseph and Pe'er 2019) (time-aware unsupervised clustering) with k=4 components. Bucova Pusta IV ancestry in context of other individuals from the Balkans. Dates given in radiocarbon years BP. When the Bucova Pusta IV genome is modelled to be composed of different European hunter-gatherer and Iranian or Aegean Neolithic populations, it appears as a 100 % Aegean farmer (green) with no sign of admixture with European hunter-gatherers.

(lab ID I2793); (Lipson et al. 2017) and Kleinhadersdorf-Marchleiten; 5205–4907 calBC; LBK; (Mathieson et al. 2018) (lab ID I5069). However, since all Central European individuals are genomically very similar, one should not overestimate these individual results; other Neolithic genomes are not much more dissimilar. In sum, the Bucova Pusta IV child is genetically similar to other Neolithic genomes.

Pigmentation of hair and skin

The genetic data was used to predict the individual's pigmentation phenotype (Fig. 9) using the HIrisPlex S eye, hair and skin colour online prediction tool (Chaitanya et al. 2018; Walsh et al. 2014; 2017). To account for the uncertainty associated with low-coverage sites, the HIrisPlex S analysis was performed twice, resulting in ranges of probabilities for each phenotype. The first were obtained assuming that all the SNPs retrieved from BAM files were homozygous for the found allele and the second assuming a heterozygous state of the SNPs.

The girl likely had a dark hair shade (p[DarkHair]=0.8848) of brown to black colour (p[BrownHair]=0.3445; p[BlackHair]=0.6269). Red hair colour cannot be completely ruled out, but is most likely an artefact due to the low sequencing depth. The child had an intermediate skin colour (p[IntermediateSkin]=0.7120). The eye pigmentation could not be predicted due to missing data.

Additional phenotypic traits

- Muscle Contraction Type: Fast twitch
  - » explanation: A SNP in the ACTN3 (alpha-actinin-3) gene is associated with a shortening of actin filaments which causes slower muscle

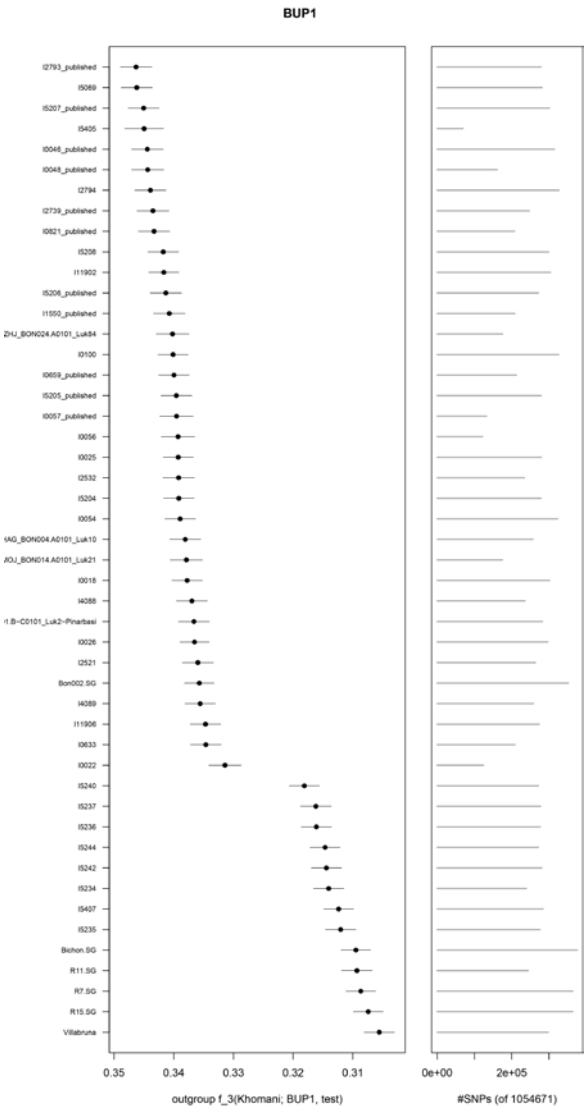


Fig. 8 Outgroup f3 statistics for the Bucova Pusta IV sample.

contractions/switches in comparison to the faster contractions/switches caused by an unmutated gene. Slow twitching muscles are linked to an increase in endurance by enabling low but steady effort over a longer period of time, while fast twitching ones are supposed to enhance higher effort over a short period and therefore help in sports like sprinting.

- Muscle Performance: heightened muscle performance
  - » explanation: The homozygous state in a SNP in the ACVR1B (activin receptor type-1B) gene is associated to sprint/power performance in individuals of European descent due to increased strength in the knees. In general athletes show a higher frequency of the allele in question than non-athletes.
- able to taste PTC (bitter)
  - » explanation: 3 SNPs in the TAS2R38 (taste receptor, type 2, member 38) gene are associated with the ability to taste the bitter compound phenylthiocarbamide (PTC) and similar molecules in foods like cabbage and raw broccoli or drinks like coffee and dark beers. It is assumed that individuals with the tasting ability rather tend to avoid the particular consumables in comparison to non-tasters. Theoretically the presence of one effective allele is enough to gain the ability but usually all three are present.
- Lactase non-persistent
  - » explanation: The child would not have digested well higher amounts of fresh milk as an adult. The non-persistent type is common in almost all Neolithic individuals.
- no increased sensitivity to saturated fats
- no Beta thalassemia
- FADS Haplotype (multi-SNP): 21 FADS-D alleles and 21 FADS-A alleles from a total of 56 are present
  - » explanation: The FADS (fatty acid desaturase) region encodes for enzymes that play an important role in the synthesis of fatty acids which

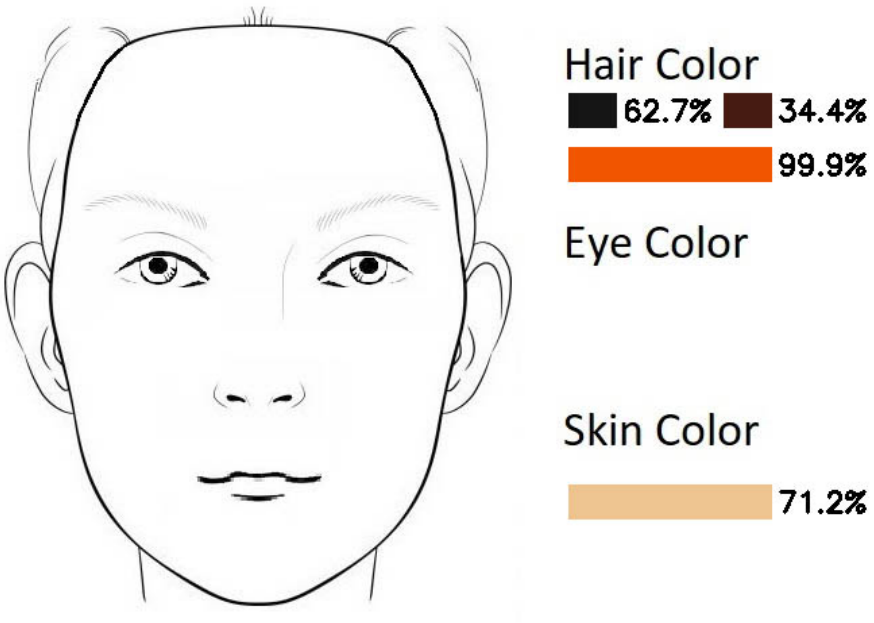


Fig. 9 Predicted pigmentation phenotype. The Bucova pusta IV child very likely had a dark hair shade of brown to black hair colour. She had an intermediate skin colour. The eye pigmentation could not be predicted due to missing data.

are essential for the function of the brain and the central nervous system. The FADS haplotype is related to the process of encephalization in humans; 28 strongly associated SNPs can either be of the ancestral (A) or derived (D) haplotype. Haplotype D, which is most common in modern European populations, is associated with high lipid levels; in contrast, haplotype A is associated with low lipid level (Ameur et al. 2012). The allele counts suggest that the investigated individual had the mixed FADS haplotype.

- Alcohol Tolerance: alcohol tolerant
- Risk for Alcoholism: not reduced
- Earwax Type and Body Odor: wet earwax and normal body odour
  - » explanation: A homozygous SNP in the ABCC11 (ATP-binding cassette, subfamily C, member 11) gene is associated with the development of dry earwax and low body odour by sweating and is the common phenotype in East Asian populations. The alternative allele that forms the common genotype in Europeans and Africans causes wet earwax and normal body odour. A heterozygous SNP still leads to wet earwax, but a slightly reduced body odour through sweating.

The Early Neolithic ceramic finds from Bucova Pusta IV

Raiko Krauß

By far the largest category of finds at Bucova Pusta IV is vessel pottery. During our excavations, a total of 24,955 individual fragments with a total weight of about 600 kg were recovered and recorded. 1073 pottery fragments can be regarded as post-Neolithic. Among them are 1066 Bronze-Iron Age pieces, and seven fragments of painted or glazed wheel-made pottery from the most recent historical periods. In addition, there are other special ceramic forms from the Early Neolithic, including four-foot bowls, also known as miniature altars, some clay figurines, and several hundred clay weights or fragments of such.

The find material is very fragmented, but some forms could be entirely reconstructed. There are some almost completely preserved vessels, and a few more pieces that have fragments fitting together from the base to the rim, so that the whole form can be reconstructed from them. However, the poor preservation of the surfaces of all the pieces is striking. This renders a distorted impression of the quality of the pottery. There were probably many more pieces with smoothed and polished surfaces than appears to be the case. Fragments could be joined from different contexts, sometimes far apart from each other (Fig. 1). This circumstance, independent of the stratigraphic observations, demonstrates the short-term and single-phase use of the Early Neolithic settlement.

The finds from the Bucova Pusta IV excavation are stored in their entirety in the museum of the municipality of Dudeştii Vechi, the bulk of them in closed euro-boxes, sorted first by context, and then by excavation section. A representative selection of the vessel pottery was compiled on the basis of its form and decoration in a reference collection, which is kept together with the mass material. An even smaller selection from this is presented in the Dudeştii Vechi Museum's exhibition. Over the years, individual pieces were brought to Tübingen for restoration. These were then returned to Romania. Likewise, pieces, especially those from the early years of the excavation, were brought to Timişoara for processing, which, with a few exceptions, also returned to Dudeştii Vechi. As far as it has been preserved, the material from the old excavation of Gyula Kisléghi Nagy is stored in the National Museum of Banat in Timişoara (see Chapter 3).

All pieces of the pottery were determined metrically and typologically, and recorded in a Microsoft Access database. Students Silvia Mircheva and Bogdana Bogdanova (2015) and

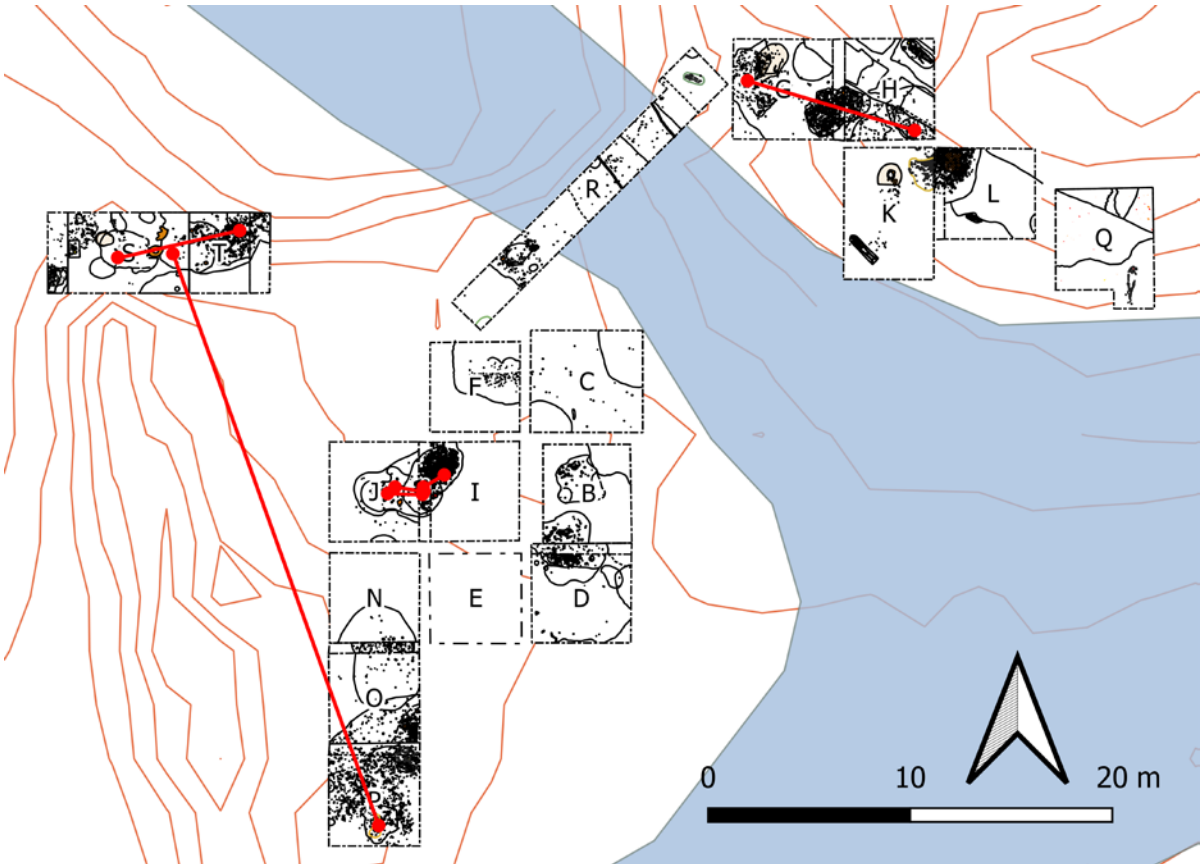


Fig. 1 Bucova Pusta IV excavation trenches with mapping of the matching ceramic fragments (red dots and lines).

David Matzig and Niklas Neumeyer (2016) helped with the data entry. Completely preserved or entirely reconstructable vessels as well as a representative selection of typologically assignable and decorated fragments were drawn by Moni Möck, Achim Frey, and Ottilie Blum, and photographed by Mircea Jar and Liviu Tulbure. Jonas Sprißler arranged most of the drawings on illustration plates, and Sophie Anders transferred the information from the database into text files, which served as preparation for the catalogue descriptions.

From complete vessels (N=34), the height, the mouth diameter, and the maximum diameter of the body were determined. The fragmented pieces include 22,184 middle sherds, 1414 rim fragments, 1147 base fragments, and 171 pieces which can be assigned to cord loops. Proper handles are hardly present on the Early Neolithic pottery. For the recording of fragments, a procedure was applied which we had already developed for the recording of the material from the Early Neolithic settlement of Ovcharovo-Gorata in northern Bulgaria (Krauß 2014). First, the degree of fragmentation was recorded on a significantly large amount of the shattered material. Interestingly, this resulted in approximately the same size classes as for the material from Ovcharovo-Gorata: 1st class consists of small fragments which fit into a round field of 5 cm diameter (N=13,743), 2nd class consists of medium-sized fragments fitting into a round field of 8 cm diameter (N=8206), and 3rd class consists of fragments larger than this (N=2995). For sherd thickness, the sample yielded a reasonable class division into 1st thin sherds, less than 0.5 cm thick (N=275),

Fig. 2 Technological groups of vessel ceramics from Bucova Pusta IV from all represented time periods.

2nd medium sherds between 0.5 and 1.2 cm thick (N=22,574), 3rd thick-walled sherds up to 2.0 cm thick (N=2025), and 4th very wide sherds with a thickness above this (N=71). The size and thickness classes were recorded with the help of a template.

1. Ceramic fabrics

In accordance with its simple production technique, presumably in a home workshop without craft specialisation, Early Neolithic pottery in particular is very heterogeneous. On one and the same vessel, one can often observe very different colourings of the sherd, which stems from the simple firing, probably in firing pits or the earth kilns found in the settlement, where the oxygen supply or reduction could only be poorly regulated. Moreover, the lean components in the Early Neolithic wares are often very irregularly distributed in the clay matrix. In addition to mineral temper, organic particles can often be observed in the fracture. Accordingly, it is difficult to assign the Neolithic pottery to a technological type of ware. For this reason, 12 individual types of wares (fabric groups) have been identified, between which the boundaries can be fluid (Fig. 2).

It is striking that almost no fine pottery occurs in the Early Neolithic material from Bucova Pusta IV. It is debatable as to what fine ceramics are, or at what wall thickness and fineness of surface treatment one can speak of fine ceramics at all. However, if we look at the fine ceramics of the Balkan Early Neolithic, there are no known fine wares from Bucova Pusta IV which are even remotely comparable. However, there are certain gradations in the other direction, for in addition to the usual utilitarian pottery, which was presumably used for the preparation and consumption of food, there is also evidence of very coarse, thick-walled vessels, which may have been used for the storage of food, liquids, and seeds, or other things.

The archaeometric analysis of the ceramic wares by Silvia Amicone (see Chapter 11) revealed that Fabric Group 1, which we determined, is tempered with organic particles. Variant 1a is oxidised on the outer surfaces and has a dark core. Variant 1b is completely oxidised, and has a homogeneously lighter colouring. In Variant 1c, the core, which is not completely burnt through, is particularly broad, and only the outermost surface, has a lighter colouring on the inside and outside. Probably due to secondary firing, Variant 1d is brick-red on the outer and inner surface but has a clearly darker core. Variant 1e represents the completely fired, homogeneously reddish coloured ware of this group. We assume that this type of ware is the main one from which the Early Neolithic pottery was made.

In addition to organic particles, Fabric Group 2 also contains particles of grog. Evidence suggests that Early Neolithic vessels were also made from this ware type, but it is uncertain whether this can be restricted exclusively to the oldest pottery from Bucova Pusta IV; later prehistoric periods are also possible.

Fabric Group 3 is only tempered with sand. A distinction was made between Variant 3a with darker fracture, and Variant 3b with lighter fracture. The structure is very homogeneous, which is why we believe it is characteristic of Late Bronze to Iron Age pottery. In general, we can say that the Bronze-Iron Age pottery wares are conspicuous for a higher homogeneity of their clay matrix and much finer components in the temper overall. The certainly Iron Age Variant 3c has a very dense shiny black surface, and is also deep black in colour when broken. In contrast to 3a and 3b, it is only coated with grog.

In our Fabric Group 4, we have grouped together various sherds which have attracted attention because of their sandy temper. However, the analysis revealed that they are different wares. Variant 4a is, indeed, sandy, and has a homogeneous ochre-yellow colour. Variant 4b has a comparable colouration on the surface, but a darker core. This ware is tempered with organic particles and grog and is thus comparable to Fabric Group 2. Variant 4c is exclusively organically tempered. We assume that all three variants are Chalcolithic wares. The Chalcolithic fabrics are closer to the Neolithic examples; they also show a rather uneven distribution of the lean components, some of which are even coarser than the temper of the Neolithic wares. Overall, the spectrum is more diverse, and apparently less standardised.

The sherds of Fabric Group 5 stand out because of their comparative hardness. They are very strong, and can only be broken with great effort. Overall, they are dark in colour. Variant 5a has a lighter outer and inner surface, whereas Variant 5b is of a uniform black colour. The analysis shows only organic tempering in the case of Variant 5a, whereas Variant 5b is coated with grog. We would assign both types to Chalcolithic pottery, which once again confirms the heterogeneous character of pottery production of this period.

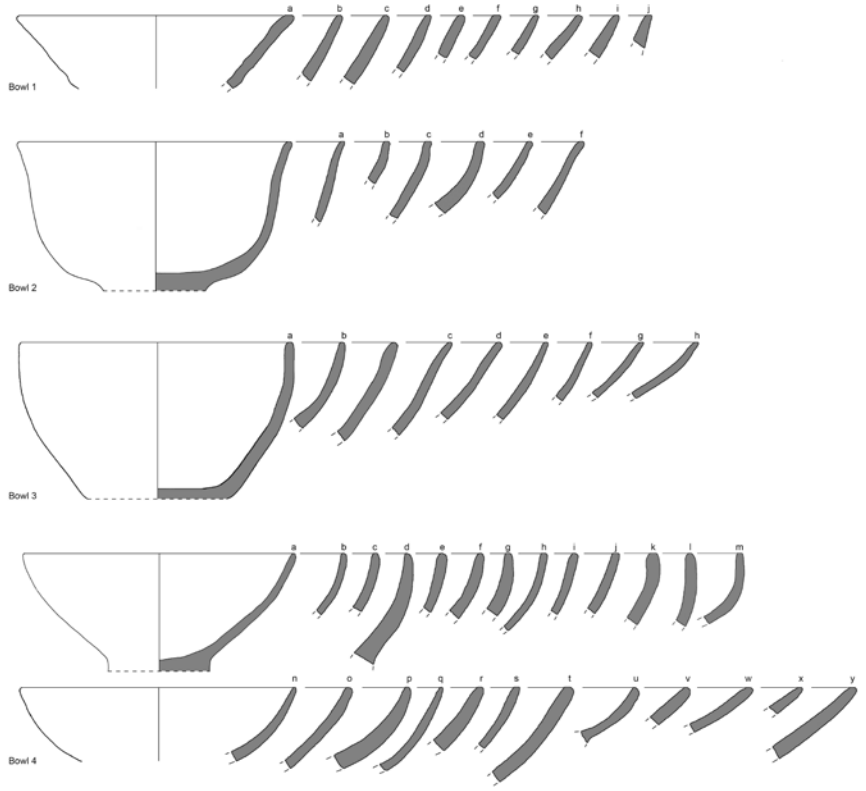


Fig. 3 Typology of the Early Neolithic bowls from Bucova Pusta IV.

Fabric Group 6 is tempered with very coarse sand, which gives it a crumbly consistency and rough surface structure. Despite the absence of organic particles, this ware type was also used to make Early Neolithic vessels. However, vessels from later prehistoric periods may also have been made from this type of ware.

Fabric Group 7 is a grey wheel-made ware typical for the Late Iron Age of the region. The clay is very finely cleaned, and displays a homogeneous firing. When the surface of the sherd is preserved, it shows a high degree of compaction.

The yellowish-grey Fabric Group 8 is very homogeneous, and macroscopically does not reveal any lean components. Only in the thin section are very fine, organic particles of tempering visible. This type of ware cannot be assigned to a specific epoch with certainty.

Fabric Group 9 demonstrates a very irregular matrix, which originates from the admixture of coarse grog. Nevertheless, the body is well-fired, and shows no clear differences in colour. This type of ware cannot be assigned to any specific period with certainty either.

Fabric Group 10 describes a green-glazed wheel-made ware which is ethnographically well-attested in the village of Dudeştii Vechi, from which mainly bulbous water bottles and single-handled pots were made.

Fabric Group 11 is a brick-red wheel-made ware with a yellowish glaze on a white ground coat. This ware is also well documented ethnographically in the village. It was used to make water or wine jugs and bowl-like sieve vessels.

Fabric Group 12 describes a wheel-made ware with pottery grooves clearly visible on the outside and partial white and reddish

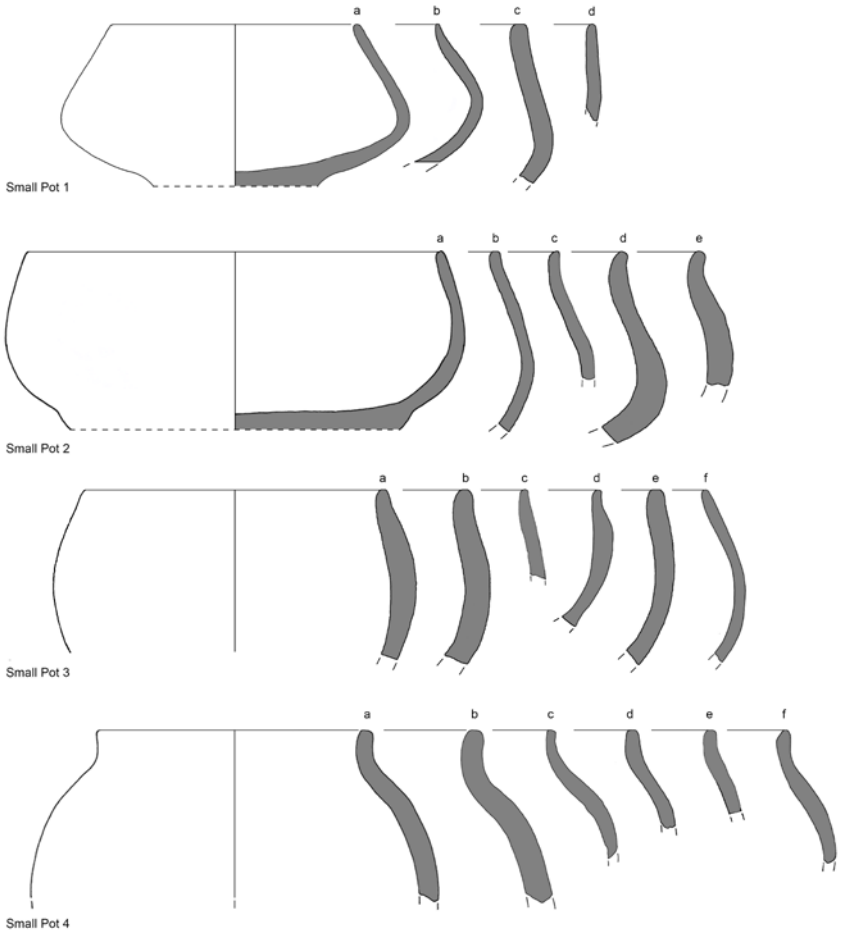


Fig. 4 Typology of the Early Neolithic small pots from Bucova Pusta IV.

painting. The vessels made from it are often glazed only on the inside, and from there to slightly beyond the rim. Large, single-handled pots and bowls made of this type of ware are also ethnographically documented in the region. There are also large storage vessels with plastic rims and a white-red painted motif known from this type of ware.

2. Vessel shapes

The Early Neolithic form spectrum of Bucova Pusta IV is not very standardised, and is difficult to classify. Rather, the individual vessel profiles merge smoothly into one another. There are vessel forms which can be clearly identified as bowls, mugs, or pots. In-between, however, there are many more variants which cannot be clearly assigned to one of the basic types mentioned. The typology presented here, therefore, serves more to present the range of different variants than to postulate a clear demarcation of the types from one another. Functional criteria were obviously in the foreground in the profiling of the vessel walls. Only in the design of the vessel bases can a certain trend towards standardisation be observed, for it is a principal decision by the potter whether to place a vessel on a flattened base, a raised stand, or on four small feet. Interestingly, the body of the vessel built on top can vary entirely from one example to another. There is a striking general division between smaller, handy vessels which were obviously used for eating or drinking, larger pots and jugs which were used for transporting liquids or preparing food, and very large vessels which

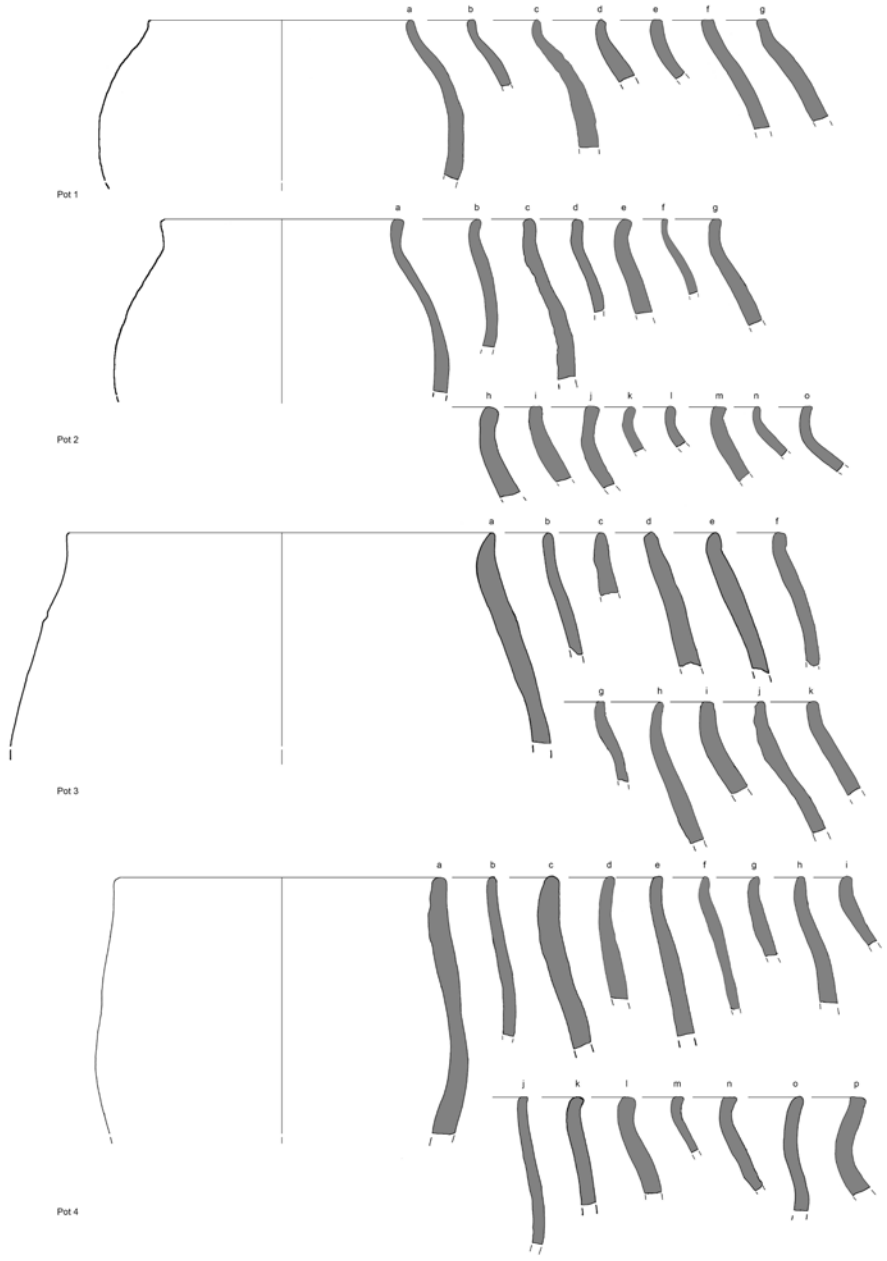


Fig. 5 Typology of the Early Neolithic pots from Bucova Pusta IV.

may have been used for storage. Separate from these are miniature vessels, which are very individually shaped, and therefore cannot be classified.

Handles are extremely rare. Only the jars regularly have simple cord loops which were used to fasten and probably also to carry the vessels. As a rule, these are modelled on the body of the vessel, and only in very rare cases are they carved subcutaneously from the vessel wall. Plastic ledges are sometimes found on pots and storage vessels, which may have served as a support for carrying the vessels.

Bowls

These are open vessels in which the mouth has the widest diameter of the vessel (Fig. 3). Bowls belong to the usual inventory of Early Neolithic settlements in the Banat. 218 vessels and vessel fragments could be reliably identified as bowls. However, a consistent

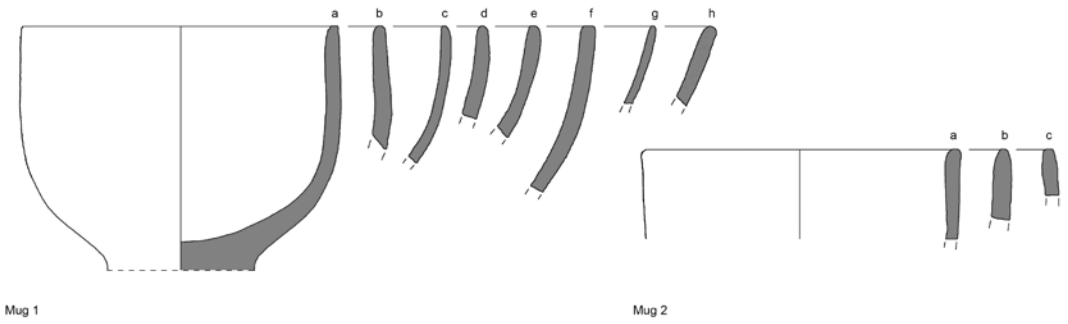


Fig. 6 Typology of the Early Neolithic mugs from Bucova Pusta IV.

identification can only be made if the rim of the vessels is preserved, which is why a great many bowls among the material from Bucova Pusta IV could not be identified as such.

Bowl 1: Open bowls with straight walls. Variants a–e are quasi-conical; Variants f–i have a slightly bulged body.

Bowl 2: As a variation of this, these are forms of open bowls with a very slightly curved rim lip, again each with a differently angled wall. In Variants b and c, the lip of the rim is offset.

Bowl 3: Shapes of open bowls with a bent wall. In this group in particular, the variants merge smoothly into one another, and do not allow a clear demarcation. The break varies in intensity, but not so much so that the shapes appear double conical.

Bowl 4: Shallow bowls with dome-shaped (Variants a–q) to straight, plate-like open profile (Variants r–y).

Small Pots

In distinction to the bowls, the pots are closed forms, in which the mouth diameter is smaller than the maximum width at the belly of the vessels (Fig. 4). These forms also belong to the usual inventory of Early Neolithic settlements in the Banat, they are particularly well suited for storing things and could have been closed with lids from case to case. 54 small pots could be reliably identified as such through their profile and the preserved mouth.

Small Pot 1: Shallow pots with a deep-seated belly bend. Variants a–b are almost biconical. Variants c–d with a slightly rounder kink and a slightly steeper rim.

Small Pot 2: Wide-mouthed forms with a straight or slightly S-shaped rim.

Small Pot 3: Spherical pots with no or only a slightly stepped rim.

Small Pot 4: Spherical pots with a clearly defined rim.

Pots

Pots are common among the standard vessels of the Early Neolithic in the entire Balkan-Carpathian region. The transitions to the small pots are fluid. However, the larger pots are typologically easier to distinguish from each other, but they occur in numerous variations (Fig. 5). With 328 reliably identified pots and pot fragments, this is by far the largest group within the vessel pottery of Bucova Pusta IV.

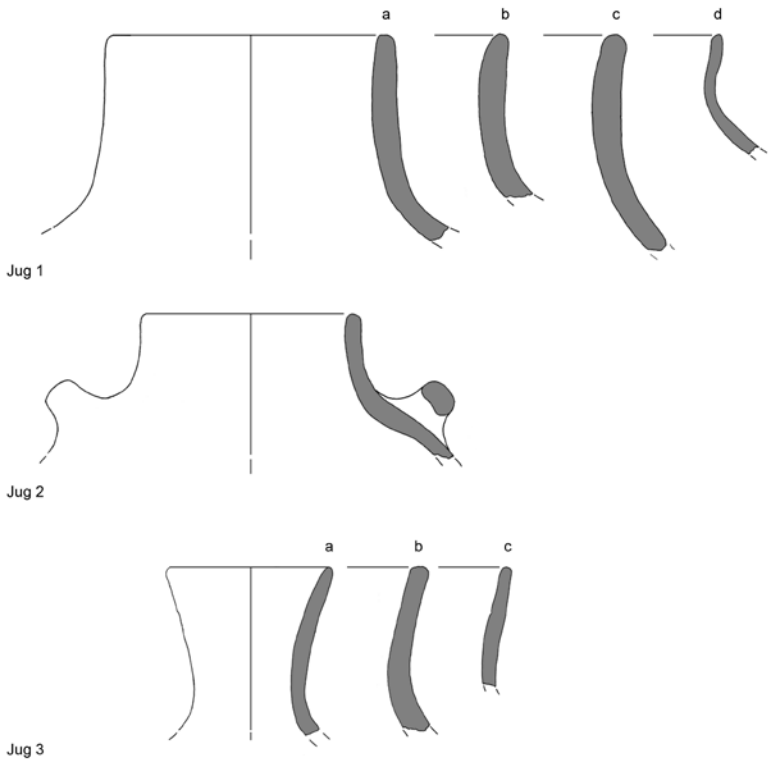


Fig. 7 Typology of the Early Neolithic jugs from Bucova Pusta IV.

Pots are suitable for storing food and liquids, but also for food preparation.

Pot 1: Bellied to spherical pots with a set rim. Variations a–e with a slightly curved lip.

Pot 2: Bellied to slender pots with a distinctly recessed to constricted rim.

Pot 3: Tall pots with a tapered top.

Pot 4: Tall, cup-like pots with a straight to slightly-flaring lip.

Mugs

These are beaker-like forms, usually on a stand, with either a slightly open wall, or a quasi-cylindrical top (Fig. 6). Compared to the Balkan Early Neolithic (Karanovo I and II), they are lower and typologically closer to bowls. Mugs are very well suited as drinking vessels. 29 specimens could be reliably identified within the material from Bucova Pusta IV.

Mug 1: Open beakers with a straight to slightly open rim.

Mug 2: Slightly closed beakers with a set rim.

Jugs

Jug-like forms with a long, narrow neck, more or less clearly offset from the spherical body. These forms are also described as bottles in the context of the Linearbandkeramik in Central Europe (Fig. 7). In fact, they are very suitable for storing liquids because of the narrow mouth. 82 shapes in the Bucova Pusta IV material could be securely identified as jugs.

Jug 1: Jugs with the neck clearly offset from the shoulder. The rim of the lips can also curve out slightly (Variant d).

Jug 2: Wide-mouthed jugs with a soft transition from the shoulder to the rim.

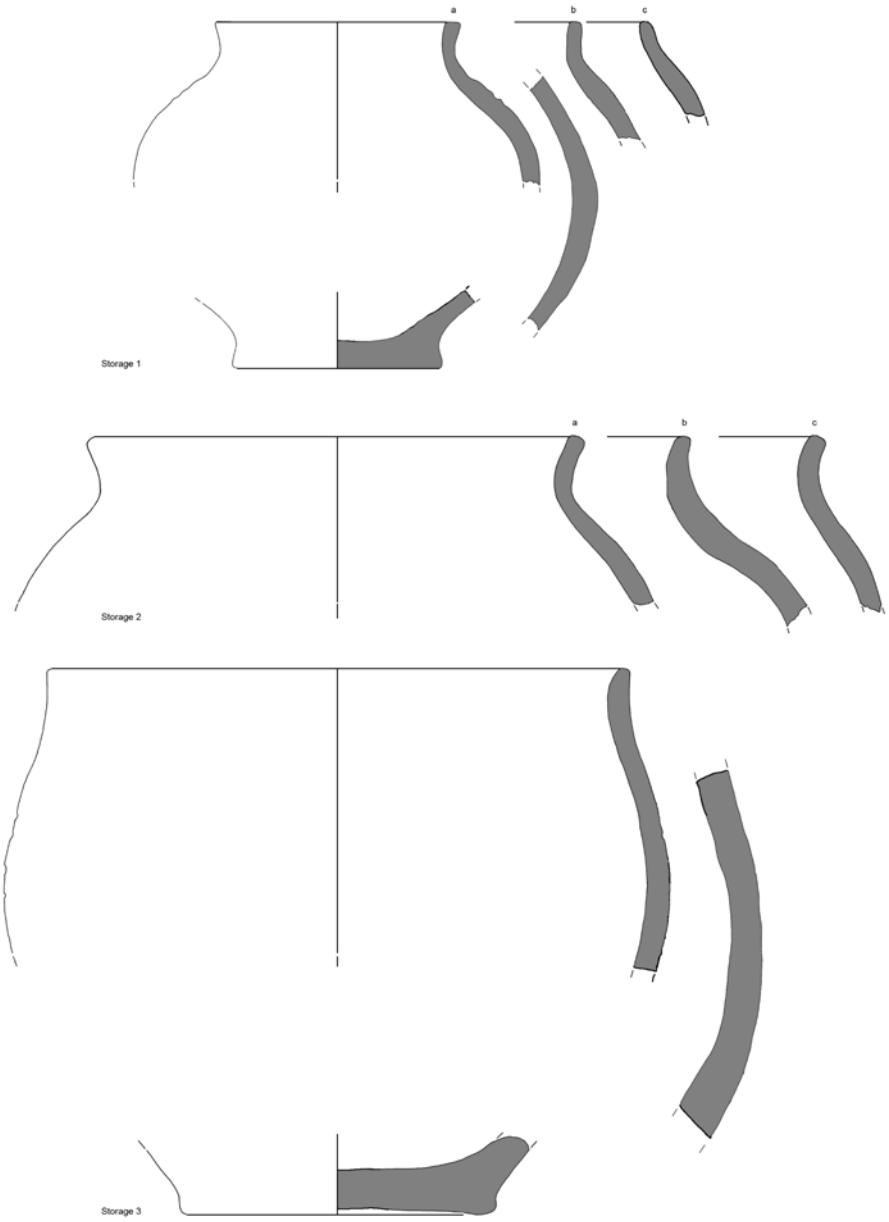


Fig. 8 Typology of the Early Neolithic big storage pots from Bucova Pusta IV.

Jug 3: Bottle-like forms with a narrow, high neck. This is slightly funnel-shaped in some cases.

Big Pots

These are large storage vessels with a narrow mouth. The lip of the rim is often offset, and usually remains undecorated. The shape of the vessels varies greatly; often they are not even roundly symmetrical, so that they can hardly be classified (Fig. 8). Often, these vessels have such large dimensions that they could no longer have been moved when full. It can therefore be assumed that they were installed in a fixed place in the house.

Storage Pot 1: Pots with spherical body and narrowed mouth.

Storage Pot 2: Spherical pots with a wider mouth but still laced neck.

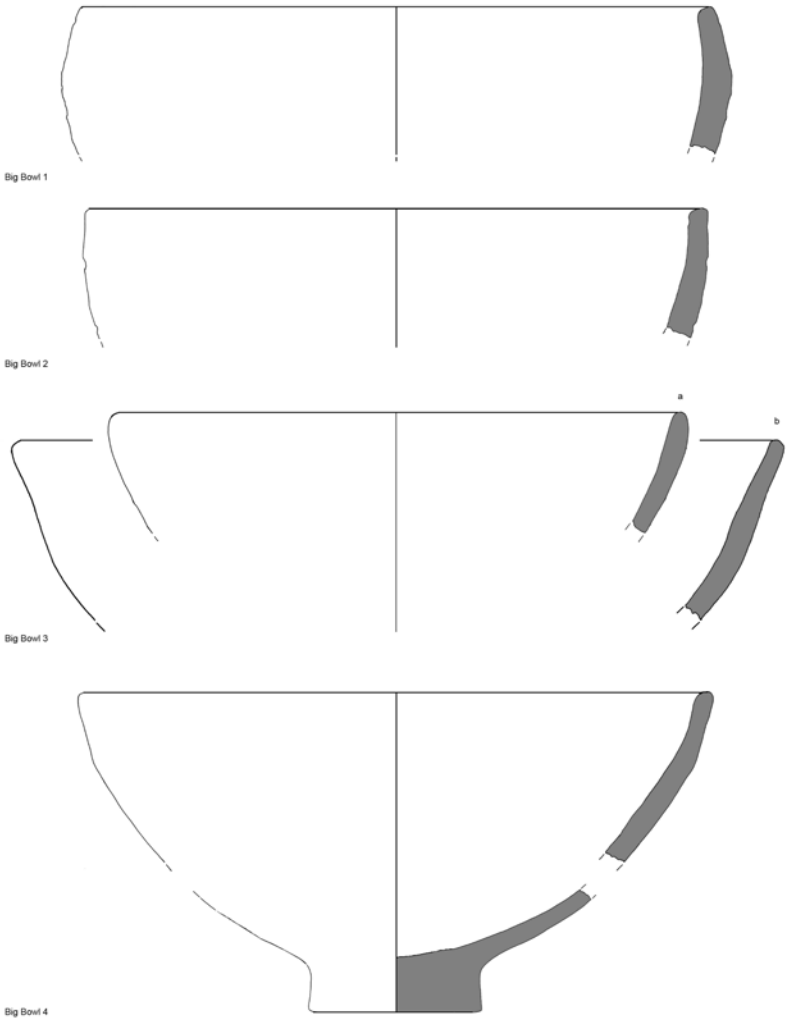


Fig. 9 Typology of the Early Neolithic big bowls from Bucova Pusta IV.

Storage Pot 3: Wide-mouthed shapes with only a slightly pronounced S-profile.

Big Bowls

These are open vessels, some of considerable size, the function of which remains unclear. The taller vessels could have been used for food preparation, and possibly also for food storage. The very shallow forms are well suited for serving or presenting things on (Fig. 9). 49 fragments in the material of Bucova Pusta IV could be safely assigned to the coarse bowls.

Big bowl 1: Tall bowls with rounded walls.

Big bowl 2: High bowls with largely straight walls.

Big bowl 3: Flat bowls with straight to slightly curved walls.

Big bowl 4: Flat bowls with curved, dome-shaped walls.

Miniature vessels

The miniature vessels documented are extremely heterogeneous, and cannot be classified. There are some simple cup-shapes of conical form with more or less pronounced bulging (Pl. 51,9.11; 52,8; 58,4.5.10; 62,1-

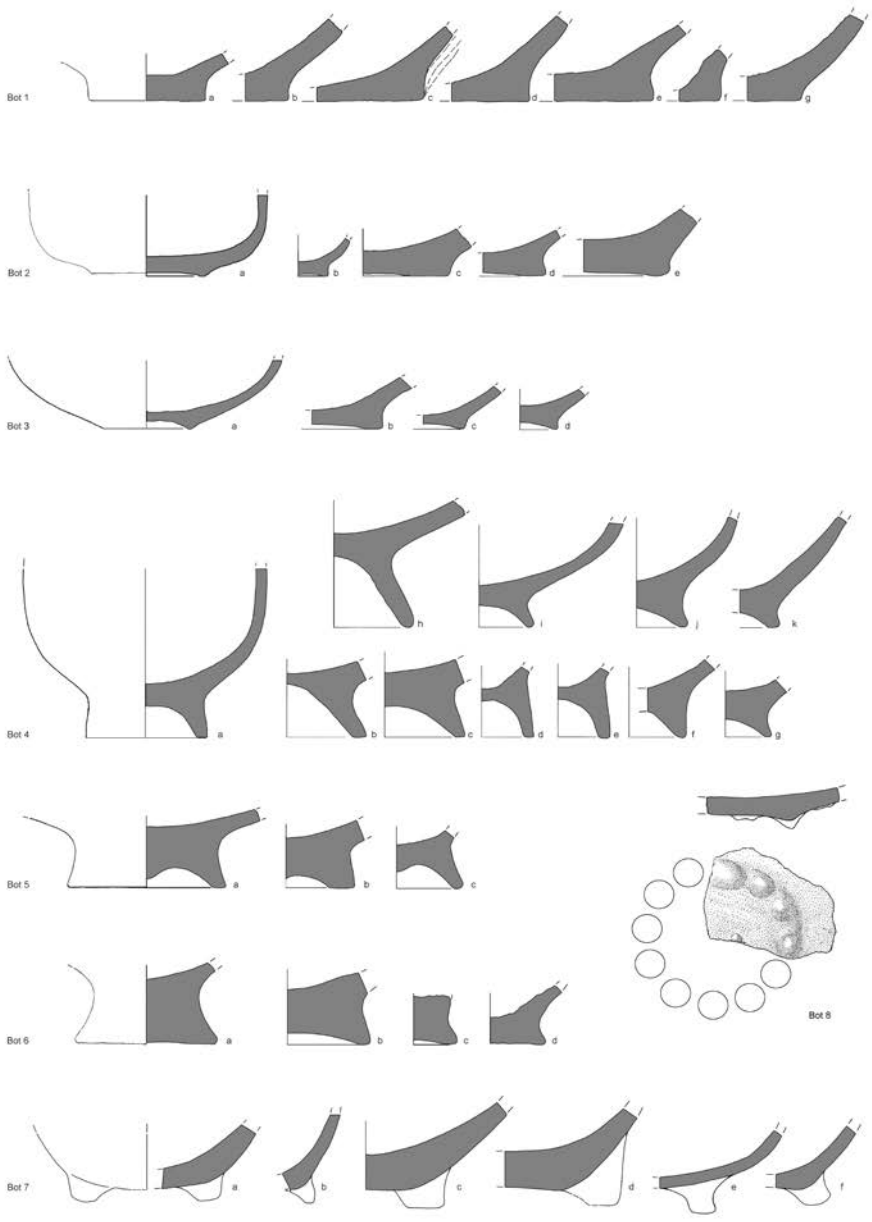


Fig. 10 Typology of the Early Neolithic ceramic vessels bottom types from Bucova Pusta IV.

3). Some small pots are conspicuous in the material, which seem to imitate the larger pots in their profiling, but also in the incised decoration and the humps attached to the centre of the belly (Pl. 51,10.12; 58,3; 59,8). Determination of the function of these vessels must be made individually on a case-by-case basis. It is also possible that the miniature vessels are to be regarded as part of the tableware, for example as small drinking cups for special drinks. In the case of those small pots which imitate the large pots in terms of shape and decoration, one could also think of dolls' tableware, which refers to the area of children's toys. As accessories for the clay figurines, these vessels are still much too large, so that this area can be excluded.

Bottom shapes

The Early Neolithic vessel bottoms display a wide range, but, in contrast to the mouth profiles, they can be clearly classified. Remarkably, the different types of bottoms are not characteristic

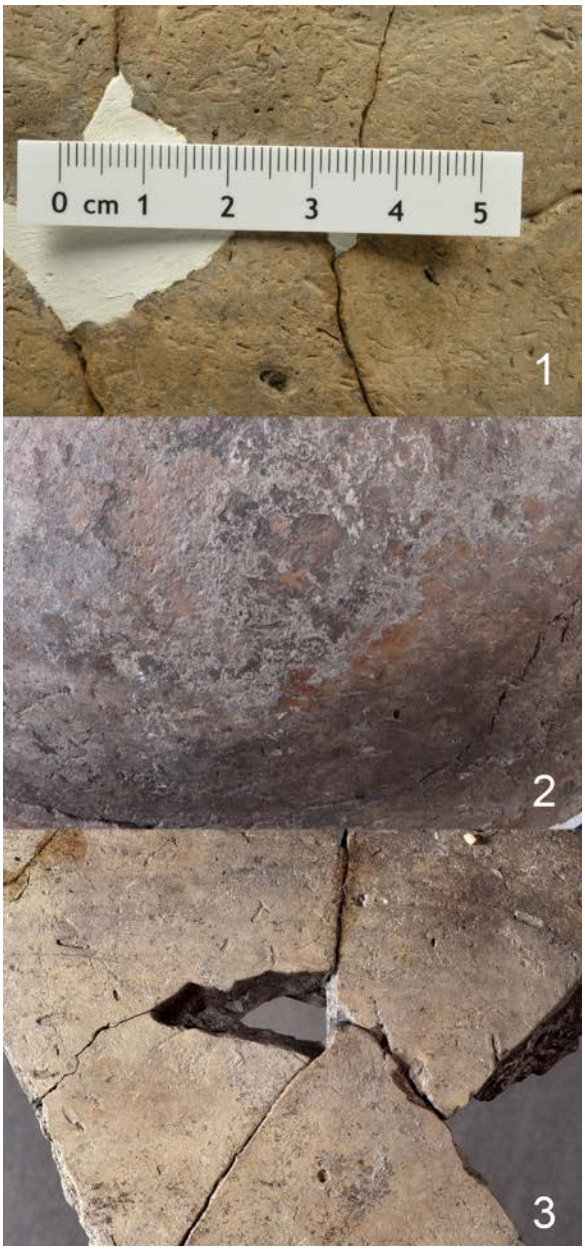


Fig. 11 Types of surface treatment of the Early Neolithic pottery from Bucova Pusta IV: 1 untreated or completely eroded surface, 2 preserved smoothed surface, 3 preserved polished surface.

of specific vessel forms, but rather occur on almost all vessel types attested here. Thus, there are bowls, mugs, plates, and pots with flat bottoms, on standing rings, hollow bases, or several feet. The following basic types of bases can be distinguished (Fig. 10).

Bottom 1: Simple, flattened bases. Variants a–g reflect the range of bottoms offset to different degrees from the body of the vessel. Some variants (c, e, and g) are slightly widened at the bottom of the vessel. Otherwise, the angles at which the vascular bodies develop from the bottoms vary.

Bottom 2: Pedestal bases with a slightly concave recessed base. Here as well, Variants a–e reflect the range of different forms of the development of the vessel body from the base. In Variants d and e, the base is slightly broader.

Bottom 3: Stand rings. In this type of base, the surface is so strongly concavely curved that a clear ring is formed on which the vessels stand. In Variant a, the vessel develops directly from the standing ring, while Variants b and c display more offset bases. There is evidence of a special form in which the rim of the standing surface is not round but angular, probably square (Pl. 52,4). This is a fragment in which it remains unclear how one single corner of the base is to be completed, and to which vessel type it is to be assigned.

Bottom 4: Hollow base. The hollow bases are not only distinguished from the standing rings by their height, but also in that they are usually clearly offset from the body of the vessel. Variants a–k reflect the range of the height of the feet and the angle of inclination of their profiles in relation to the standing surface.

Bottom 5: Hollow base with an internal hump. This is a variation of the hollow base with a central small hump at the apex of the arch of the base. As a rule, these small pegs are not so large that they touch the ground. They are only visible when the vessel is lifted. Variants a–c represent the size variance within this type, and the varying degree of the hump.

Bottom 6: Massive stand base. This is the simplest form for raising a vessel from the

Fig. 12 Red-slipped surface on Early Neolithic pottery from Bucova Pusta IV: 1 largely rubbed off , 2 preserved.

Fig. 13 Early Neolithic ceramic fragments slipped with barbotine.

Fig. 14 Rim fragment of a large Early Neolithic storage vessel with projecting rim lip, dimples in the rim and a surface decorated with fingernail impressions. The vessel was covered with fresh clay after firing, with the puncture decoration serving to improve the adhesion of the raw clay.

ground. In contrast to the hollow base, the potters here refrained from making the stand lighter by removing material. Variants b and c demonstrate an only slightly concave curved base. Variant d is less massive, but still so strongly offset from the body of the vessel that it does not belong to the category of simply flattened standing surfaces.

Bottom 7: Foot vessels. Usually there are four feet. However, there is at least one miniature vessel standing on only three feet, which is better for static reasons. With many fragments, it is impossible to decide how many feet there actually were. Variant a is with small, only slightly disembodied feet. Variant b displays small, gracefully tapered feet. In Variants c and d, the feet are flattened at the bottom, which may partly be due to the use of the vessels. In Variants e and f, the feet are sculpturally round.

Bottom 8: Openwork stand rings in the form of numerous small stand bosses arranged in a ring. There is only one fragment of this type. The flat wear marks at the tip of the preserved small bosses testify that it is not a decoration of a vessel wall, but rather a type of base decoration. This is also indicated by the curvature and thickness of the sherd.

Surface treatment

The types of surface treatment of the Early Neolithic pottery from Bucova Pusta IV are comparatively limited. Compared to the Balkan Early Neolithic, for example, the spectrum of vessel pottery comprises only coarse pottery. The vast majority of vessels evidence no special surface treatment (98 %). Only on 318 pieces could a smoothing of the surface be reliably proven, and seven vessels were additionally polished (Fig. 11). The proportion of vessels with a smoothed surface could be higher if the poor preservation is taken into account. Nevertheless, this does

Fig. 15 Variations of simple dimples, notches or finger impressions in the rim lip of Early Neolithic vessels from Bucova Pusta IV.

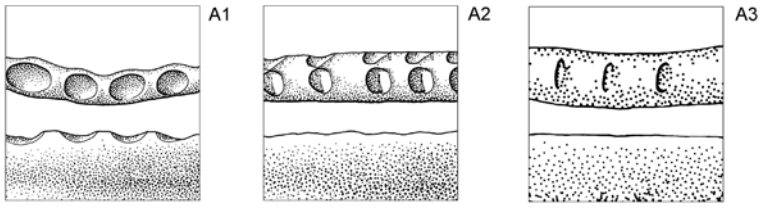


Fig. 16 Typology of Early Neolithic rim decorations from Bucova Pusta IV.

not result in any fundamental shifts in the general tendency that the vast majority of pieces were not subjected to any special smoothing. In addition, there are numerous types of plastic ornamentation on the surface for which smoothing or polishing would have been a hindrance.

A special slip with red colour, a characteristic element of Early Neolithic pottery in the Balkan region, can only very rarely be observed on the pottery from Bucova Pusta IV (Fig. 12). It is reliably attested on only 19 fragments. Here, too, there could be considerably more examples, should the conditions of preservation be taken into account. This is evidenced by the very damaged surfaces on the few fragments with a red-coloured coating.

On larger storage vessels and medium-sized pots and bowls, the surface is sometimes roughened (104 sherds). In some cases, the rough surface is due to barbotine application (Fig. 13). This is certainly attested in 10 pieces. We assume that there must have been more, but that this kind of roughening has not been preserved.

On a few pieces, it can be observed that roughening by means of punctures, fingernail impressions, or simple finger pinches served for the application of a raw clay mass after firing (Fig. 14). Since this was not fired, it is usually not preserved. Such an application would improve the thermal properties of the vessels, and may have served to insulate them, for example when cooling the contents of a vessel. However, the majority of plastic

Fig. 17
Variations of insertion decorations on Early Neolithic pottery from Bucova Pusta IV.

surface treatments will have been visible, as they are often decorative in nature. Plastic roughening by punctures, incisions, warts, or applied plastic decorations also improves the adhesion of the vessels, for example when handling them if they contained moist or even greasy contents.

Types of decorations

85 % of the Early Neolithic pottery documented is undecorated. Among the 15 % of decorated vessels and pottery fragments, there are only four pieces on which coloured painting can be reconstructed. All the other pieces are plastic types of decoration by means of punctures, impressions, incisions, or applied relief decoration. The decoration usually spares the rim of the vessels. Rims, however, may themselves be decorated, for example by notches or dimples in the lip of the rim. Some vessel bases evidence incised decoration, which is remarkable because these surfaces were hardly ever visible to the observer. Possibly, this is an indication that the target was more to roughen the surface than for any decorative purposes. Yet, this could also be a kind of product marking by an individual potter.

Rim decorations (A)

Rim decorations are an element of the oldest Balkan Early Neolithic which is preserved in the Banat until the end of the Early Neolithic (Fig. 15). A pronounced conservatism is evident here. Often, these are small depressions which were pressed into the moist clay with a finger. More rarely, a tool was used to notch the edge of the lip. Rim decoration is most common on medium-sized pots (rarely bowls) and the large storage vessels. Large

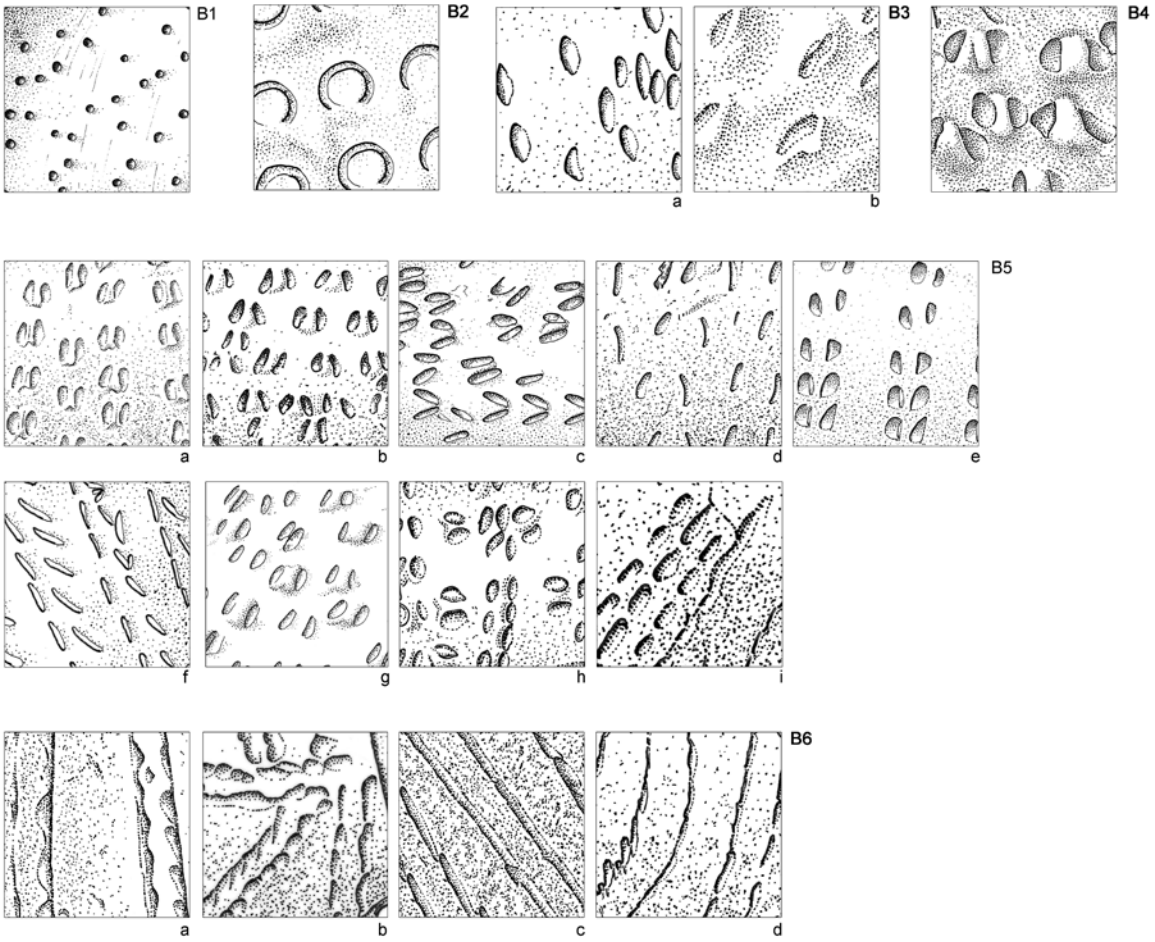


Fig. 18 Typology of Early Neolithic insertion decorations from Bucova Pusta IV.

bowls also often display rims decorated in this way. This type of decoration is attested at least 359 times in the material. The following types of decoration of the rim of vessels can be differentiated (Fig. 16):

A1: Rims with dimples in the lip rim.

A2: Rims with double dimples in the rim.

A3: Notched rims.

Insertion decorations (B)

There is a great variety of inserted decorations in Bucova Pusta IV material (Fig. 17). Sometimes the impressions were made with the help of a tool, but very often they were simply pressed into the still wet clay with fingers or fingernails. This type of surface treatment probably served not only decorative purposes but also to roughen the surface of the vessel so that it was easier to handle, especially when wet or greasy. Typologising the individual decorative techniques is almost impossible, as the variants on hardly any vessel are alike. Impression decoration was also often combined with other decorative techniques. Usually, vessels with rim decorations are also decorated with impressions on the surface. Plastic mouldings on vessels decorated with impressions are also common combinations. More rarely, incised and impressed decorations occur on the same vessel. Among the B6 Variants, the punctures are set so close together that furrow stitches and sometimes even incisions are produced. The various types of incised decoration are attested at

Fig. 19 Variations of incised decorations on Early Neolithic pottery from Bucova Pusta IV.

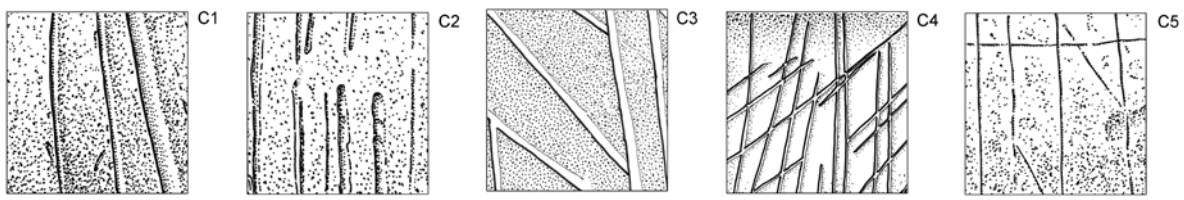


Fig. 20 Typology of Early Neolithic incised decorations from Bucova Pusta IV.

Fig. 21 Variations of applied mouldings on Early Neolithic pottery from Bucova Pusta IV.

least 2186 times in the material. Roughly, they can be divided into the following categories (Fig. 18):

B1: Small punctures with the help of a pointed tool.

B2: Ring-shaped punctures with the help of a tubular tool.

B3: Simple, disorderly fingernail impressions. Variation a, without visible ridges; Variation b, with protruding ridges.

B4: Simple, disordered fingernail punctures.

B5: Ordered fingernail punctures. The different Variants a–i are merely examples of the range of decorative patterns.

B6: Furrow stitches from fingernail indentations. In Variants a, b, and d, the fingernail impressions are still clearly visible. Variant c already forms a transition to incised ornamentation.

Incised decorations (C)

Incised decorations may have been made with the help of a tool, but also with the fingernail. The individual types of incised decoration are also difficult to classify. Incised decorations are also found on some vessel bases (Fig. 19). Compared to the inserted decorations, incisions are much rarer in the Bucova Pusta IV material. Accordingly, the variety of incised decorations is also smaller. They were found on at least 336 vessels and vessel fragments. The incised decorations can be roughly classified into the following five groups (Fig. 20).

C1: Broad, parallel incised lines.

C2: Broad, parallel incised lines with interruptions.

C3: Broad, disorganised, partially overlapping incised lines.

C4: Fine, crossing incised lines.

C5: Fine incised lines crossing each other at right

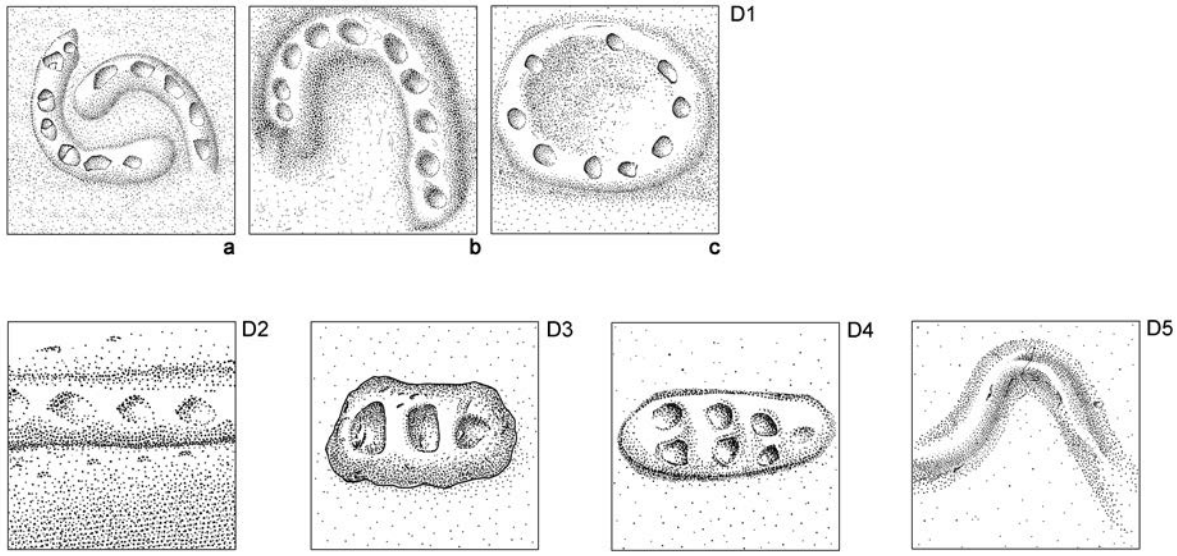


Fig. 22 Typology of Early Neolithic applied mouldings from Bucova Pusta IV.

angles.

Applied mouldings (D)

Plastic mouldings are among the simplest types of profiled decoration (Fig. 21). In some cases, they could be imitations of wide cords used in the making of the vessels, for example to prevent the vessels from breaking during the drying process. Short mouldings seem to be constructive elements, such as simple handles. Still others are purely decorative. Plastic ledges could be detected 186 times in the material. In general, there are single-row and double-row polka dots, which are either short or long. The following classification system can be applied (Fig. 22):

D1: Ornamental mouldings with finger spots. Variant a consists of two interlocking arches; Variant b, simple hook pattern; Variant c, circular motif.

D2: Circumferential plastic finger-dotted moulding.

D3: Short tang with finger dots.

D4: Short tang with double finger dots.

D5: Plastic moulding without finger dots.

Disordered plastic wart or nipple (E)

This is a simple type of surface roughening by subsequent application of coarse clay (Fig. 23). This type of surface treatment merges smoothly into barbotine application. Patterns are rarely recognisable. This type of surface roughening could be detected 600 times in the material. No system can be applied here because there are no two vessels with similar types of surface roughening. The three classes suggested here are therefore to be regarded merely as variants of this type of decoration (Fig. 24):

E1: Small humps or nipples of similar size and at comparatively regular intervals.

E2: Larger warts of indeterminate shape and with rather angular contours.

E3: Irregular plastic bodies applied to the surface of the vessel at wide intervals.

Fig. 23 Variations of disordered plastic warts or nipples on Early Neolithic pottery from Bucova Pusta IV.

Fig. 24 Typology of Early Neolithic disordered plastic warts or nipples decorations from Bucova Pusta IV.

Ordered plastic decorations (F)

Medium-sized vessels and especially large storage vessels often display relief decoration alongside various types of incised and impressed decoration on the belly (Fig. 25). Some may have served as handles, others are purely decorative. The various bosses appear comparatively standardised, but the relief decorations are very individual. This ornamental style could be documented a total of 352 times. If one wanted to systematise the great diversity of ordered plastic decorations, the following classes could be applied (Fig. 26):

F1: Single hump.

F2: Single hump with central dimple.

F3: Sculptured ring.

F4: Split hump.

Fig. 25 Variations of ordered plastic decorations on Early Neolithic pottery from Bucova Pusta IV.

F5: Hump modelled out with finger pinches.

F6: Double hump. Variant a, horizontal; Variant b, vertical; Variant c, horizontal, elongated humps; Variant d, horizontal humps with a central dimple.

F7: Row of several humps. Variant a, of simple bosses; Variant b, of split bosses.

F8: Ornament of plastic mouldings in the shape of a rhombus.

F9: Sculpturally modelled spiral motif.

F10: Sculptured figurative representation.

Vessel painting (G)

Vessel painting is very rarely found in

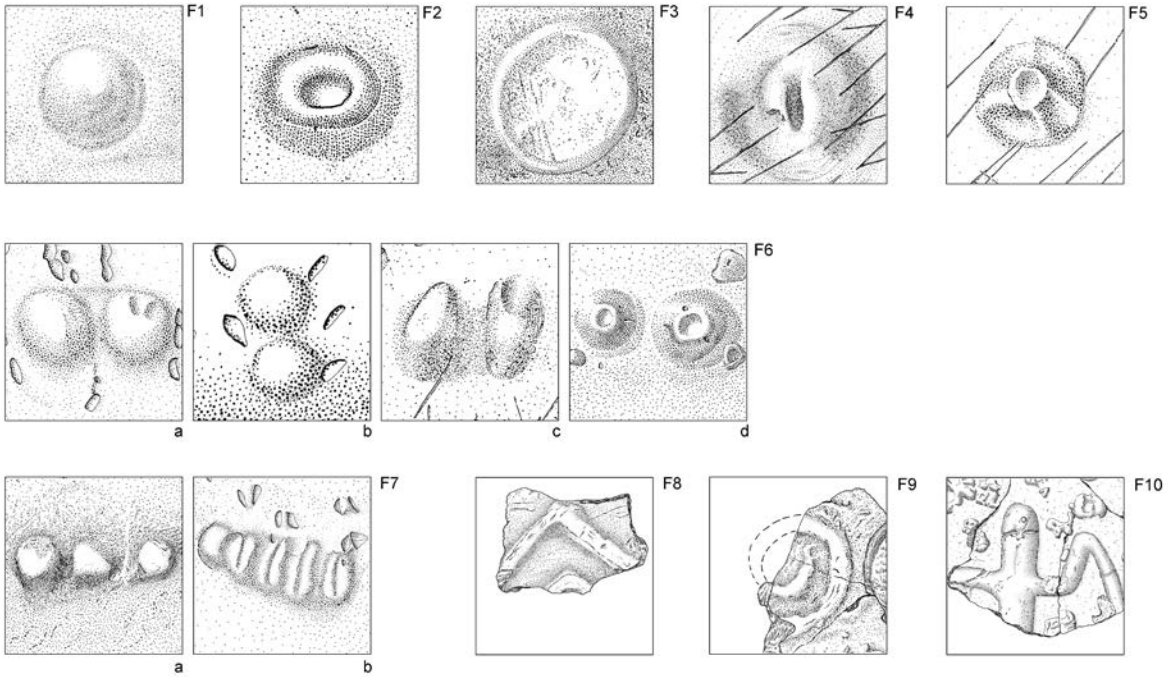


Fig. 26 Typology of Early Neolithic ordered plastic decorations from Bucova Pusta IV.

the Early Neolithic material from Bucova Pusta IV. Due to the damaged surfaces, the proportion could have been much higher, but it cannot be proven. Among the four fragments with painted remains are two bowls with a broad zig-zag motif applied with dark paint to the lighter clay ground (Fig. 27–28). Traces of painting were also found on two other fragments. For the time being, it remains unclear which painting materials were actually used. According to the structure, this could be a mineral-coloured clay slip.

3. Observations on the production technique and use of Early Neolithic pottery

Local clay resources were available in sufficient quantities as raw material for pottery production. The loess-rich soil was already suitable for plastic modelling. In many places around the settlement, there are also finer clay deposits which could be extracted without deep soil intervention. The lean components of the Early Neolithic pottery were primarily organic admixtures. These were produced during grain processing, for example as straw or chaff. Animal dung (from sheep, goats, or cattle) could also have been used as an additive.

The vessels were modelled in bead technique, and then more or less carefully formed by hand (Fig. 29). There is little evidence that mats or boards were used as supports for turning the vessels. Only very few vessels are exactly round, and so there is some evidence that the vessels were modelled with only a few technical aids. Some of the bony spatulas may have been used to compact the surfaces. After the first drying, the plastic decorations were applied to the surface, or the plastic elements were glued on (Fig. 30). Only very few sherds demonstrate a subsequent slipping of the vessels with liquid clay. This is certainly true for all vessels with barbotine application and for the plastic decoration Type E. Plastic decorations were also applied in a leather-hard state, and the surface was then smoothed again. Siltation can be assumed on all vessels covered with red paint. Only a few sherds

Fig. 27 Remains of painting on an Early Neolithic small pot, apparently a zig-zag band painted with dark paint on a light background. Bucova Pusta IV, Feature B9.

Fig. 28 Remains of painting on an Early Neolithic small pot. Bucova Pusta IV, Feature G6. The shiny surface is due to an over-restoration of the vessel. Originally it was comparable to the one in Fig. 27.

show traces of more thorough smoothing or polishing.

The firing of the pottery could have been done on site in the numerous kilns which were found. Reliable evidence for the firing of pottery at the site is provided by misfiring (Fig. 31), which was mainly found in the backfill of the kidney-shaped pit G/H 1, which was adjacent to large earthen kilns (G12 and K12). The firing temperature was 700–800°C max. and thus comparatively low. Different colourings of the sherds indicate that the oxygen supply in the kilns could only be poorly controlled. Open pit firing would also have been possible. On some pots with surfaces roughened by impressions, an application of fresh clay after firing can be detected. It is therefore possible that the patterned surface also had the purpose of enabling better adhesion of this clay mass.

Overall, pottery production appears to be less specialised, and could have been carried out at home. Individual decorative techniques point to individual potters who, however, were not exclusively entrusted with this work. Rather, there are indications that many people were occupied with pottery making at certain times of the year, who otherwise also performed other activities.

Samples for content analyses were taken from a wide range of the pottery, but their results are still pending. We assume that the small vessels (Bowls and Small Pots) served as tableware. The handiness of these forms is striking, and one can drink or eat directly from them without the aid of eating utensils. We consider the use of the bony spatulas as eating spoons (cf. Stefanović et al. 2019) unlikely. Compared to the number of eating vessels, the bony spatulas are clearly underrepresented. This is true not only for Bucova Pusta IV, but for all Early Neolithic settlements in the Balkan Carpathian region. At the very least, we would like to question a primary use of the spatulas as spoons for eating. That bite marks of small children can be found on the spatulas is normal, because babies and small children bite into many

Fig. 29 Structure of Early Neolithic vessel pottery in bead technique. In poorly worked vessels, the sherds break along the individual segments. One can see how the vessel wall was raised in several steps on the vessel base.

Fig. 30 Plastic ornamental elements of Early Neolithic pottery that have fallen off the surface. The siltation of the vessels after the application of the relief decorations is clearly visible.

Fig. 31 Misfiring of an Early Neolithic bowl on four small feet. Bucova Pusta IV, Feature G-H1.

Fig. 32 Large ceramic cooking pots with stews at the wine festival in Zrenjanin in the summer of 2013. Noteworthy are the decorative elements of surrounding plastic mouldings as well as inserted and incised decorations.

things in the household. One would be surprised how many children's bite marks could be found in our own households, were one to specifically look for them. Rather, an interpretation of the spatulas as instruments for pottery production (cf. Zidarov 2014) is plausible. The main argument for this is the asymmetric abrasion of the spatula heads, in some cases to the point of being completely worn.

Mugs and jugs could have been used to store and serve liquids. The cord loops on the jugs (Jug 1 and Jug 2) and bottle-like large vessels (Jug 3) might have served to attach carrying straps. The narrow mouths of the jars make them very suitable for carrying liquids.

The medium-sized pots (Pots) are suitable for food preparation and storage. We hope especially to obtain good results from the content analyses with these forms, as many of them have macroscopically visible attachments of organic material. Animal bones were also found in some of these vessels, which could have come from food remains.

The very large bowls (Big Bowls) may also have served to present food. They may also have been used to store durable, dry foodstuffs. The large pots (Big Pots) are ideal storage vessels for liquids and solid food. From the decoration of their surface, they will have been free-standing vessels. Evidence of storage vessels sunk into the ground in the manner of pithoi could not be found at Bucova Pusta IV. In the Serbian part of the Banat, stews are still prepared directly in such large vessels, especially at large folk festivals (Fig. 32). Similar to the ethnographic examples, the vessels would then have to have been heated slowly, directly over the embers, because evidence of cooking stones has not been found in Bucova Pusta IV either. Here again, the general lack of stones in the natural area comes into play.

4. Special ceramic items

Four-legged tables

The classical form of the so-called „altars" in the shape of a four-legged table on which a bowl is placed is attested in Bucova Pusta VI in large numbers. Not a single example has survived in its entirety, and it even appears that these objects were deliberately destroyed. In many cases, only the feet have survived,

Fig. 33 Two matching fragments of a four-legged small table. The bowl on top is broken off. An incised zig-zag decoration is visible on the sides. Bucova Pusta IV, Features I7 and I–J 3.

Fig. 34 A completely preserved miniature table. The small bowl protruding from the tabletop is clearly visible. Bucova Pusta IV, Feature G6.

Fig. 35 Strongly stylised figural object (idol?) on a round base. Bucova Pusta IV, Feature I7.

recognisable because of their characteristic round to triangular cross-section. Some of them are decorated with longitudinal incised lines. One example has an incised decorative motif of zig-zag lines on the edge of the table, which can be considered a typological rudiment (Fig. 33; Pl. 62,1). The older small tables of the Balkan Early Neolithic often have a plastically modelled sequence of hanging triangles at this point. The bowl itself is not preserved on any of the fragments. However, a completely preserved miniature table shows how the forms can be completed (Fig. 34; Pl. 62,4). At least one miniature specimen has also survived from the rescue excavation at Hódmezővásárhely-belterület. The decoration with zigzag lines on the sides can be traced as far afield as the Alföld. The same applies to the design of the corners in the form of animal heads, which is rare in the Balkan region, but is documented on at least one a few examples from Röszke-Lúdvár and Hódmezővásárhely-Kotacpart (Trogmayer et al. 2005, 21).

The angular objects depicted on Plate 62,5–8 are possibly to be regarded as an independent type of table. One of them (Pl. 62,7) has slight incised decorations on all sides. The possible table fragments on Pls. 62,5 and 62,8 are pierced transversely. In total, there are 16 fragments of tables from Bucova Pusta IV and the mentioned complete miniature example

Fig. 36 Fragment of a larger clay figure modelled over a core. Bucova Pusta IV, Feature T4.

Fig. 37 Torso of an early Neolithic anthropomorphic figurine. Bucova Pusta IV, Feature B2. On the rod-shaped head, the eyes are visible as small slits next to the nose modelled out as a hump.

(Plate 62,4). The Carpathian specimens seem to be exclusively quadrupedal and square.

There has already been much speculation about the function of these objects. They also exist in Bulgaria in triangular form and then with only three legs. The Veliko Tarnovo Museum keeps a small table from Kachitsa in which the lower part of an anthropomorphic figurine sits. I have interpreted these tables accordingly elsewhere (Krauß 2014, 145–147). The figurines of the Balkan type are often shaped in such a way that they can be both stood up and sat down. In a sitting position, they fit well into the tables. The tables would then not only be the place where the idols were kept, but in a metaphorical sense they served as thrones for these persons. Remarkably, the number of figurines in the Early Neolithic settlements roughly corresponds to the number of tables found. In any case, the bowl firmly attached to the table was used to store or present things. Like the ceramic figurines, the tables are usually fragmented. The fractures indicate that these are not simply taphonomic changes, but that these objects were deliberately destroyed and thus rendered unusable.

Clay figurines

There are some larger pieces of fired clay for which their surface indicates that they were neither construction elements of houses nor of clay weights, but may rather have belonged to large-scale figures. One piece on a round base has an angular body ending in a kind of bird's beak at the top (Fig. 35; Pl. 63,1). In his diary, Kishléghi depicted a similar stone object standing on a comparable round base (Nagy 2015, 45). The origin of

Fig. 38 Fragment of a large Early Neolithic storage pot with the relief depiction of an anthropomorphic figure against the background covered with ring-shaped small humps. Bucova Pusta IV, Feature I8.

the piece is unclear; it is said to have come from Bohemia. Three other pieces of rather unclear shape show that they were built up in several layers (Pl. 63,2–4). Eszter Bánffy was able to prove through a computer tomography for a monumental figure from Szakmár-Kisülés that it was built up in at least three layers (cf. Bánffy 2019, 33–46). It seems that these objects are typical for the Körös area, as several of them are mentioned as parallels. The question arises whether this manufacturing must have been connected with ritual practices or whether this type of construction is simply necessary for such large figures in terms of fabrication. In the case of one piece (Fig. 36; Pl. 63.4), the core over which the outer shell was built can still be seen on one broken side. Comparable is an object from the old excavation of Kishléghi, which also comes from Bucova Pusta IV (see Chapter 3, Fig. 15).

Only a few small-sized figurines hail from the site of Bucova Pusta IV. These are small figurines the anthropomorphic pictorial intentions of which are evident. The head of a figure with an elongated neck and an extremely reduced face, only indicated by a slightly protruding nose and two slits marking the eyes, is broken off in the chest area (Fig. 37; Pl. 64, 1). This is obviously a very typical type of idol for the Körös area. Parallels can be found in Röszke-Lúdvár, Hódmezővásárhely-Kopáncs, and Hódmezővásárhely-Kotacpart (Trogmayer et al. 2005, 15–17). This type of representation corresponds to the figure depicted in relief on the sherd of a large storage vessel (Fig. 38; Pl. 60,11). Unfortunately, not much of this figure has survived. The left arm, however, seems to be holding something, perhaps a rope. It was possibly part of an entire group of figures. This would be something special because usually only single persons or animals (mostly with horns) are depicted on large storage vessels of the Körös culture. An interesting aspect is that this type of representation appears both as an idol and as relief decoration on a storage vessel. Possibly the same personality or mythological figure is meant here. The figure on the vessel

Fig. 39 Roughly stylised anthropomorphic plug idol. Bucova Pusta IV, Feature H3.

Fig. 40 A simple little clay figure with a suggested nose. Bucova Pusta IV, Feature L12.

Fig. 41 Coil-shaped small clay figure with hair (?) indicated as incised lines on the upper edge. Bucova Pusta IV, Feature G–H1.

is depicted in the midst of ring-shaped humps which resemble the background of a starry sky. The fact that the constellation above the figure is reminiscent of the constellation of the Big Dipper could be a coincidence.

A plug idol of the Körös type with an oversized nose has two small arm stumps on its sides (Fig. 39; Pl. 64,2). This piece is also very typical of the region's Early Neolithic, despite the strong stylisation of the human form. Comparable figures come from Szeged-Gyálarét, Röszke-Lúdvár, and Hódmezővásárhely-Kopáncs (Trogmayer et al. 2005, 15–17). A characteristic feature of these idols is their vertical piercing, which allowed them to be placed on a stick. In our piece, the hole is continuous; in other examples, a hole has only been drilled in the figure from the lower end. These are therefore plug-in figures which could either be combined with others, or played with in the same way as hand puppets.

A small, roughly cylindrical object has a small hump at its upper part, which could suggest a nose or a bird's beak (Fig. 40; Pl. 64,3). Similarly minimalist in shape is a spindle-like figure with fine indentations on the top edge which could suggest hair (Fig. 41; Pl. 64,4). Both objects are shaped like today's game pieces (for chess, for example). Especially the piece with the small snub nose finds numerous equivalents in the Körös area (Trogmayer et al. 2005, 15f.). Often, these figures have the characteristic slit eyes, but there are also examples like ours, simply with a small hump suggesting the nose.

Another figure has an unusual shape, consisting of a round body with two tails (Fig. 42; Pl. 64,5). Seen from the side, this idol is reminiscent of a chicken with a head and tail. This piece, however, fits into a group of figurines in which the horned head of a cow is the focal point (Bánffy 2019, 47–57). Representations of cattle and especially their

Fig. 42 Small horn idol made of fired clay. Bucova Pusta IV, Feature G7.

Fig. 43 Three matching pieces of a clay idol in the shape of a "bread loaf". Bucova Pusta IV, Features G6 and H9.

horned heads have a special significance in the Neolithic of Anatolia, and from there also in Europe (Krauß 2016). Only against the background of other, similarly abstracted representations of cattle from the Early Neolithic in the Carpathian Basin does this small figure become understandable. It fits easily into this group of simple horned idols. The fragment on Plate 64,7 should be seen in the same context. There, too, it was sufficient to simply indicate the animal horns in order to do justice to the image's message. A small pendant made of fired clay with a round body and a sharpened end (Pl. 64,6) represents a common form in the region. It is decorated with fine incisions on the sides.

Since we know the structure and typology of Early Neolithic vessel pottery well, some arch-shaped fragments with a round cross-section can hardly be considered vessel handles (Pl. 64,8–10). It is also possible that these are fragments of figurines or ring fragments.

Bread loaf idols

A special feature of the region is hand-shaped, elongated rectangular to oval clay

Fig. 44 Burnt loom weights in different size classes. Bucova Pusta IV, Feature S24.

objects. They are reminiscent of small loaves of bread (Pl. 65). Of course, we do not know what function these objects originally had. One striking feature is their handiness. In this respect, they are very individually designed. Significantly, their ergonomic shape is reminiscent of today's smartphones. It is this handiness that makes them individual, even personal objects. Some of these items have a small depression in the centre from an impression with the thumb (Fig. 43). These small loaves are also heavily fragmented. In respect to these pieces, few parallels can be pointed out on a large scale in the Balkans. However, they seem to be typical for the Early Neolithic of the northern Banat. Numerous complete specimens have been documented on the Movila lui Deciov (ongoing excavations by the authors of this volume), and there is even a stone piece of such an idol from this site in the private collection of Constantin Kalcsov. If there is one object which indicates individuality in respect to its manufacture, but possibly also of individual ownership, it is these small handy loaves.

Rings and tokens

At the site of Bucova Pusta IV, numerous small rings and sticks made of clay were documented. A simple way of making a pendant or token was to pierce a ceramic sherd, and then grind it until it was circular (Pl. 64,11–12). Either before grinding or afterwards, the pieces could be drilled through (Pl. 66,15–21). Besides completely pierced sherds, there are also pieces with perforation started and not completed, mostly from both sides, but in some cases only from one side. It is also conceivable that these sherds, which were not completely pierced, simply served as drilling supports for piercing softer materials (fur, leather, bone). The completely pierced pottery sherds could also have served as spinning whorls or as rotating weights in spinning tops, as they are also used as toys. Other uses, such as tokens, small

Fig. 45 Large clay weights in their find context at the bottom of the large pit Feature S24.

weights (here again the general lack of stones comes into play), or ornamental elements would also be conceivable.

Rings cut from stone (Pl. 66,1), bone, or shells (Pl. 66,4) were also found. In one of the rings, the raw material consists of petrified wood (lignite), which was a rare raw material in the Early Neolithic of the Banat, but which has also been evidenced elsewhere (Pl. 66,3). These objects could have been used as jewellery, game pieces, or counting aids. No indications of their function were found.

However, there are also rings and small rods formed from plastic clay (Pl. 66,6–14). Especially the piece on Pl. 66,14 is reminiscent of a small wheel with a thickened wheel hub. Either it is an early wheel model, which seems unlikely due to the chronology, or a spinning whorl for yarn production or a rotary weight for a spinning top.

Clay weights

A peculiarity of the landscape in the northern part of the Banat is the complete absence of stones. The geological subsoil in the nowadays flat plain is completely covered with aeolian or fluvial sediments. The numerous rivers in the area also flow very slowly, and meander through the land due to the low slope of the terrain. Their flow velocity is so low that they do not carry any gravel, and are muddy at the bottom. For any activity usually involving the use of stones, the people of the Banat had to make do with other materials. This shortcoming provides archaeologists with a unique opportunity to gain insight into activities which are otherwise not visible or not very visible. The use of malleable clay as a working material made it possible to shape the objects freely according to the respective need, and then to use them either immediately or after they had been hardened in the fire.

This explains the large number and variety of clay weights found in Bucova Pusta IV. Since the pieces were most likely made on demand, spontaneously, and individually, they can hardly be classified. A distinction must be made between smaller, more or less standardised weights, such as those which may have been used in looms, and larger weights which vary greatly in shape.

The smaller clay weights must indeed have been standardised if they were used as weights in a loom, as the warp threads should have a more or less uniform tension (Fig. 44; Pl. 69). These small weights, which are either oval, conical, or flattened rectangularly, are available in two weight classes of about 70–125 g and 250 g. These pieces were fired before use, and usually show signs of wear on the holes. There are no surviving decorations on these weights.

The larger weights often display fingerprints. Some are completely pierced, others only partially, or not at all. The complete pieces weigh between 90 and 880 g (Pl. 67-68, 70-71). There are misshapen lumps, only roughly pressed together, and very elaborately worked shapes with several grooves. Some are reminiscent of shamrocks or crosses, others are more elongated to tubular in shape. They come in various stages of production, from roughly portioned clay to fully formed weights. This indicates that they were often made ad hoc, as needed. Some of the unfinished pieces have apparently been preserved by secondary firing, and were originally used in an air-dried state. The wide range of shapes suggests that they were made for different purposes. Some are shaped like flowers or exotic fruits, have a very smooth surface, and seem to belong more to the realm of figurative representations (Pl. 70,2; 71,7-8). In addition to a single or multiple piercing, there are also quite a few pieces with grooves, which could also have been laced with ropes from the outside (Pl. 67,3; 70,4; 71,2). Especially the cloverleaf-shaped pieces seem to have been used as coils. Other pieces are not pierced throughout, and seem to have been set on sticks. The pieces which are completely pierced are most likely to have been used as weights. There are clear signs of fishing in the Early Neolithic settlement at Bucova Pusta IV. In order to lower nets, weights were needed, which in the absence of stones were made of baked clay. Feature S24 below the Early Neolithic child's grave consists of a large pit containing a total of 43 complete and another 19 fragmented clay weights. The position of these pieces shows that they were strung on a rope (Fig. 45). It is possible that a fishing net was lying there. Other uses are also conceivable. In the Tornyai János Museum in Hódmezővásárhely, a model of an Early Neolithic house from Tiszajenő-Szárazpartról is on display, in which clay weights are used to tension ropes tethering the straw covering of the roof.

6. Catalogue

The following catalogue is structured in such a way that, as a rule, the drawing number is mentioned first (DNr), followed by the corresponding archaeological context (Feature). This is followed by an assignment to one of the described vessel types, as far as this was possible. In the case of fragments, a distinction was made between rim, middle, and base sherds. Then, for the majority of the pieces, an assignment to the ware group (Fabric group), the type of surface treatment, and the typology of any decoration present followed.

Vessel shapes

Bowl 1:
Open bowl with straight walls
Bowl 2:
Open bowl with slightly curved rim lip
Bowl 3:
Open bowl with bent wall
Bowl 4:
Shallow bowl with dome-shaped to straight profile

Small Pot 1:
Shallow pot with deep-seated belly bend
Small Pot 2:
Wide-mouthed pot with straight or S-shaped rim
Small Pot 3:
Spherical pot with no or only slightly stepped rim
Small Pot 4:
Spherical pot with clearly defined rim

Pot 1:
Bellied to spherical pot with set rim
Pot 2:
Bellied to slender pot
Pot 3:
Tall pot with tapered top
Pot 4:
Tall, cup-like pot with straight to slightly flaring lip

Mug 1:
Open mug with straight to slightly open rim
Mug 2:
Slightly closed mug with set rim

Jug 1:
Jug with the neck clearly offset from the shoulder
Jug 2:
Wide-mouthed jug with soft transition from shoulder to rim
Jug 3:
Bottle-like form with narrow, high neck

Storage Pot 1:
Pot with spherical body and narrowed mouth
Storage Pot 2:
Spherical pot with wider mouth
Storage Pot 3:
Wide-mouthed pot with pronounced S-profile

Big bowl 1:
Tall bowl with rounded walls
Big bowl 2:
High bowl with largely straight walls
Big bowl 3:
Flat bowl with straight to slightly curved walls
Big bowl 4:
Flat bowl with curved, dome-shaped walls

Bottom shapes

Bottom 1:
Simple, flattened base
Bottom 2:
Pedestal base with concave recessed base

Bottom 3:
Stand ring
Bottom 4:
Hollow base
Bottom 5:
Hollow base with internal hump
Bottom 6:
Massive stand base
Bottom 7:
Foot vessel
Bottom 8:
Small stand bosses arranged in a ring

Types of decorations

A1:
Rim with dimples in the lip rim
A2:
Rim with double dimples in the rim
A3:
Notched rim

B1:
Small punctures of a pointed tool
B2:
Ring-shaped punctures of a tubular tool
B3:
Disorderly fingernail impressions
B4:
Disordered fingernail punctures
B5:
Ordered fingernail punctures
B6:
Furrow stitches from fingernail indentations

C1:
Broad, parallel incised lines
C2:
Broad, parallel incised lines with interruptions
C3:
Broad, disorganised, overlapping incised lines
C4:
Fine, crossing incised lines
C5:
Fine incised lines crossing in right angles

D1:
Ornamental mouldings with finger spots
D2:
Circumferential plastic finger-dotted moulding
D3:
Short tang with finger dots
D4:
Short tang with double finger dots
D5:
Plastic moulding without finger dots.

E1:
Small humps or nipples in regular intervals
E2:
Larger warts with angular contours
E3:
Irregular plastic bodies applied at wide intervals

F1:
Single hump
F2:
Single hump with central dimple
F3:
Sculptured ring
F4:
Split hump
F5:
Hump modelled out with finger pinches

F6:
Double hump
F7:
Row of several humps
F8:
Plastic mouldings in the shape of a rhombus
F9:
Spiral motif
F10:
Sculptured figurative representation

G:
Vessel painting

Plates

1 DNr 89d; ID 489; Feature A10; Pot; middle fragment; Fabric Group 1 surface untreated; decoration D2.

2 DNr 92a; Feature A5/48; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F3.

3 DNr 85a; Feature A12-A13; Big Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5h.

4 DNr 88a; Feature A8/58; Mug or Jug; rim fragment; Fabric Group 1; surface untreated; undecorated.

5 DNr 88b; Feature A8/67; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F2.

6 DNr 89e; Feature A10/80; Pot; middle fragment; Fabric Group 3; surface untreated; decoration F1.

7 DNr 95d; Feature A13/114; Pot or Storage Pot; middle fragment with plastic ledge; Fabric Group 2; surface untreated; undecorated.

8 DNr 95b; Feature A13/111; Pot; middle fragment; Fabric Group 3; surface untreated; decoration B3b and F6a.

9 DNr 95a; Feature A13/108; Pot; middle fragment; Fabric Group 3; surface untreated; decoration B4.

10 DNr 92b; ID 329; Feature A5/49; Storage Pot or Big Bowl; middle fragment; Fabric Group 2; surface untreated; decoration D2.

11 DNr 95e; ID 653; Feature A13/112; Pot; middle fragment; Fabric Group 3; surface untreated; decoration F2 and B4.

12 DNr 95c; Feature A13/112; Pot or Big Bowl; middle fragment; Fabric Group 3; surface untreated; decoration B4.

13 DNr 89f; ID 487; Feature A10/82; Pot; middle fragment; Fabric Group 3; surface untreated; decoration B4.

14 DNr 86c; ID 588; Feature A12-A13; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

15 DNr 90c; ID 591; Feature A12/101; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E3.

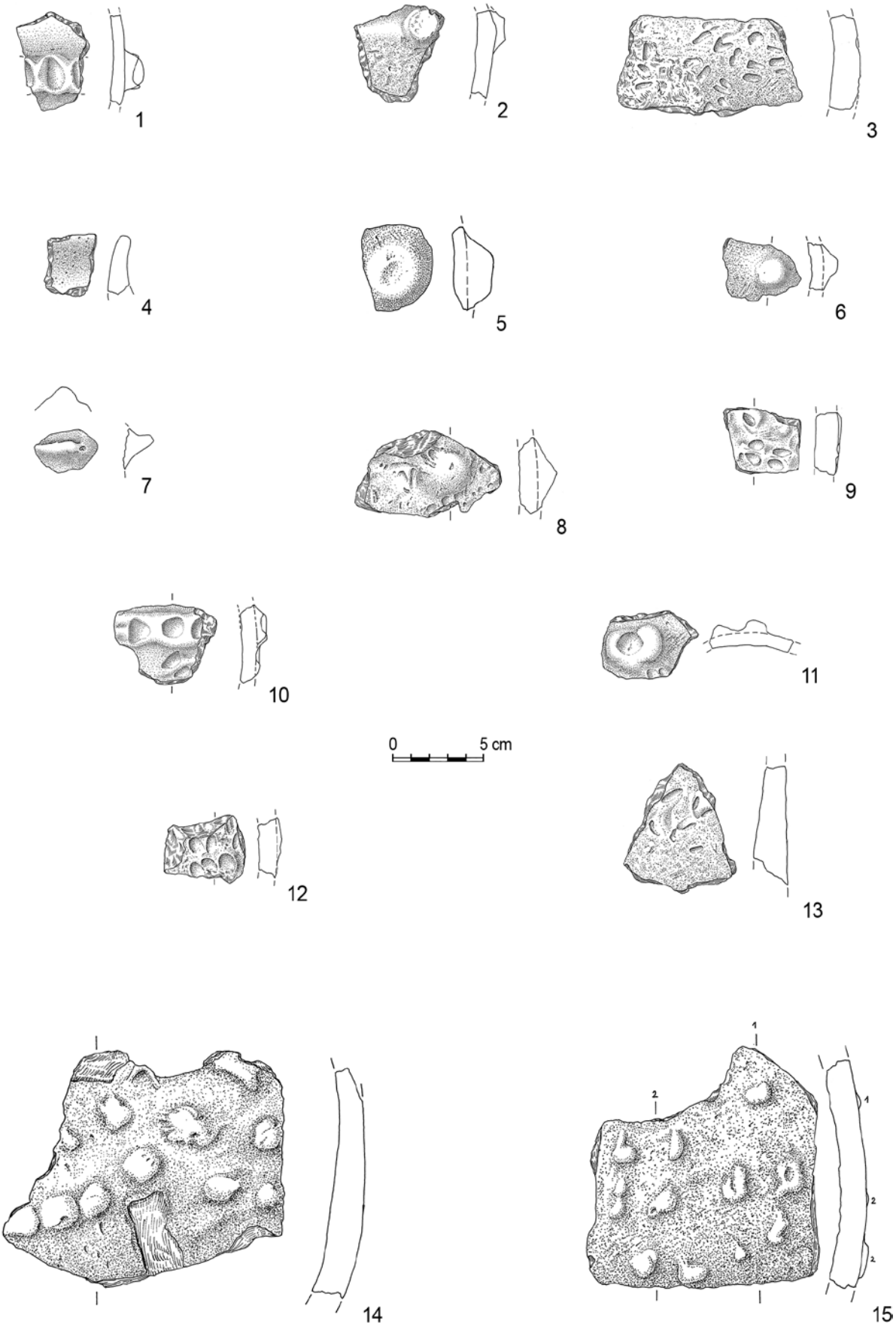


Plate I

1 DNr 85b; Feature A12-A13/160; Pot 1; rim fragment; Fabric Group 1; surface untreated; decoration A1 and B4.

2 DNr 90b; Feature A12/100; Pot; rim fragment; Fabric Group 1; surface untreated; decoration A1.

3 DNr 90a; Feature A12; Bottom 2a fragment; Fabric Group 1; surface untreated; undecorated.

4 DNr 89a; ID 490; Feature A10/74; Bottom 2c fragment; Fabric Group 3; surface untreated; undecorated.

5 DNr 95f; Feature A13/119; Pot 1; rim fragment; Fabric Group 1; surface untreated; decoration B3; max. diameter 23 cm.

6 DNr 79a; ID 24379; Feature A27/148; Bottom 1b fragment; Fabric Group 5; surface untreated; undecorated.

7 DNr 58i; ID 16302; Feature B3/64; Storage Pot; middle fragment; Fabric Group 1; surface untreated; decoration E3.

8 DNr 77j; Feature B3/50; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E2.

9 DNr 98g; Feature B2/34; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

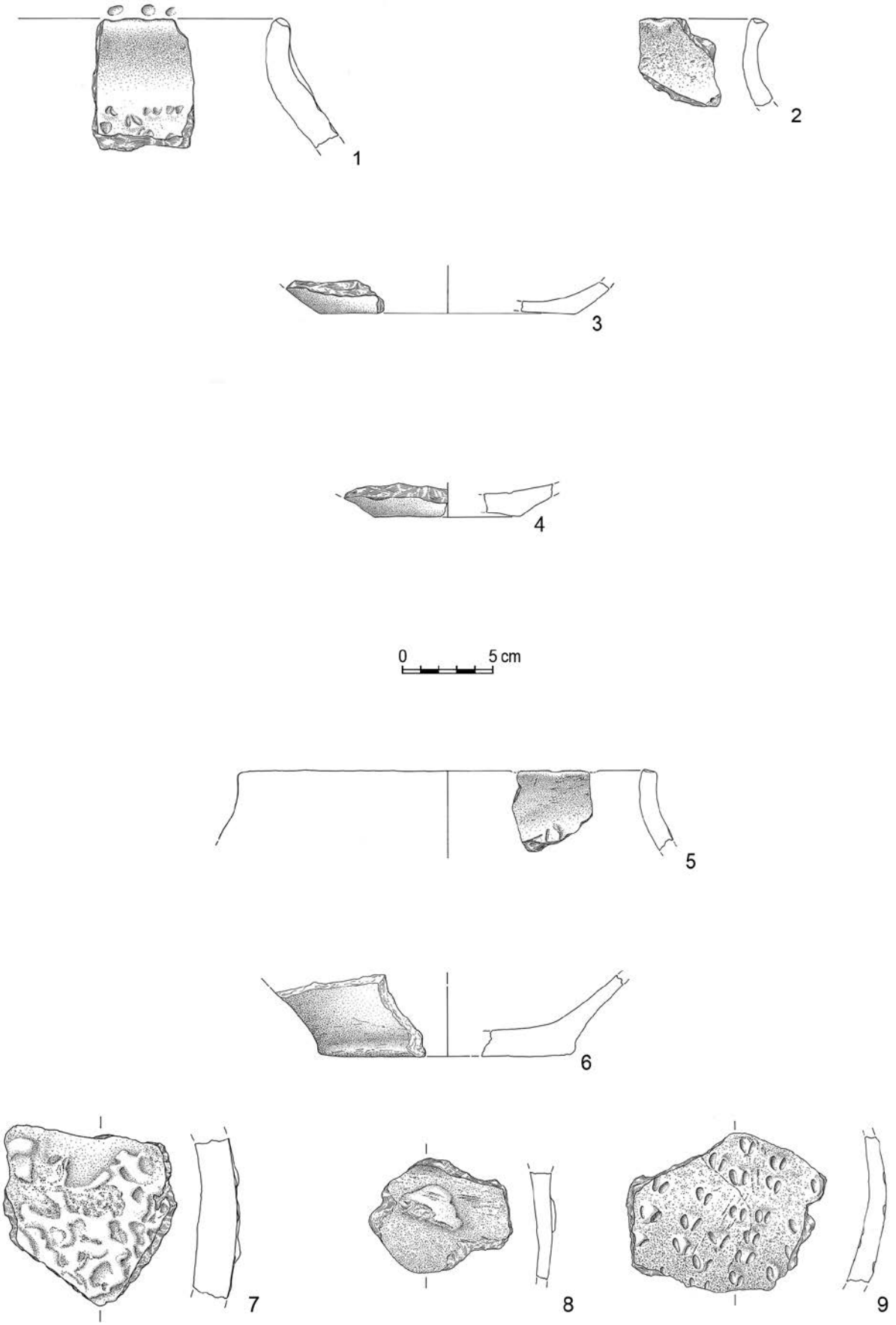


Plate 2

1 DNr 5; Feature B9/B3; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F3.

2 DNr 11c; ID 1111; Feature B1/11; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

3 DNr 98b; Feature B2/29; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F6b.

4 DNr 98e; Feature B2/32; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

5 DNr 58j; Feature B3/61; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F1.

6 DNr 77l; ID 1346; Feature B3/45; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

7 DNr 98h; ID 16305; Feature B2/36; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

8 DNr 98i; Feature B2/37; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2 and B3.

9 DNr 98k; Feature B2/39; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F6c.

10 DNr 98l; Feature B2/40; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5c.

11 DNr 98 m; Feature B2/41; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F1 and B3b.

12 DNr 98f; Feature B2/33; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5b.

13 DNr 58g; ID 16300; Feature B3/58; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E1.

14 DNr 58h; ID 16301; Feature B3/57; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E2.

15 DNr 77i; ID 1343; Feature B3/55; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6a.

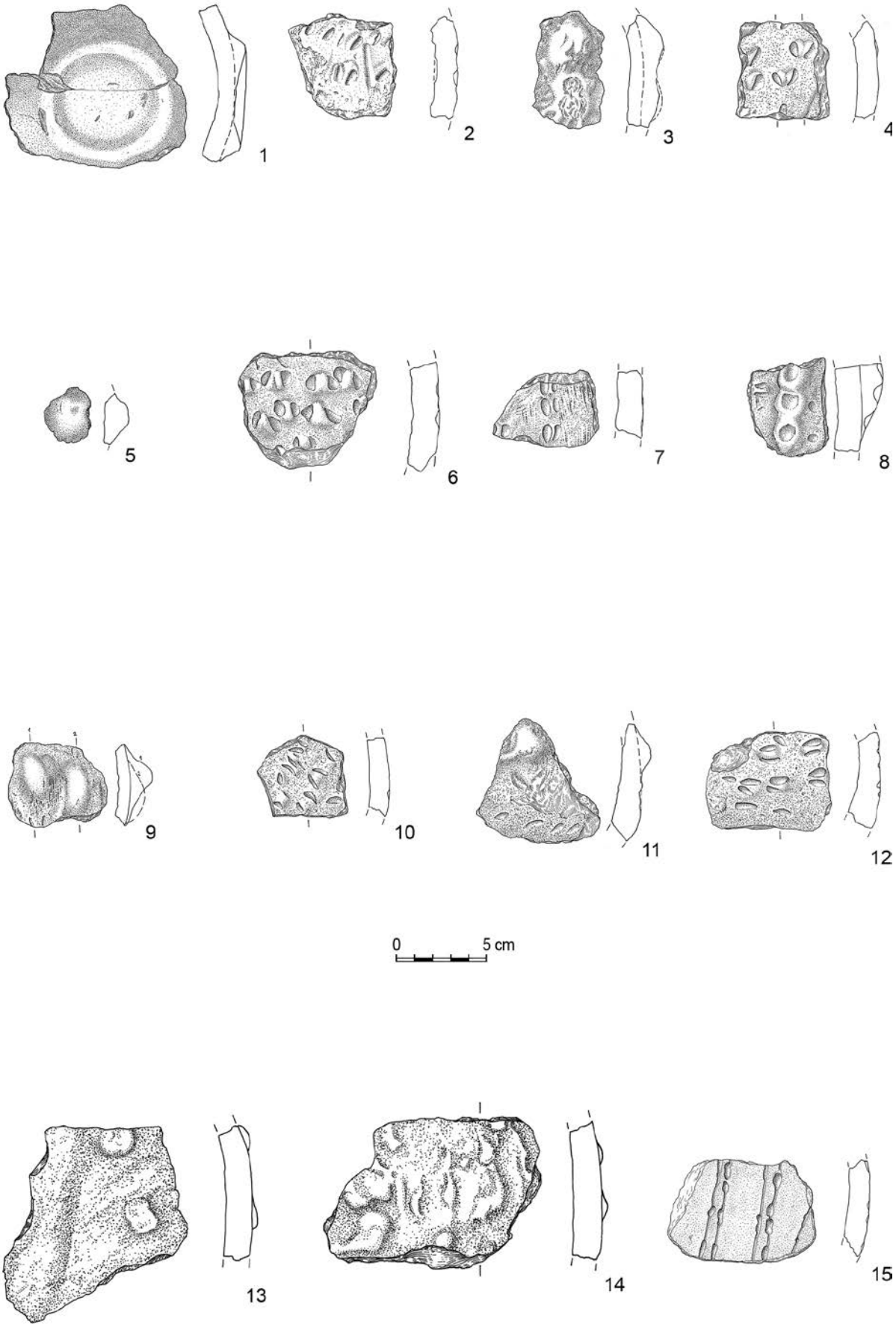


Plate 3

1 DNr 77 m; Feature B3/44; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E3.

2 DNr 77n; Feature B3/49; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F5.

3 DNr 77o; Feature B3/52; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2.

4 DNr 77k; Feature B3/54; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

5 DNr 14b; Feature B7/192; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

6 DNr 14c; Feature B7/171; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2.

7 DNr 15a; Feature B7/199; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6a.

8 DNr 15b; Feature B7/170; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D3.

9 DNr 507; ID 23990; Feature B9/268; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6b.

10 DNr 16a; Feature B7/173; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e and E1.

11 DNr 16b; Feature B7/172; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E2.

12 DNr 480; ID 23949; Feature B9/253; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4 and D2.

13 DNr 475; ID 23950; Feature B9/290; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5h and F6a.

14 DNr 101a; ID 1913; Feature B12/314; Pot; middle fragment; Fabric Group 1; surface untreated; decoration C1.

15 DNr 15c; Feature B7/193; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5a.

16 DNr 14a; Feature B7/196; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F7b.

17 DNr 101b; ID 1910; Feature B12/312; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5i.

18 DNr 101c; Feature B12/316; Pot; middle fragment; Fabric Group 1; surface untreated; decoration C1.

19 DNr 101d; Feature B12/313; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

20 DNr 101e; ID 1912; Feature B12/315; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F1.

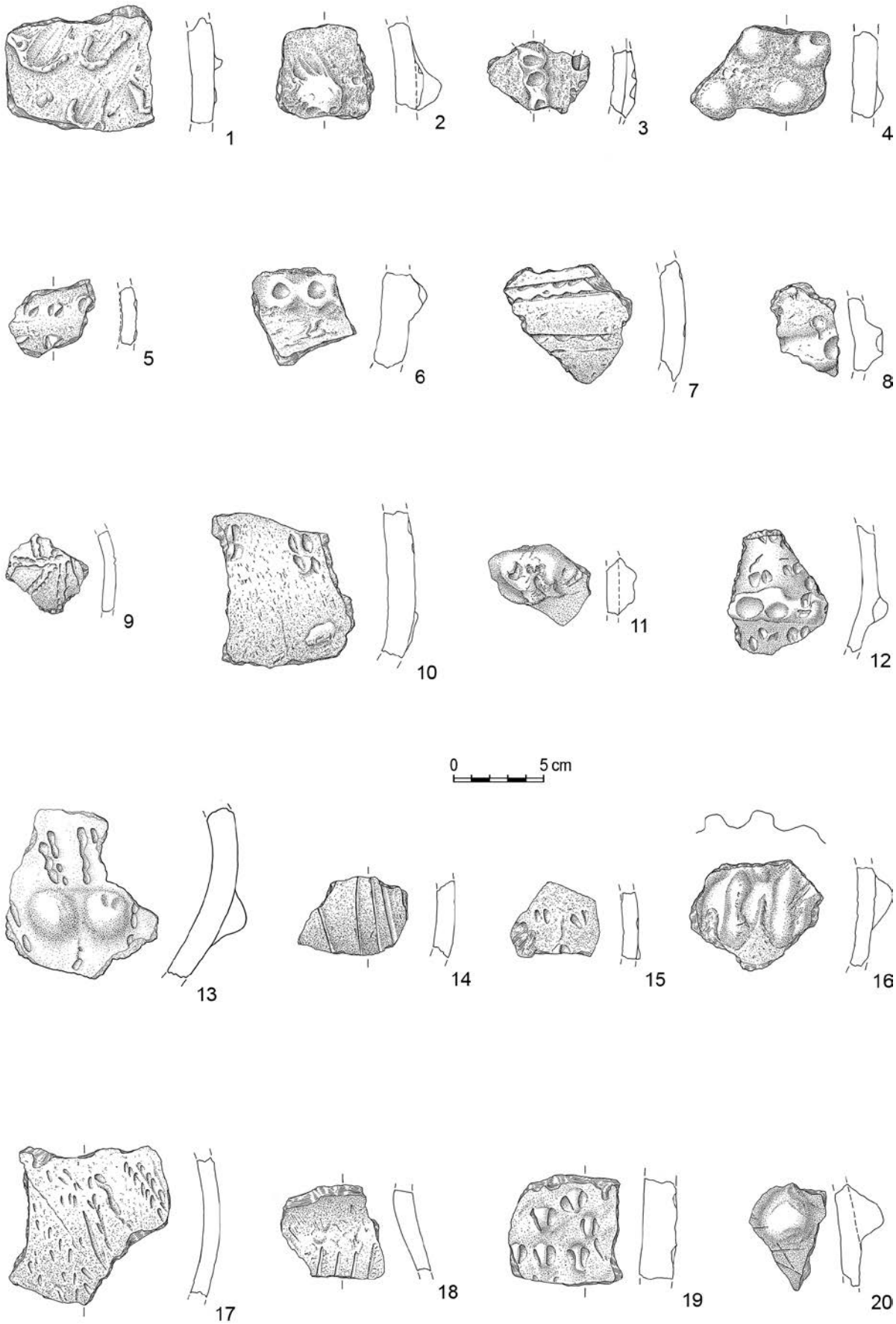


Plate 4

1 DNr 101g; Feature B12/310; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5b and B4.

2 DNr 101h; Feature B12; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

3 DNr 474; ID 23953; Feature B9/293; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5b and F7b.

4 DNr 101f; Feature B12/311; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3a.

5 DNr 9a; Feature B14/319; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3b.

6 DNr 109b; Feature B21/368; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

7 DNr 8a; Feature B14/322; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2.

8 DNr 9b; Feature B14/318; middle fragment; Fabric Group 1; surface untreated; decoration B3b.

9 DNr 107; ID 24955; Feature B20; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6d.

10 DNr 9c; Feature B14/326; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3b.

11 DNr 17a; ID 2027; Feature B20/350; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

12 DNr 1; ID 16504; Feature B9; almost complete vessel; Fabric Group 1; Miniature Mug; surface untreated; undecorated; height 4 cm; diameter at mouth 3.50 cm; max. diameter 4.20 cm.

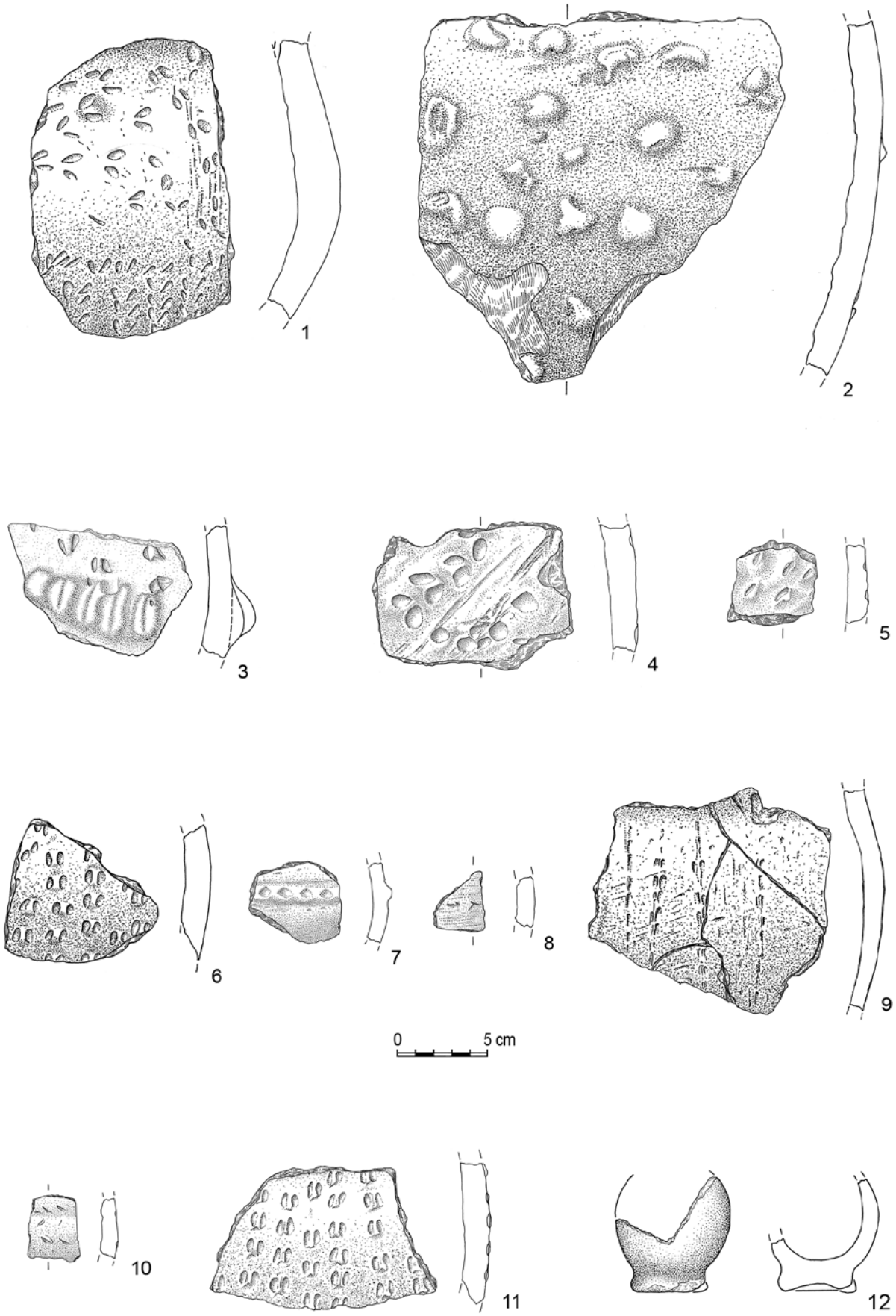


Plate 5

1 DNr 109c; Feature B21/369; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3b.

2 DNr 109e; Feature B21/371; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6d.

3 DNr 109f; Feature B21/372; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

4 DNr 18b; ID 2029; Feature B20/352; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration D2.

5 DNr 17b; Feature B20/351; Pot; rim fragment; Fabric Group 1; surface untreated; decoration A1.

6 DNr 109h; ID 1990; Feature B21/374; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

7 DNr 109g; Feature B21/373; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2.

8 DNr 109i; Feature B21/375; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3a.

9 DNr 109a; Feature B21/367; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3b and D5.

10 DNr 109j; Feature B21/376; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3a.

11 DNr 109l; Feature B21/378; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

12 DNr 108d; ID 2090; Feature B22/396; Pot; middle fragment; Fabric Group 1; roughened surface; decoration D1b.

13 DNr 108b; ID 2089; Feature B22/394; Pot; middle fragment; Fabric Group 1; roughened surface; decoration B3a and D1b.

14 DNr 108a; ID 2091; Feature B22/393; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3a.

15 DNr 208; ID 13761; Feature B-D2/552; Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E3.

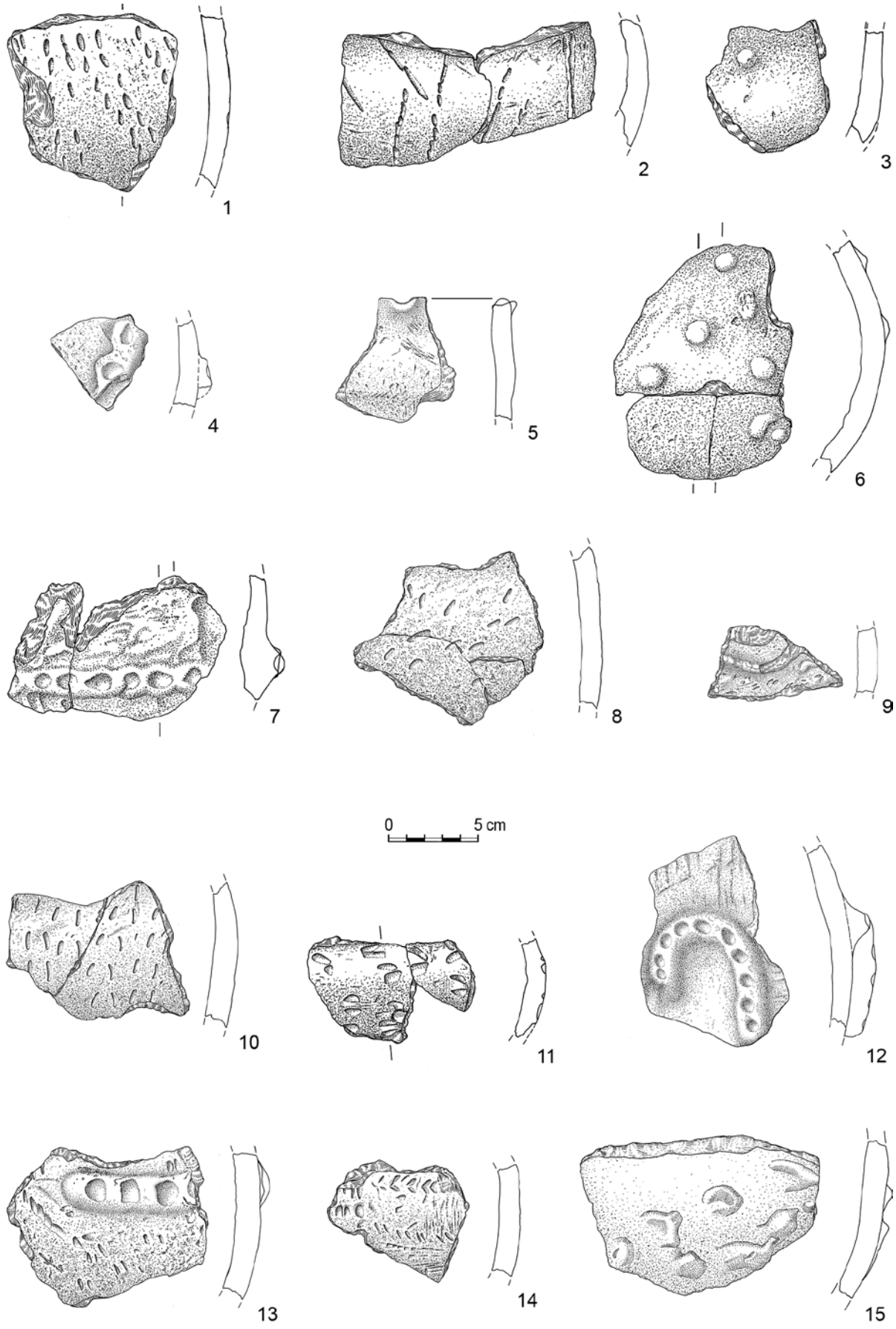


Plate 6

1 DNr 220a; Feature B-D2/592; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

2 DNr 298; ID 13745; Feature B-D2/558; Pot; middle fragment; Fabric Group 1; surface untreated; decoration C2 and F6a.

3 DNr 218; ID 13753; Feature B-D2/555; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3a and F4.

4 DNr 220b; ID 13772; Feature B-D2/587; Storage Pot; rim fragment; Fabric Group 1; surface untreated; undecorated.

5 DNr 220e; ID 13767; Feature B-D2/590; Pot; rim fragment; Fabric Group 1; surface untreated; decoration B6b.

6 DNr 220g; feature B-D2/592; Bowl 1; rim Fragment; Fabric Group 1; surface untreated; undecorated.

7 DNr 313; ID 13755; Feature B-D2/551; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5e, C1 and F7a.

8 DNr 214; ID 13765; Feature B-D2/573; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

9 DNr 415b; Feature B-D2; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E1.

10 DNr 223; ID 13762; Feature B-D2/535; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

11 DNr 216; ID 13746; Feature C15, profile C-F/680; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B2.

12 DNr 219; ID 13759; Feature B-D2/554; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5a; max. diameter 25 cm.

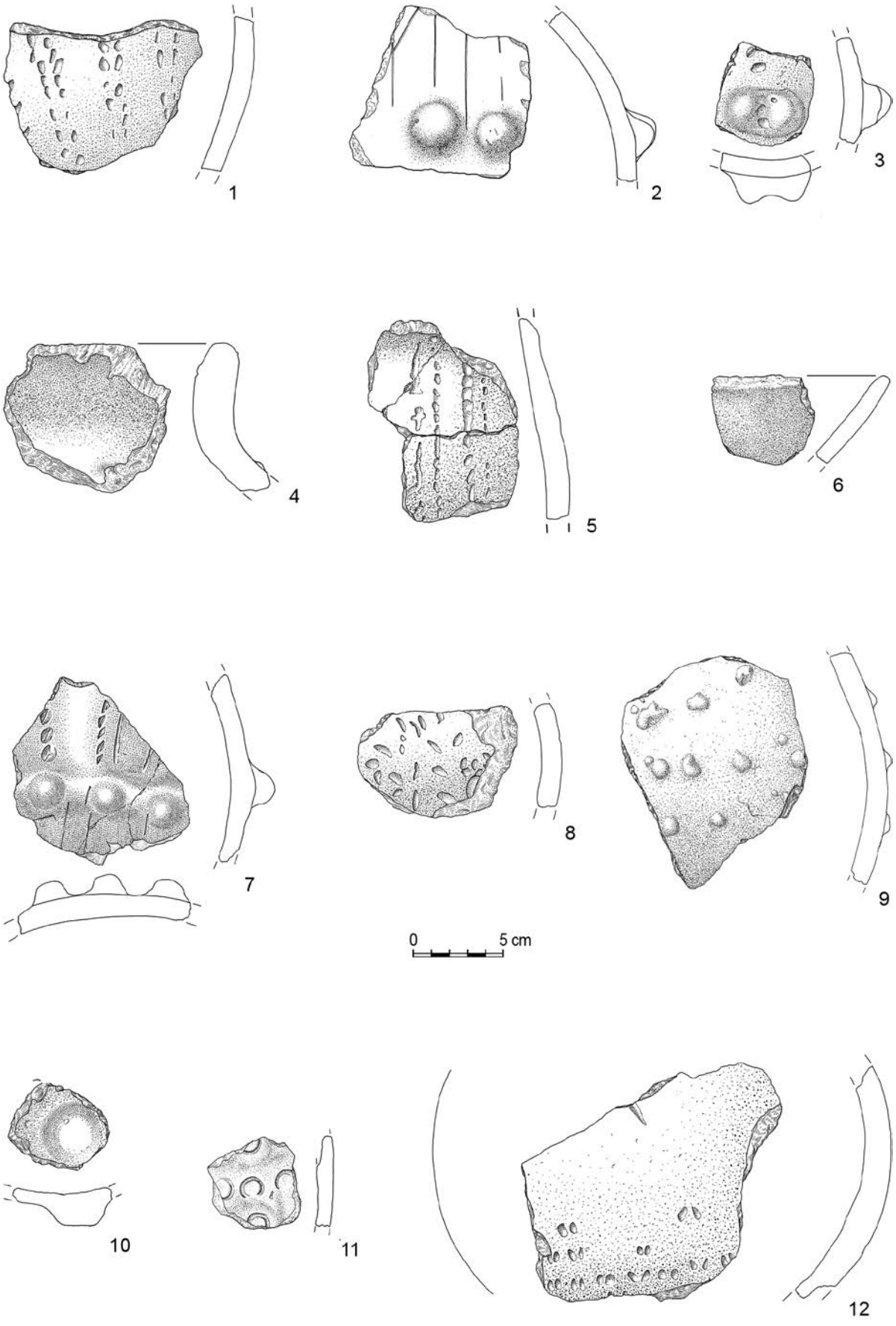


Plate 7

1 DNr 98d; Feature B2/31; Pot 1; rim fragment; Fabric Group 1; surface untreated; undecorated. rim diameter 28.6 cm.

2 DNr 499; ID 23972; Feature B-D2; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration C5; rim diameter 19 cm.

3 DNr 58b; ID 16295; Feature B3/59; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter 27 cm.

4 DNr 77c; ID 1345; Feature B3/46; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration A1 and B3b.

5 DNr 77f; ID 1334; Feature B3/42; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration B4 and F6a.

6 DNr 108c; ID 2088; Feature B22/395; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration A1 and B5e.

7 DNr 77e; Feature B3/53; Bowl 4; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter ca. 32 cm.

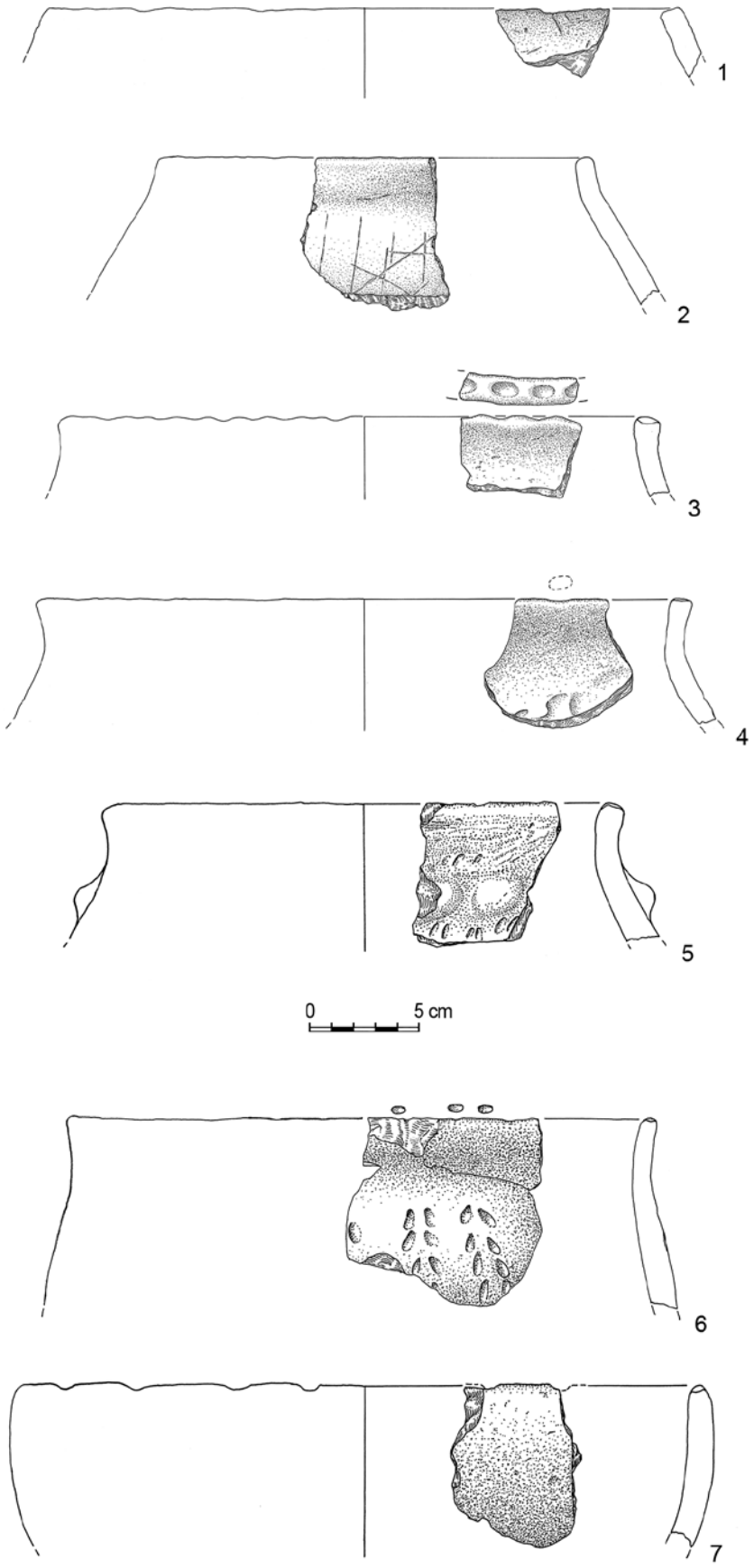


Plate 8

1 DNr 415; ID 16520; Feature B-D2/602; Storage Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1, B4, and E1; rim diameter 36 cm.

2 DNr 413a; ID 16519; Feature B12; Storage Pot 2, rim fragment; Fabric Group 1; surface untreated; decoration A1 and E3; rim diameter ca. 53 cm.

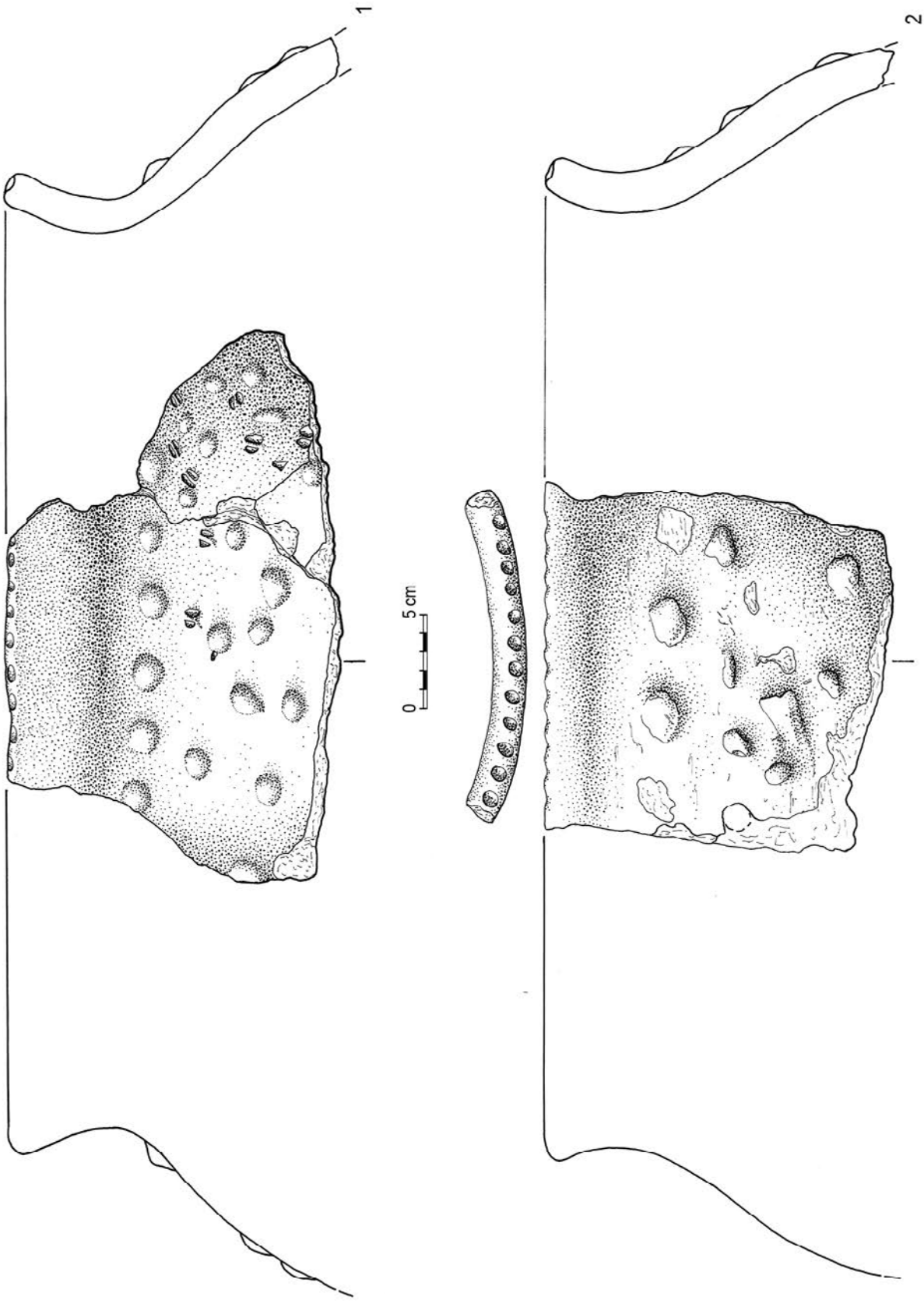


Plate 9

1 DNr 489; ID 23959; Feature B9; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1 and F1; rim diameter 24.6 cm.

2 DNr 102; ID 1905; Feature B12/307; Pot 4; rim fragment; Fabric Group 1; surface roughened; decoration B5g; max. diameter ca. 22 cm.

3 DNr 338; ID 16161; Feature B-D2/338; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration B6d.

4 DNr 227; ID 16519; Feature B12/560; Big Bowl 3; rim fragment; Fabric Group 1; surface untreated; decoration A1 and E1; rim diameter 53 cm.

5 DNr 200; ID 13756; Feature B-D2/563; Big Bowl 4; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter 42 cm.

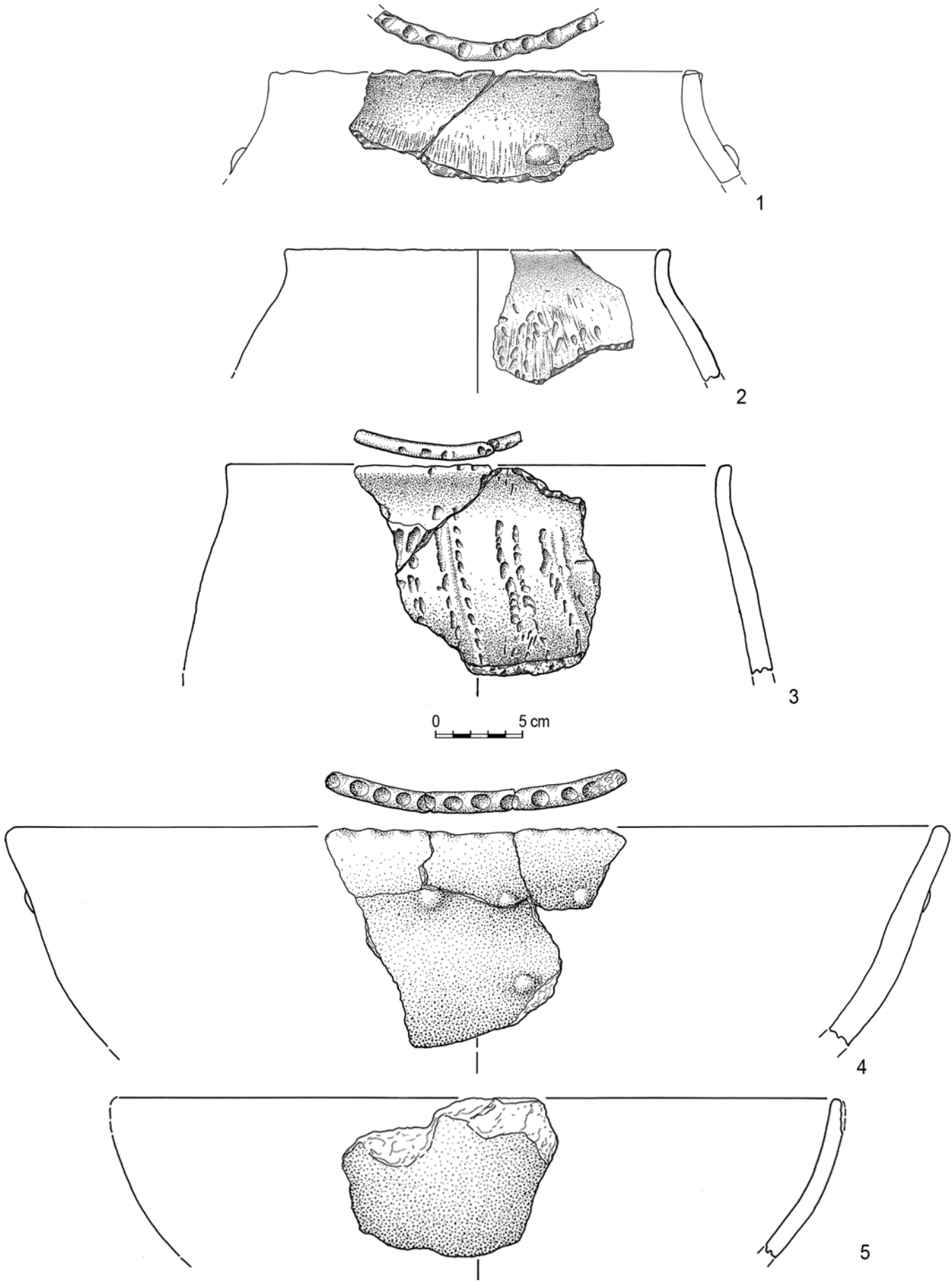


Plate 10

1 DNr 58a; ID 16294; Feature B3/60; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter ca. 21 cm.

2 DNr 98d; Feature B2/38; Bowl 1; rim fragment; Fabric Group 1; surface untreated; undecorated rim diameter 20 cm.

3 DNr 77d; Feature B3/48; Bowl 3; rim fragment; Fabric Group 1; surface untreated; decoration A1 and E3; rim diameter ca. 25 cm.

4 DNr 487; Feature B9/228; Small Pot 1; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter ca. 32 cm.

5 DNr 13b; Feature B7/168; Bowl 1; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter ca. 20 cm.

6 DNr 13d; Feature B7/167; Pot 3; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter ca. 22 cm.

7 DNr 506; Feature B9/286; Big Bowl 3; rim fragment; Fabric Group 1; surface untreated; undecorated.

8 DNr 497; ID 23991; Feature B9/282; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration B5i; rim diameter 16.5 cm.

9 DNr 508; ID 23956; Feature B9/295; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration A1, C3, and D5; rim diameter 39.6 cm.

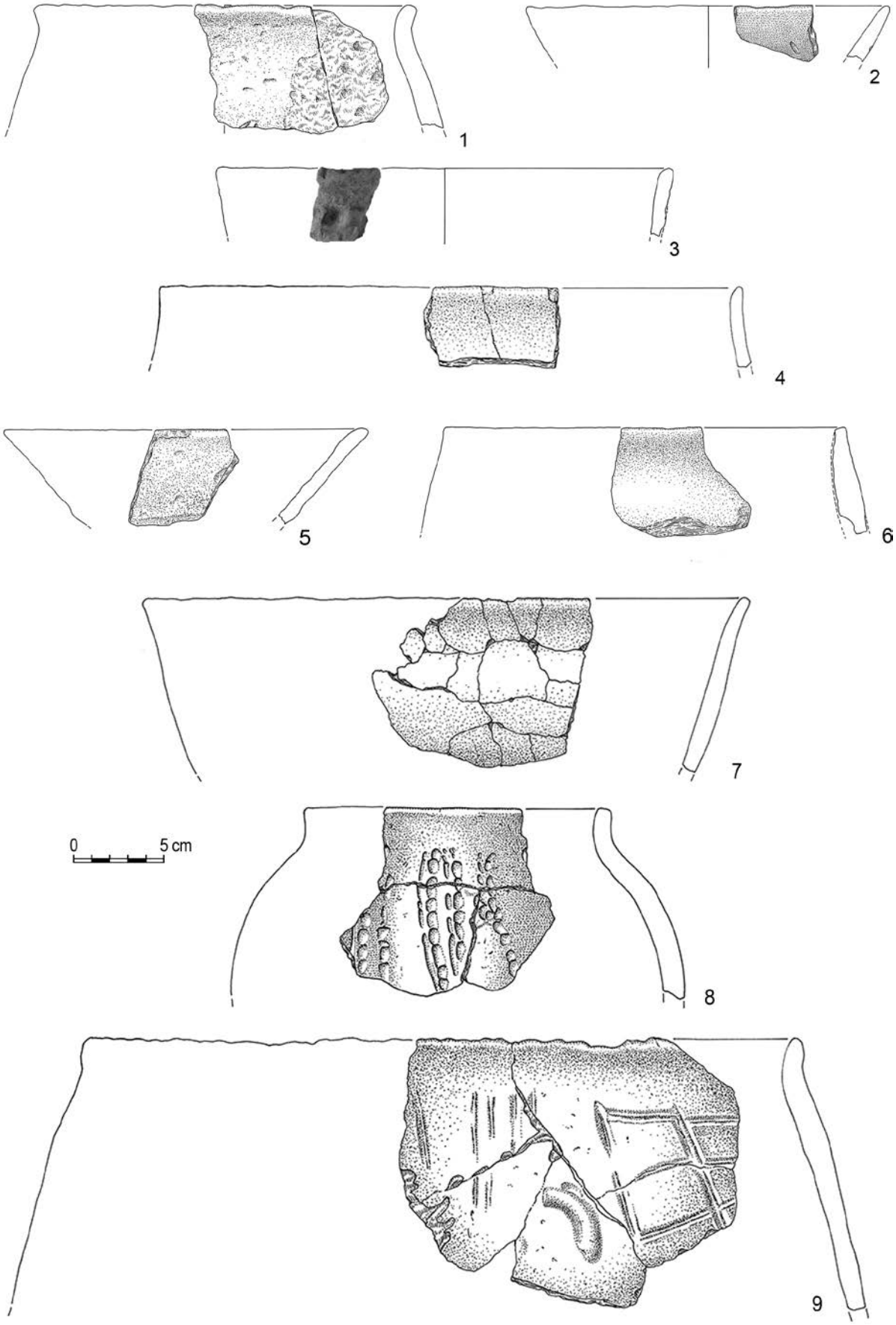


Plate 11

1 DNr 340; ID 16296; Feature B3/583; Big Bowl 3; rim fragment; Fabric Group 1; surface untreated; decoration A1, B3a, and F1; rim diameter 36 cm.

2 DNr 58c; ID 16296; Feature B3/66; Small Pot b2; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter 23 cm.

3 DNr 105; Feature B3/70; Big Bowl 1; rim fragment; Fabric Group 1; surface untreated; decoration E1.

4 DNr 13c; Feature B7/191; Big Bowl; rim fragment; Fabric Group 1; surface untreated; decoration A1.

5 DNr 13a; Feature B7/194; Jug 1; rim fragment; Fabric Group 1; surface untreated; undecorated.

6 DNr 77b; Feature B3/47; Jug 3; rim fragment; Fabric Group 1; smoothed surface; undecorated.

7 DNr 23; Feature B9; Small Pot 1; complete vessel; Bottom 3; Fabric Group 1; smoothed surface; decoration G (painted); rim diameter 13 cm; height 8,5 cm; max. diameter 17.4 cm.

8 DNr 210; ID 13757; Feature B-D2/562; Jug 1; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter 11.8 cm.

9 DNr 109 m; ID 1987; Feature B21/379; Small Pot 2; rim fragment; Fabric Group 1; smoothed surface; undecorated.

10 DNr 275; ID 13757; Feature B-D2/582; Jug 1; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter 12.1 cm.

11 DNr 477; ID 23989; Feature B9/260; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration B6a; rim diameter 32.8 cm.

12 DNr 18a; ID 2026; Feature B20/353; Big Bowl 2; rim fragment; Fabric Group 1; roughened surface; decoration E1.

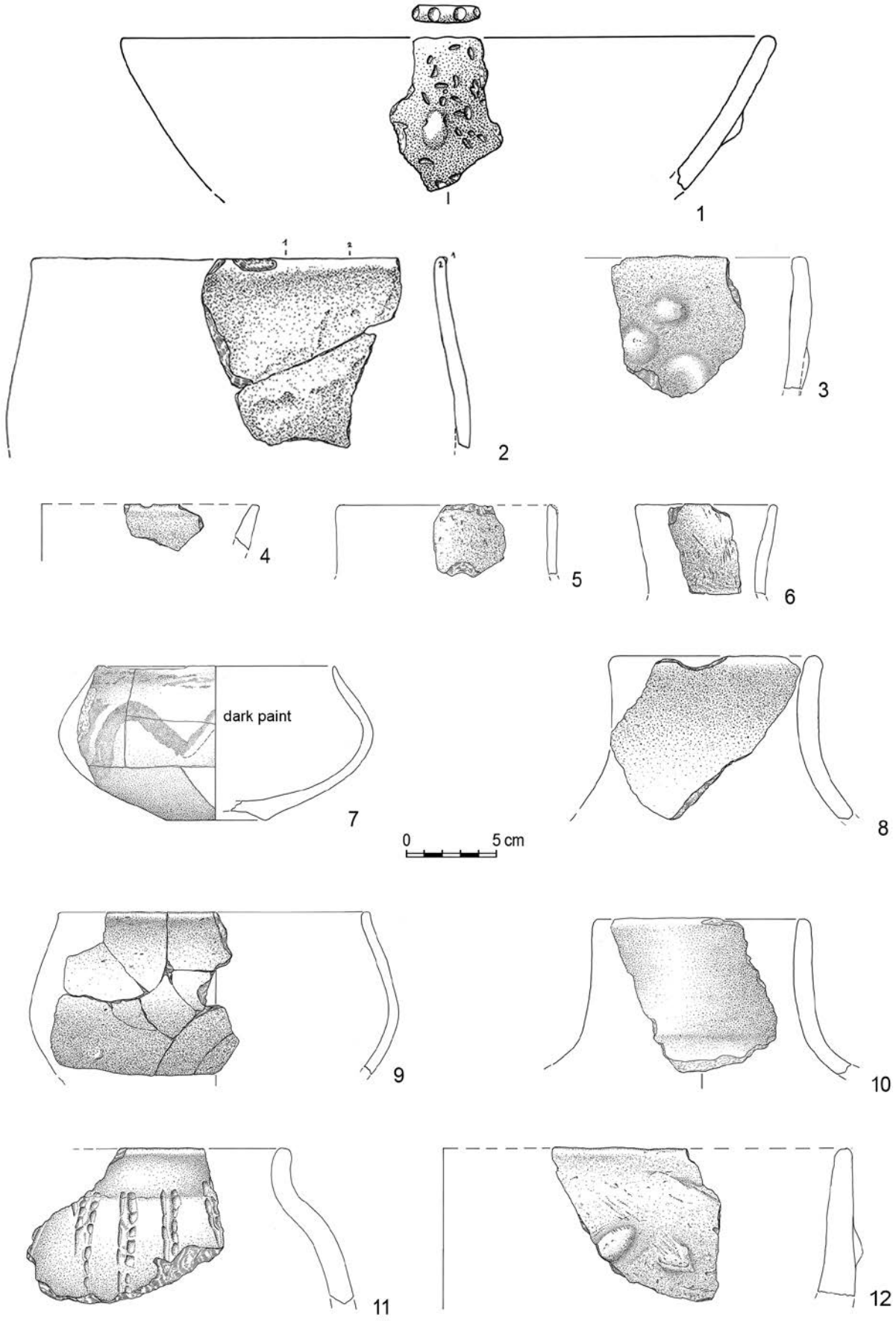


Plate 12

1 DNr 220f; Feature B-D2/591; Pot 3; rim fragment; Fabric Group 1; surface untreated; decoration B4; rim diameter ca. 24 cm.

2 DNr 77g; Feature B3/56; Storage Pot 3; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter ca. 55 cm.

3 DNr 110; ID 24954; Feature B20; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration E1; rim diameter 22 cm.

4 DNr 109d; Feature B21/370; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration C2; rim diameter ca. 30 cm.

5 DNr 224; ID 24952; Feature B-D2/569; Bowl 3; rim fragment; Fabric Group 1; surface untreated; undecorated; rim diameter ca. 22 cm.

6 DNr 488; ID 23944; Feature B9/284; Big Bowl 1; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter 39 cm.

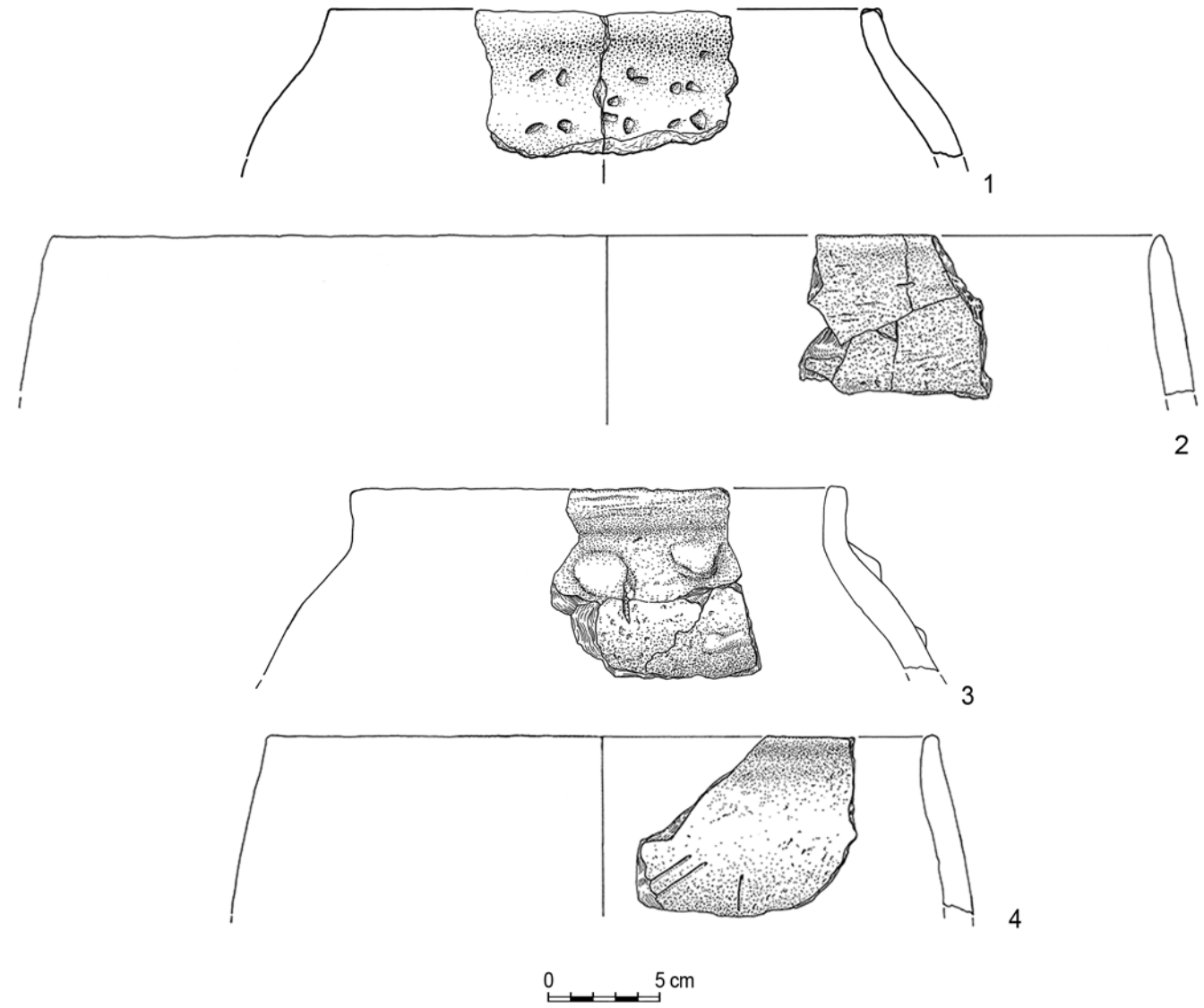


Plate 13

1 DNr 58e; ID 16298; Feature B3; Bottom 1 fragment; Fabric Group 1; surface untreated; decoration B5e.

2 DNr 12a; ID 1726; Feature B7/164; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

3 DNr 77a; ID 1339; Feature B3/43; Bottom 6 fragment; Fabric Group 3; surface untreated; undecorated.

4 DNr 58f; ID 16299; Feature B3/63; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

5 DNr 12e; ID 1727; Feature B7/165; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

6 DNr 58d; ID 16297; Feature B3/62; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

7 DNr 104; Feature B12/305; Bottom 1 fragment; Fabric Group 1; surface untreated; decoration B5b.

8 DNr 12c; ID 1728; Feature B7/195; Bottom fragment; Fabric Group 1; surface untreated; undecorated.

9 DNr 179; Feature B12/309; Bottom 1 fragment; Fabric Group 1; surface untreated; decoration C2.

10 DNr 211; ID 13760; Feature B-D2/574; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

11 DNr 98; Feature B2/28; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

12 DNr 11a; ID 1112; Feature B1/12; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

13 DNr 97; Feature B12; Bottom 1; Fabric Group 1; surface untreated; decoration C2.

14 DNr 6a; Feature B14/320; Bottom 1; Fabric Group 1; surface untreated; undecorated.

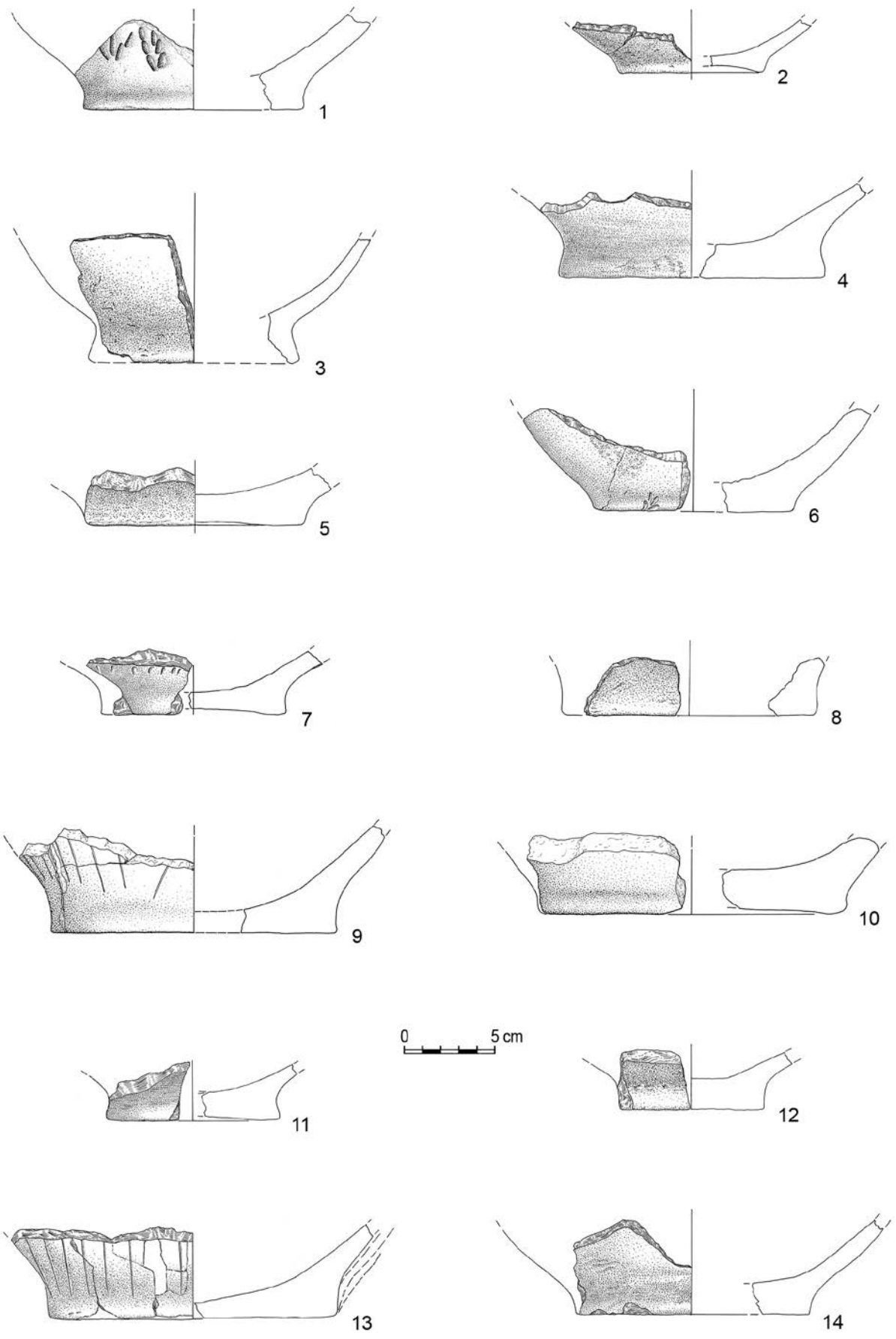


Plate 14

1 DNr 103; Feature B12/306; Bottom 5 fragment; Fabric Group 1; surface untreated; undecorated.

2 DNr 476; ID 24008; Feature B9/281; Bottom 6 fragment; Fabric Group 1; surface untreated; undecorated.

3 DNr 10a; ID 2087; Feature B22/397; Bottom 4 fragment; Fabric Group 1; surface untreated; undecorated.

4 DNr 12b; Feature B7/196; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

5 DNr 260; ID 13763; Feature B-D2/575; Bottom 4 fragment; Fabric Group 1; surface untreated; undecorated.

6 DNr 6b; Feature B7/325; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

7 DNr 4; ID 13763; Feature B7/B14; Bottom 4 fragment; Fabric Group 1; surface untreated; undecorated.

8 DNr 290; ID 24353; Feature B9/264; Bottom 5 fragment; Fabric Group 1; surface untreated; undecorated.

9 DNr 339; ID 24018; Feature B7/B14/317; Bottom 4 fragment; Fabric Group 1; surface untreated; undecorated.

10 DNr 12d; ID 1724; Feature B7/190; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

11 DNr 10b; Feature B22/398; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

12 DNr 98c; Feature B2/30; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

13 DNr 77h; ID 1340/1341; Feature B3/51; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

14 DNr 496; ID 24013; Feature B9/256; Bottom 7 fragment; surface untreated; undecorated.

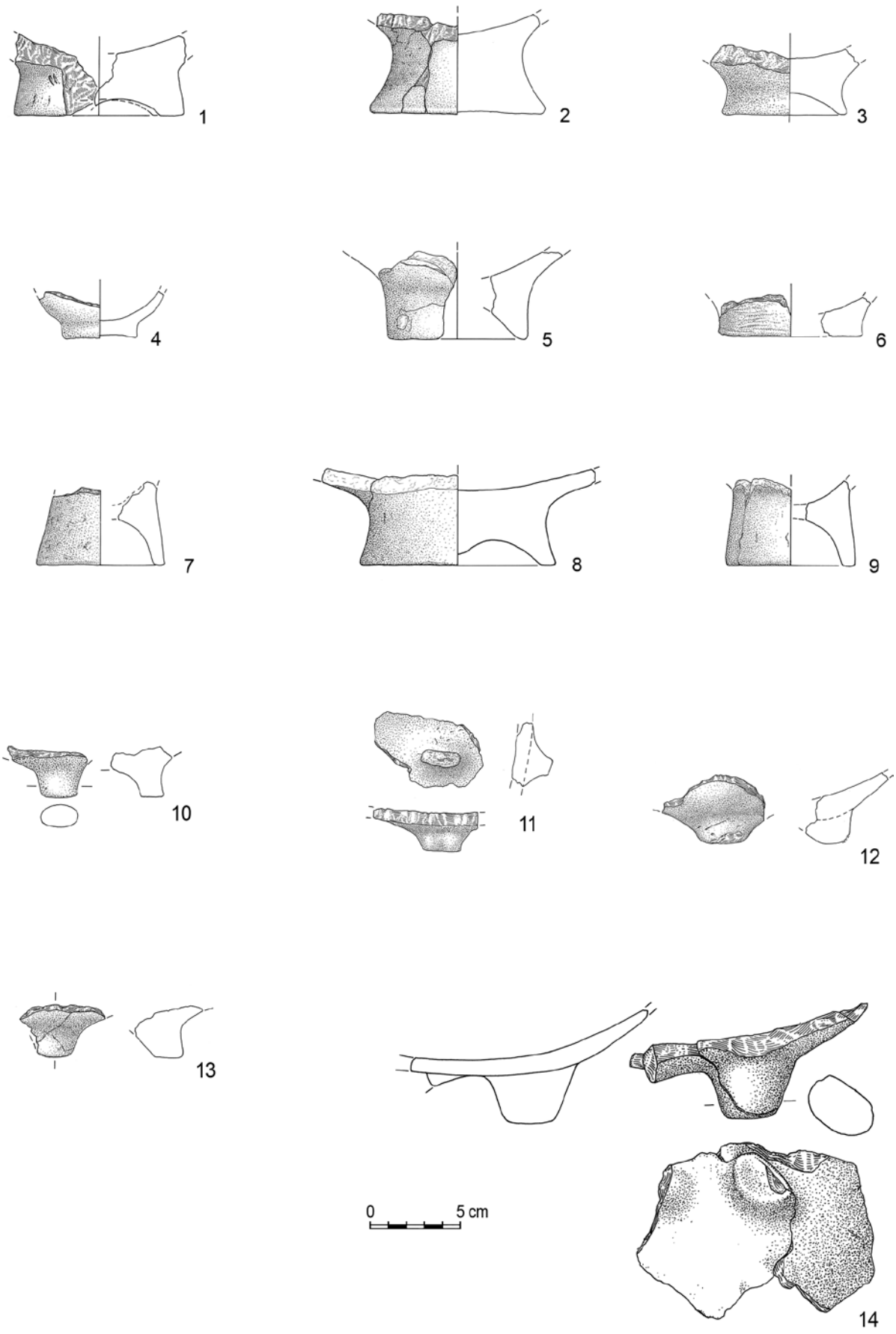


Plate 15

1 DNr 41; Feature C10/102; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F3.

2 DNr 40; Feature C10/106; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D2.

3 DNr 527; Feature C10; middle fragment; Fabric Group 1; surface untreated; decoration D2.

4 DNr 42; Feature C10/101; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

5 DNr 45; ID 3120; Feature C10/104; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F6c.

6 DNr 82; ID 24365; Feature D1; complete vessel; Fabric Group 1; Miniature Mug; Bottom 1; surface untreated; undecorated; height 5.60 cm; diameter at mouth 6.40 cm; max. diameter 6.80 cm.

7 DNr 26; ID 3124; Feature C13/119; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F6c.

8 DNr 34; ID 3125; Feature C13/122; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D4.

9 DNr 39; Feature C10/105; Jug; middle fragment with cord loop; Fabric Group 1; surface untreated; undecorated.

10 DNr 44; Feature C10/107; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E2.

11 DNr 52; ID 3129; Feature C15/134; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

12 DNr 129; ID 3155; Feature C19/203; Pot; middle fragment; Fabric Group 1; surface untreated; decoration D1b.

13 DNr 35; ID 3114; Feature C8/99; Pot or Big Bowl; middle fragment; Fabric Group 1; surface untreated; decoration E3.

14 DNr 36b; ID 3108; Feature C3/89; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5i.

15 DNr 59; Feature C18/179; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

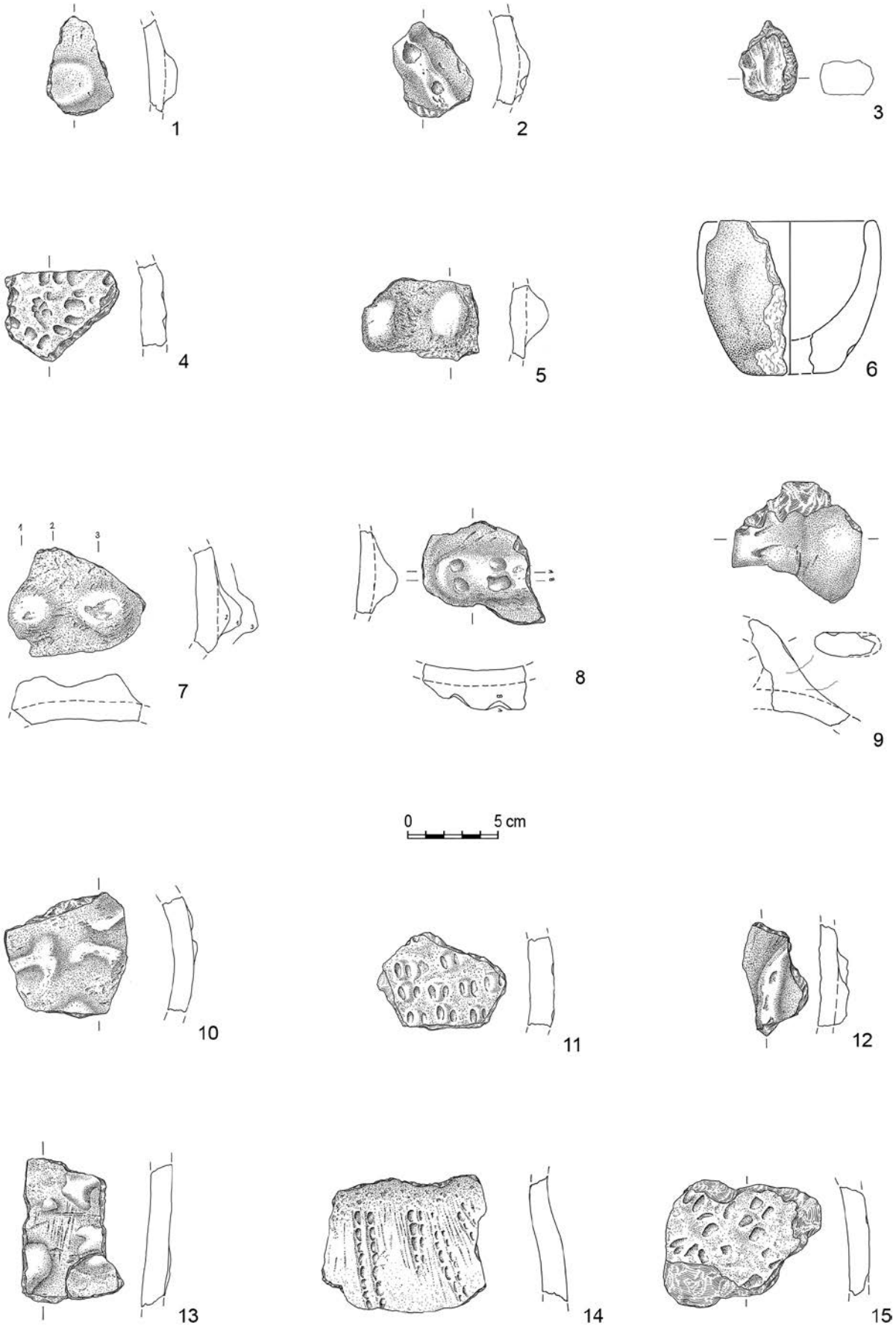


Plate 16

1 DNr 59c; ID 3140; Feature C18/178; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

2 DNr 115; ID 3151; Feature C18/189; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

3 DNr 64; ID 3132; Feature C18/173; Jug; middle fragment with cord loop; Fabric Group 1; surface untreated; undecorated.

4 DNr 65; ID 3150; Feature C18/181; Pot; middle fragment; Fabric Group 1; surface untreated; decoration E1.

5 DNr 114c; Feature C10/191; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B6c.

6 DNr 75; ID 3130; Feature C18/172; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F6a.

7 DNr 114b; ID 3149; Feature C18/192; Big Bowl; rim fragment; Fabric Group 1; surface untreated; decoration A1 and E3.

8 DNr 114d; Feature C18/193; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

9 DNr 114a; Feature C18/190; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B3b and F1.

10 DNr 83; ID 3134; Feature C18/174; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

11 DNr 67; ID 3144; Feature C18/171; Jug; middle fragment with rest of a cord loop; Fabric Group 1; surface untreated; undecorated.

12 DNr 118; ID 3152; Feature C18/186; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

13 DNr 127; ID 3142; Feature C18/183; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F7a.

14 DNr 128b; ID 3136; Feature C18/200; Pot; middle fragment; Fabric Group 1; surface untreated; decoration C5.

15 DNr 217; ID 13751; Feature C18/533; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4 and D1b.

16 DNr 59d; Feature C18/177; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B5d.

17 DNr 138; ID 24543; Feature C18/215; Pot; middle fragment; Fabric Group 1; surface untreated; decoration F3.

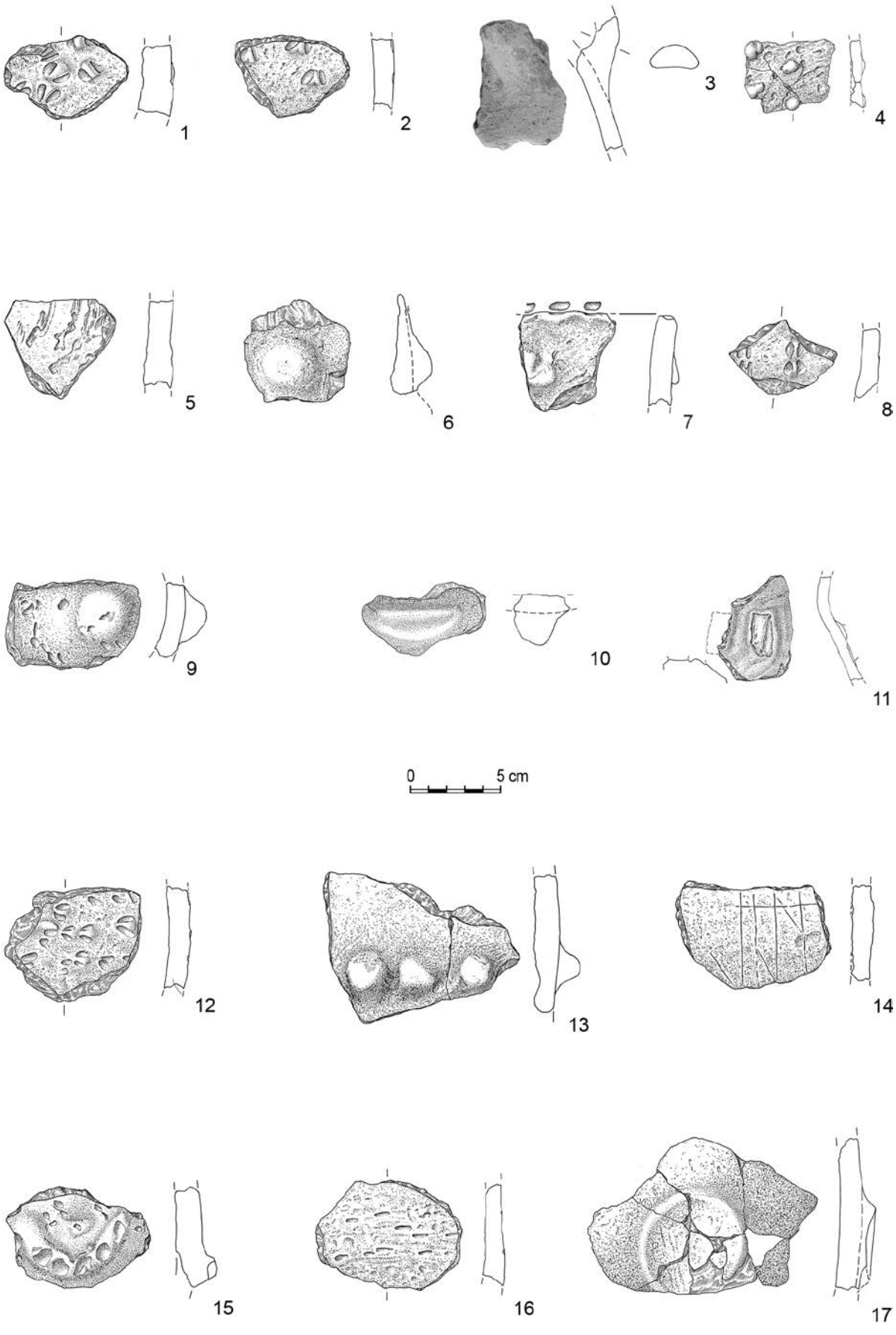


Plate 17

1 DNr 137; ID 24956; Feature C13/130; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

2 DNr 145; Feature C18/184; Bottom 2 fragment; Fabric Group 1; surface untreated; undecorated.

3 DNr 114e; ID 3148; Feature C18/194; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

4 DNr 116; ID 3143; Feature C18/188; Bottom 1 fragment; Fabric Group 1; surface untreated; decoration B4.

5 DNr 38; Feature C15; Bottom 1 fragment; Fabric Group 1; surface untreated; undecorated.

6 DNr 25; Feature C10/100; Bottom 4 fragment; Fabric Group 1; surface untreated; undecorated.

7 DNr 128a; ID 3135; Feature C18/199; Bottom 4 fragment; Fabric Group 1; smoothed surface; undecorated.

8 DNr 136; Feature C18/214; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

9 DNr 202; ID 13745; Feature C21/543; Bottom 7 fragment; Fabric Group 1; surface untreated; undecorated.

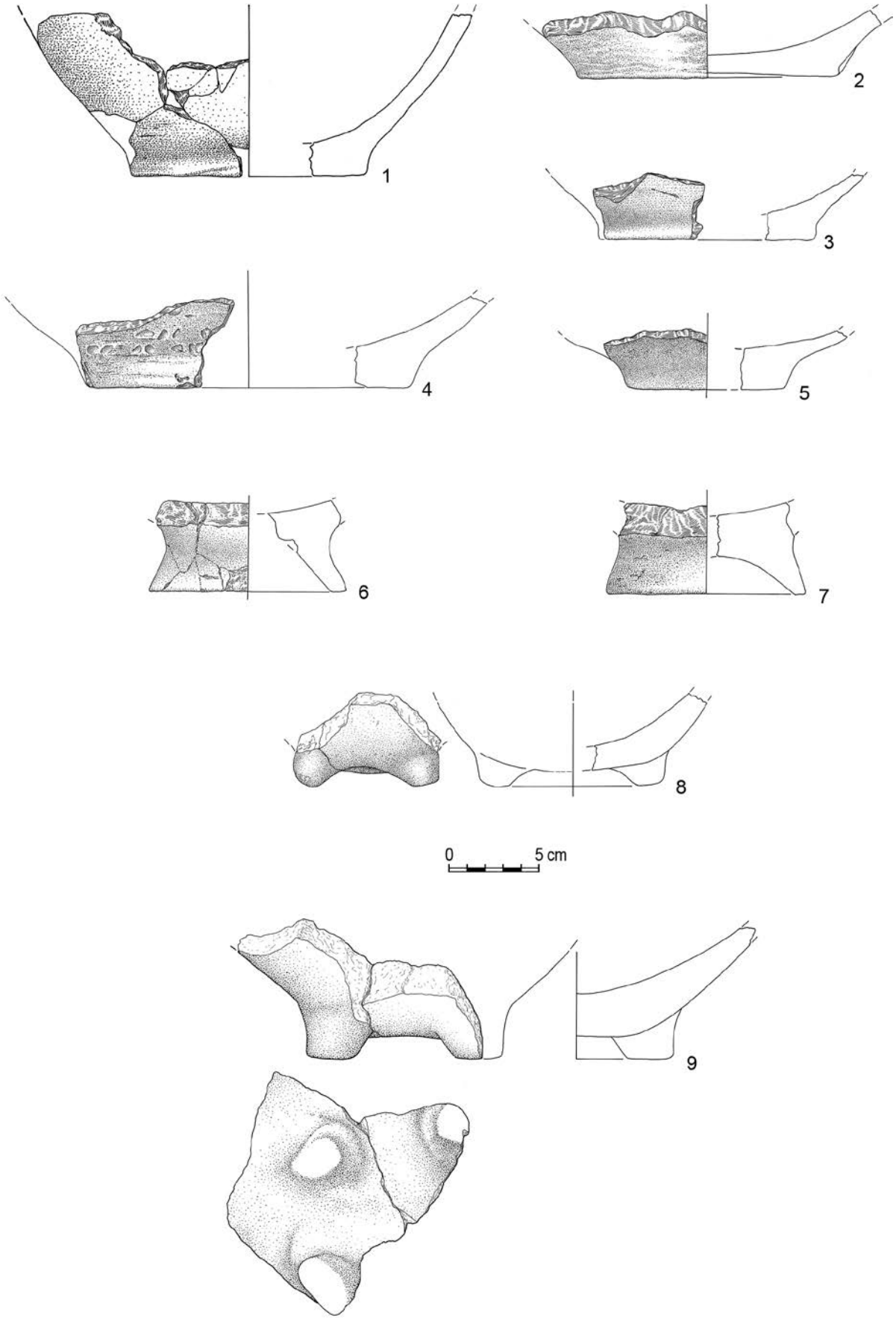


Plate 18

1 DNr 69; ID 3109; Feature C18/170; Pot 4; rim fragment; Fabric Group 1; surface untreated; decoration A1 and B3b.

2 DNr 124; ID 3131; Feature C18/187; Pot 3; rim fragment; Fabric Group 1; surface untreated; decoration B5b.

3 DNr 59a; Feature C18/180; Big Bowl 3; rim fragment; Fabric Group 1; surface untreated; undecorated.

4 DNr 59b; Feature C18/176; Pot; rim fragment; Fabric Group 1; surface untreated; decoration C2.

5 DNr 516; ID 24626; Feature C18; Pot; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter 41 cm.

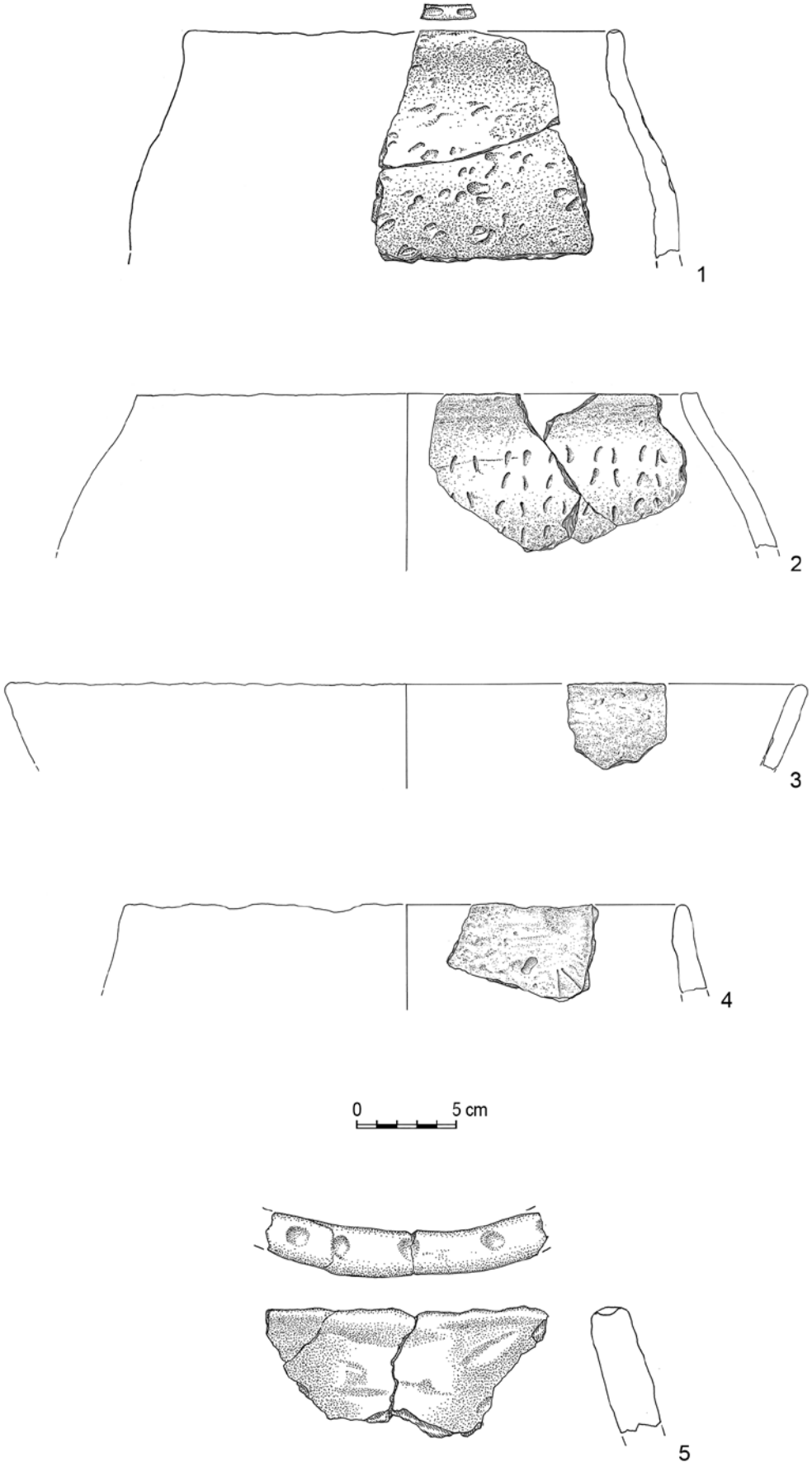


Plate 19

1 DNr 36a; ID 3106; Feature C3/90; Pot 3; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter 18 cm.

2 DNr 54; ID 3153; Feature C18/175; Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration B1; rim diameter 17 cm.

3 DNr 27; ID 3123; Feature C13/118; Pot 3; rim fragment; Fabric Group 1; surface untreated; decoration B6c; rim diameter 21 cm.

4 DNr 43; Feature C10/108; Storage Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter ca. 26 cm.

5 DNr 33; ID 3127; Feature C13/121; Storage Pot 2; rim fragment; Fabric Group 1; surface untreated; decoration A1; rim diameter 21 cm.

6 DNr 207a/b; Feature C extension/614; Pot; rimfragment; Fabric Group 1; surface untreated; decoration A1.

7 DNr 306b; Feature C extension/609; Pot; middle fragment; Fabric Group 1; surface untreated; decoration B4.

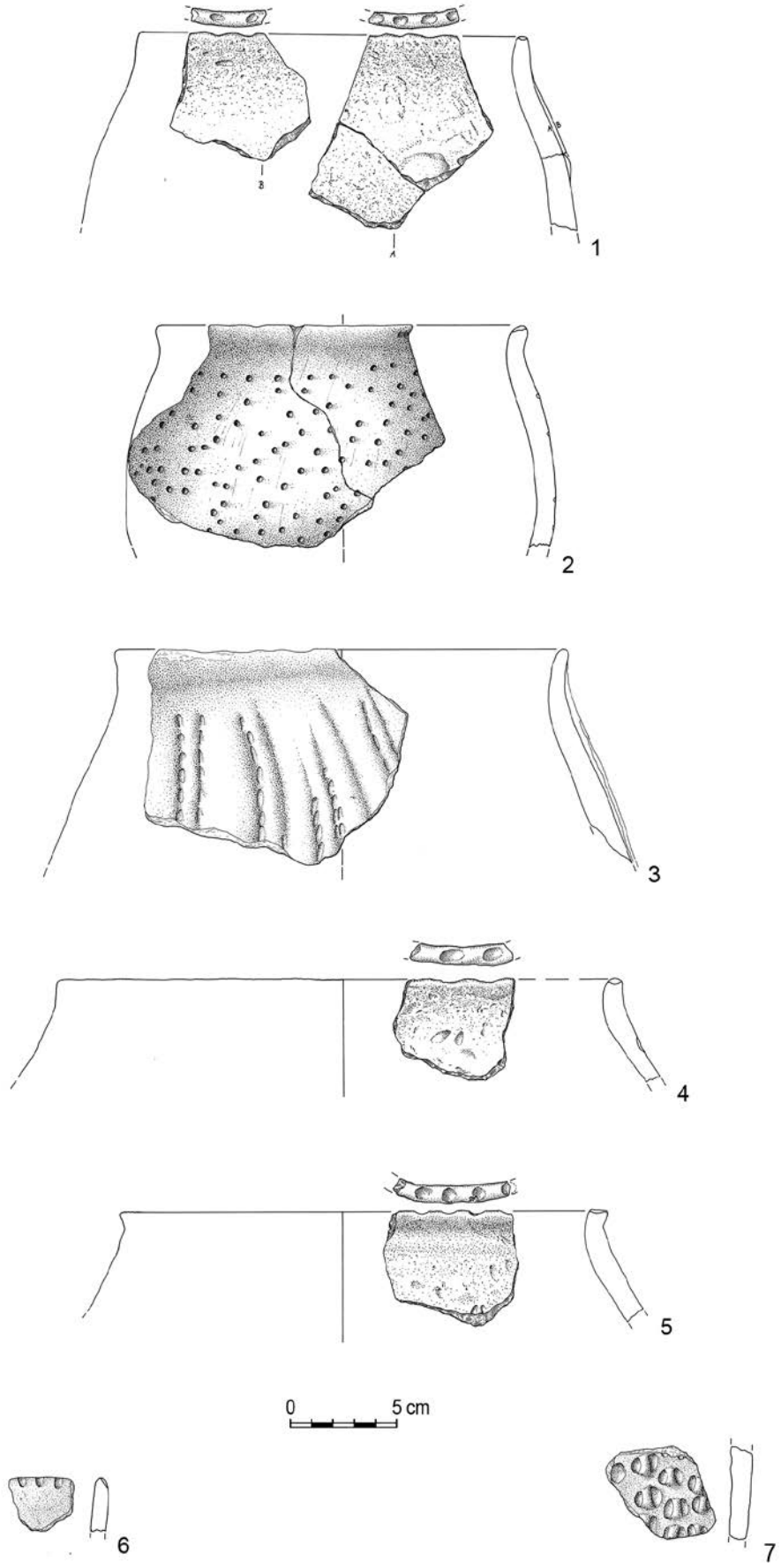


Plate 20

1 DNr 47; Feature D14; middle fragment; surface untreated; decoration B5 and D2.

2 DNr 37; Feature D12; middle fragment; surface untreated; decoration B4 and F2.

3 DNr 106; ID 3324; Feature D17; middle fragment; Fabric Group 1; cord loop; jar-like vessel; smoothed surface; undecorated.

4 DNr 24; ID 3277; Feature D14; middle fragment; Fabric Group 1; surface untreated; decoration C4.

5 DNr 51; ID 3328; Feature D17; middle fragment; Fabric Group 1; surface untreated; decoration E2.

6 DNr 56; ID 3278; Feature D14; middle fragment; Fabric Group 1; surface untreated; decoration B4.

7 DNr 63; ID 3326; Feature D17; middle fragment; Fabric Group 1; surface untreated; decoration B4.

8 DNr 76; Feature D17; middle fragment; surface untreated; decoration D5.

9 DNr 60; ID 33329; Feature D17; middle fragment; Fabric Group 1; surface untreated; decoration B4.

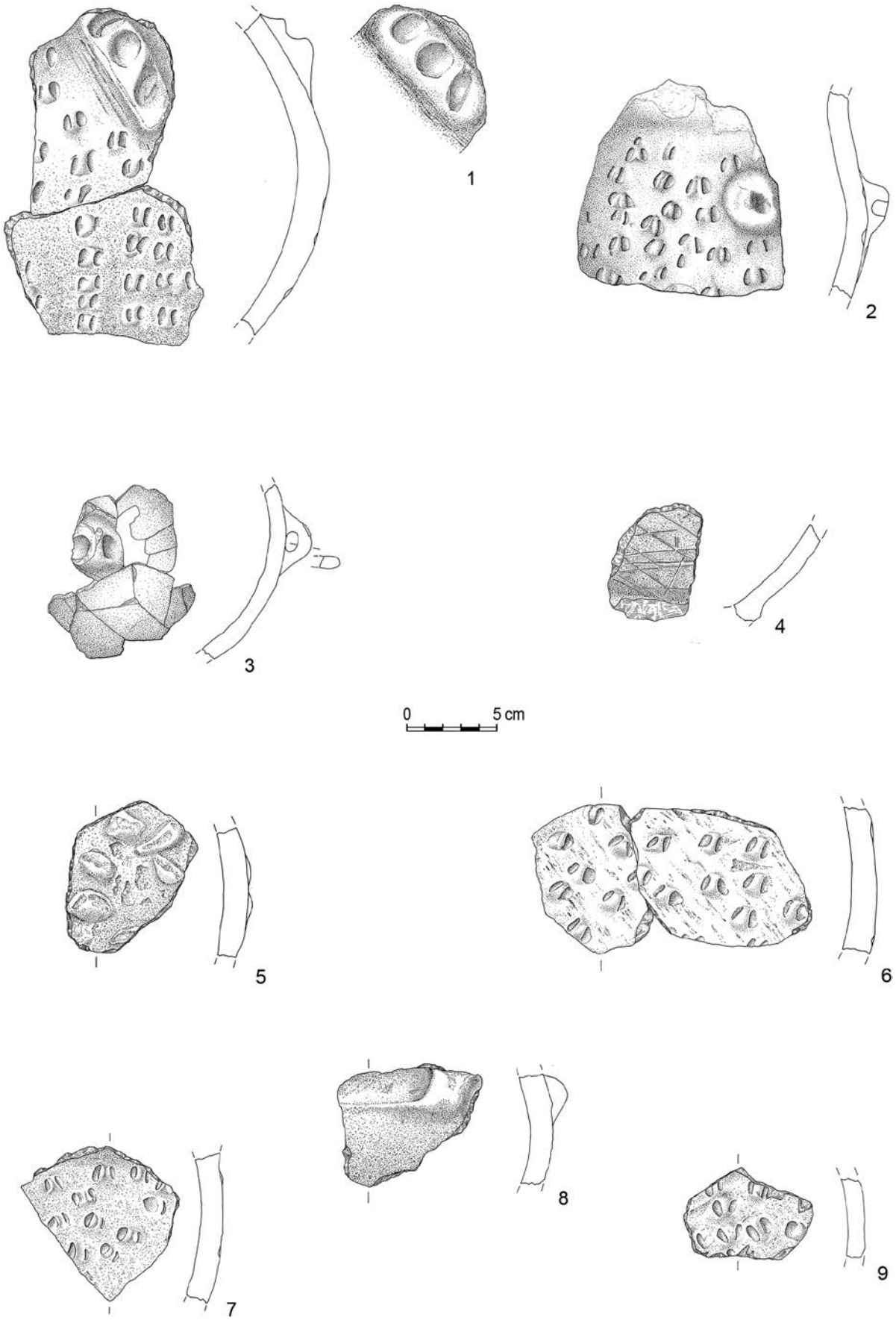


Plate 21

1 DNr 135; ID 23993; rim Fragment; Fabric Group 1; Pot 4; surface untreated; decoration A1, B4, and E3; diameter at mouth 40 cm.

2 DNr 30; ID 3276; Feature D14; Bottom 4; Fabric Group 1; smoothed surface; undecorated.

3 DNr 48; Feature D14; rim fragment; surface untreated; decoration B6.

4 DNr 31; ID 3409; Feature E1; middle fragment; Fabric Group 1; surface untreated; decoration F7.

5 DNr 32; ID 3410; Feature E1; middle fragment; Fabric Group 1; surface untreated; decoration E1.

6 DNr 146; ID 3870; Feature F2N; middle fragment; Fabric Group 1; surface untreated; undecorated.

7 DNr 147; ID 23992; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration B5.

8 DNr 148; ID 23951; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration B5 and F6.

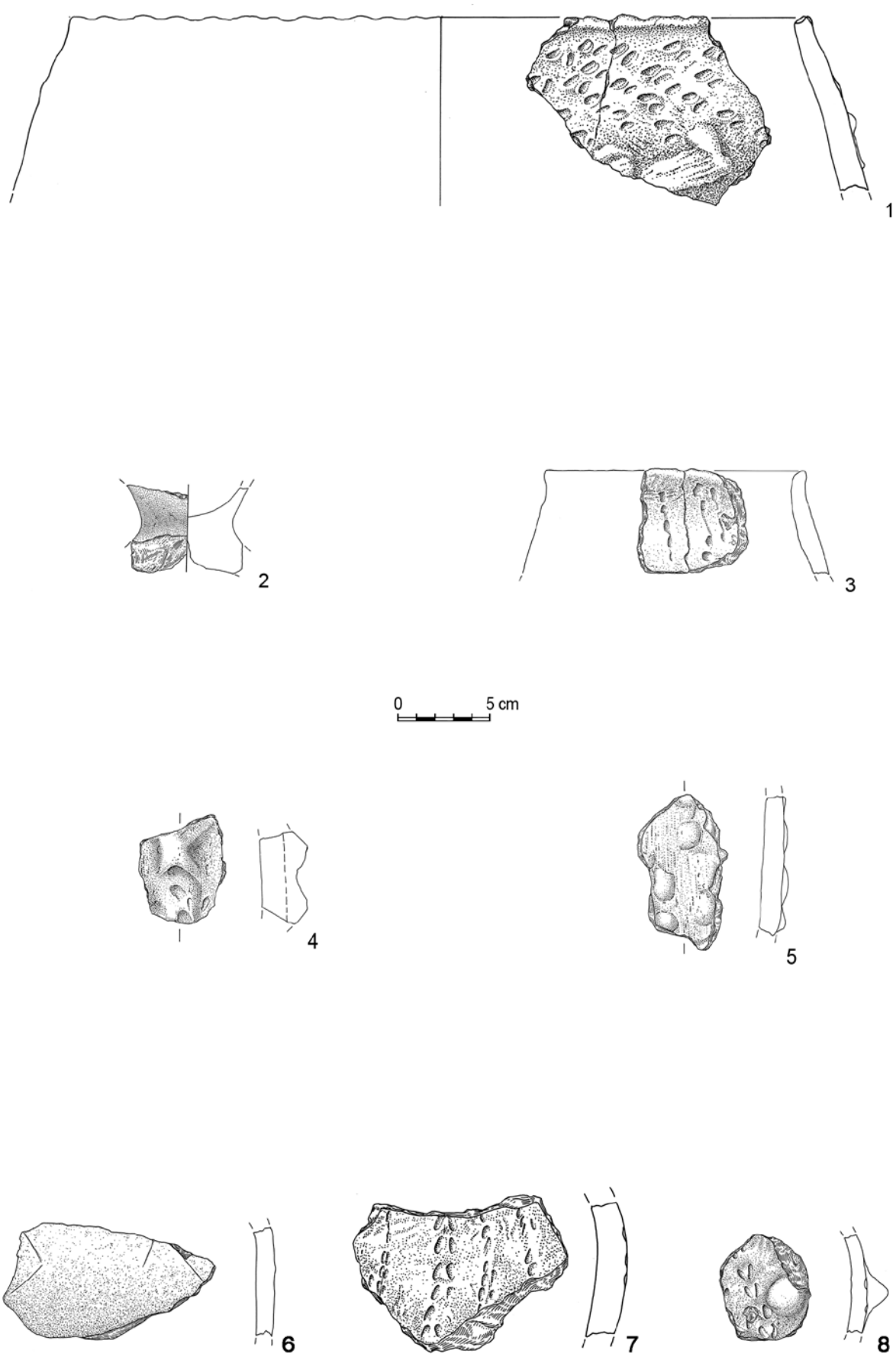


Plate 22

1 DNr 57; ID 3842; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration E2.

2 DNr 61; ID 3850; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

3 DNr 68; ID 3843; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration D2 and D5.

4 DNr 74; ID 3847; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration F6.

5 DNr 140; ID 3845; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration B3.

6 DNr 141; ID 3846; Feature F2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

7 DNr 139d; ID 3860; Feature F2N; middle fragment; Fabric Group 3; surface untreated; decoration D2.

8 DNr 149c; ID 3854; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration E1.

9 DNr 139a; ID 3859; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration E3.

10 DNr 139c; ID 3856; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration B3 and F6.

11 DNr 139e; ID 3861; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration E2.

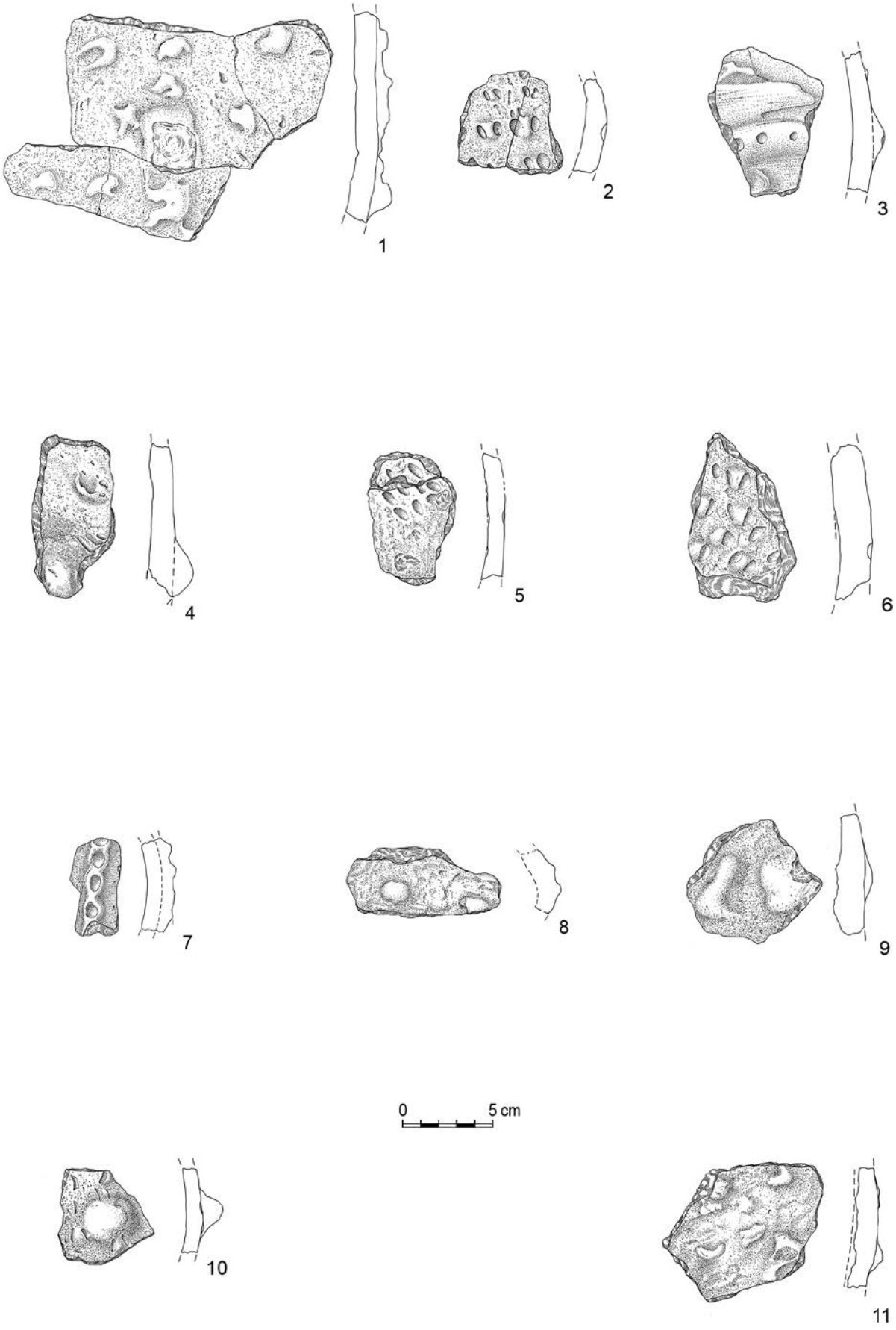


Plate 23

1 DNr 149a; ID 3854; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration E1.

2 DNr 149b; ID 3855; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration F6.

3 DNr 152; ID 3878; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration F6.

4 DNr 155; ID 3873; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration B5 and F6.

5 DNr 156; ID 3877; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration B2.

6 DNr 143; ID 3885; Feature F4; middle fragment; Fabric Group 1; surface untreated; decoration D1.

7 DNr 157; ID 3876; Feature F2; rim fragment; Fabric Group 1; surface untreated; decoration B2.

8 DNr 159; ID 3852; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration B5 and F6.

9 DNr 158; ID 3874; Feature F2N; middle fragment; Fabric Group 1; surface untreated; decoration E1.

10 DNr 113; ID 3881; Feature F4; middle fragment; Fabric Group 1; surface untreated; decoration D3.

11 DNr 120; ID 3884; Feature F4; middle fragment; Fabric Group 1; surface untreated; decoration E3.

12 DNr 589; Feature F4; middle fragment; surface untreated; decoration B3

13 DNr 144; ID 23987; Feature F6; middle fragment; Fabric Group 1; surface untreated; decoration B2.

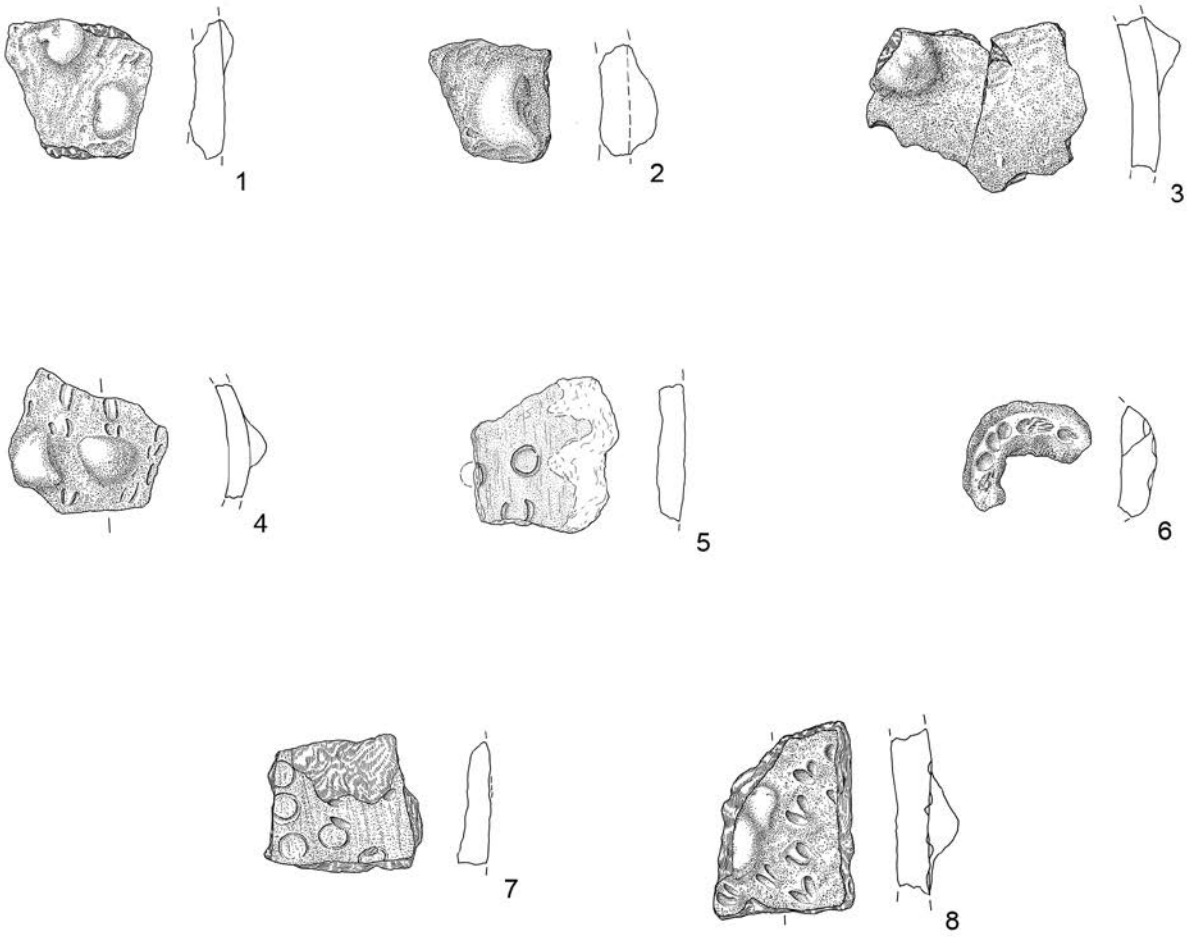


Plate 24

1 DNr 81; ID 3849; Feature F2; Bottom 1; Fabric Group 1; surface untreated; undecorated.

2 DNr 66; ID 3844; Feature F2; Bottom 1; Fabric Group 1; surface untreated; undecorated.

3 DNr 62; ID 3848; Feature F2; Bottom 1; Fabric Group 1; surface untreated; decoration B3.

4 DNr 142; ID 3868; Feature F2N; Bottom 1; Fabric Group 1; surface untreated; decoration B5.

5 DNr 153; ID 3872; Feature F2; Bottom 4; Fabric Group 1; surface untreated; undecorated.

6 DNr 119; ID 3880; Feature F4; Bottom 7; Fabric Group 1; surface untreated; undecorated.

7 DNr 122; ID 3882; Feature F4; Bottom 1; Fabric Group 1; surface untreated; decoration B5.

8 DNr 160; ID 3883; Feature F4; rim fragment; Fabric Group 1; Jug 3; smoothed surface; undecorated.

9 DNr 123; ID 3822; feature F4; rim fragment; Fabric Group 1; Small Pot 3; surface untreated; decoration C4; diameter at mouth 11 cm; max. diameter 13 cm.

10 DNr 151; ID 3869; Feature F2N; rim fragment; Fabric Group 1; surface untreated; undecorated.

11 DNr 154; ID 3871; Feature F2N; rim fragment; Fabric Group 1; surface untreated; undecorated.

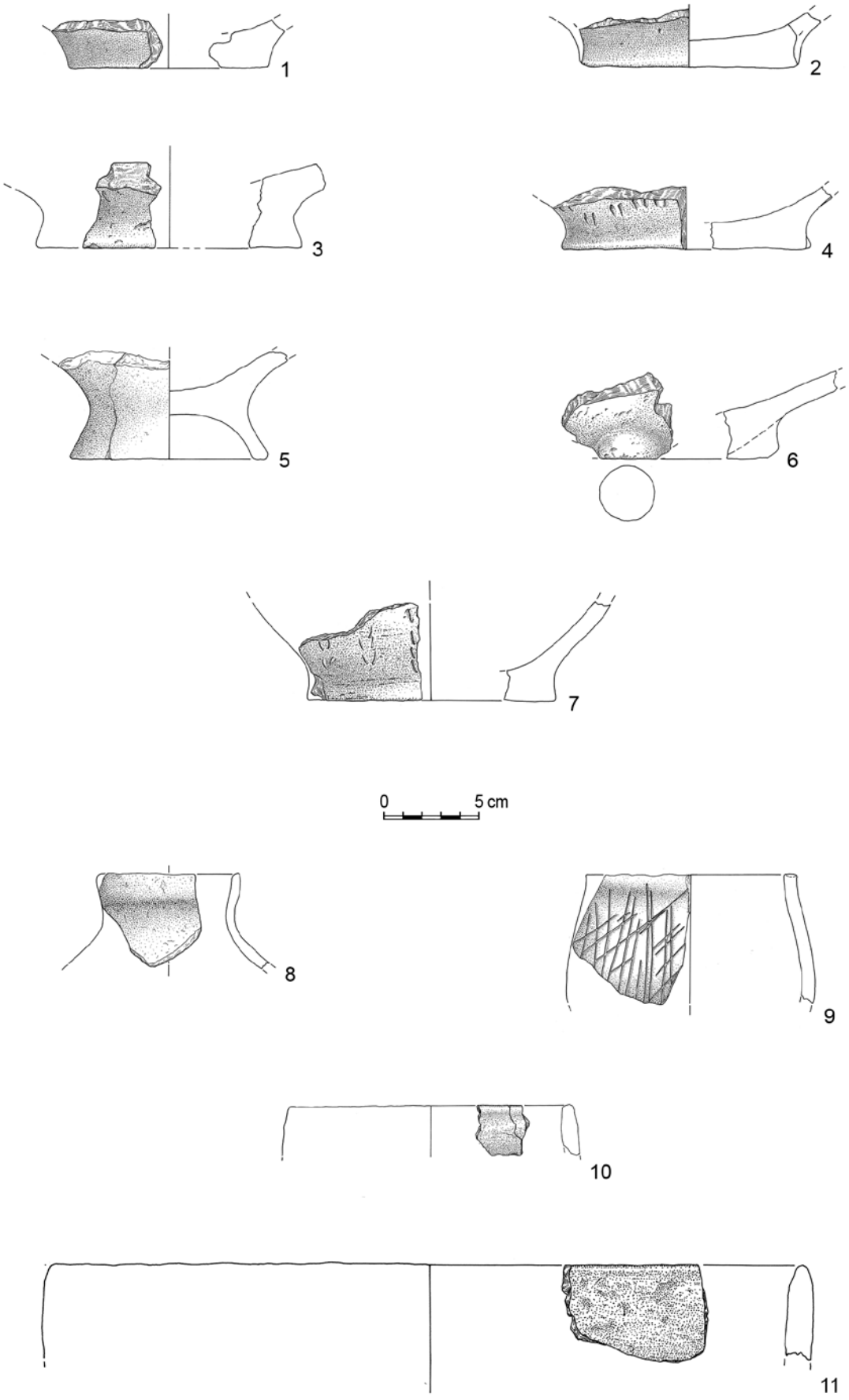


Plate 25

1 DNr 72f; Feature G2; middle fragment; Fabric Group 1; surface untreated; decoration B3.

2 DNr 72g; Feature G2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

3 DNr 72h; Feature G2; middle fragment; Fabric Group 1; surface untreated; decoration B3.

4 DNr 72i; Feature G2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

5 DNr 209; ID 13584; Feature G2; middle fragment; Fabric Group 1; cord loop; surface untreated; decoration B3.

6 DNr 251a; ID 13559; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration E1.

7 DNr 471; ID 23994; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration B3.

8 DNr 213; ID 13561; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration B3 and C3.

9 DNr 226; ID 13556; Feature G6; middle fragment; Fabric Group 1; cord loop; surface untreated; decoration B3.

10 DNr 308; ID 13586; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration D5.

11 DNr 538; Feature G-H1; middle fragment; surface untreated; undecorated.

12 DNr 268a; ID 13584; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration B4.

13 DNr 500; ID 23946; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration C4 and F4.

14 DNr 221; ID 13549; Feature G2; middle fragment; Fabric Group 1; surface untreated; decoration B3 and F1.

15 DNr 251b; ID 13558; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration C5.

16 DNr 312; ID 23946; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration B5.

17 DNr 185; ID 13550; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration B6.

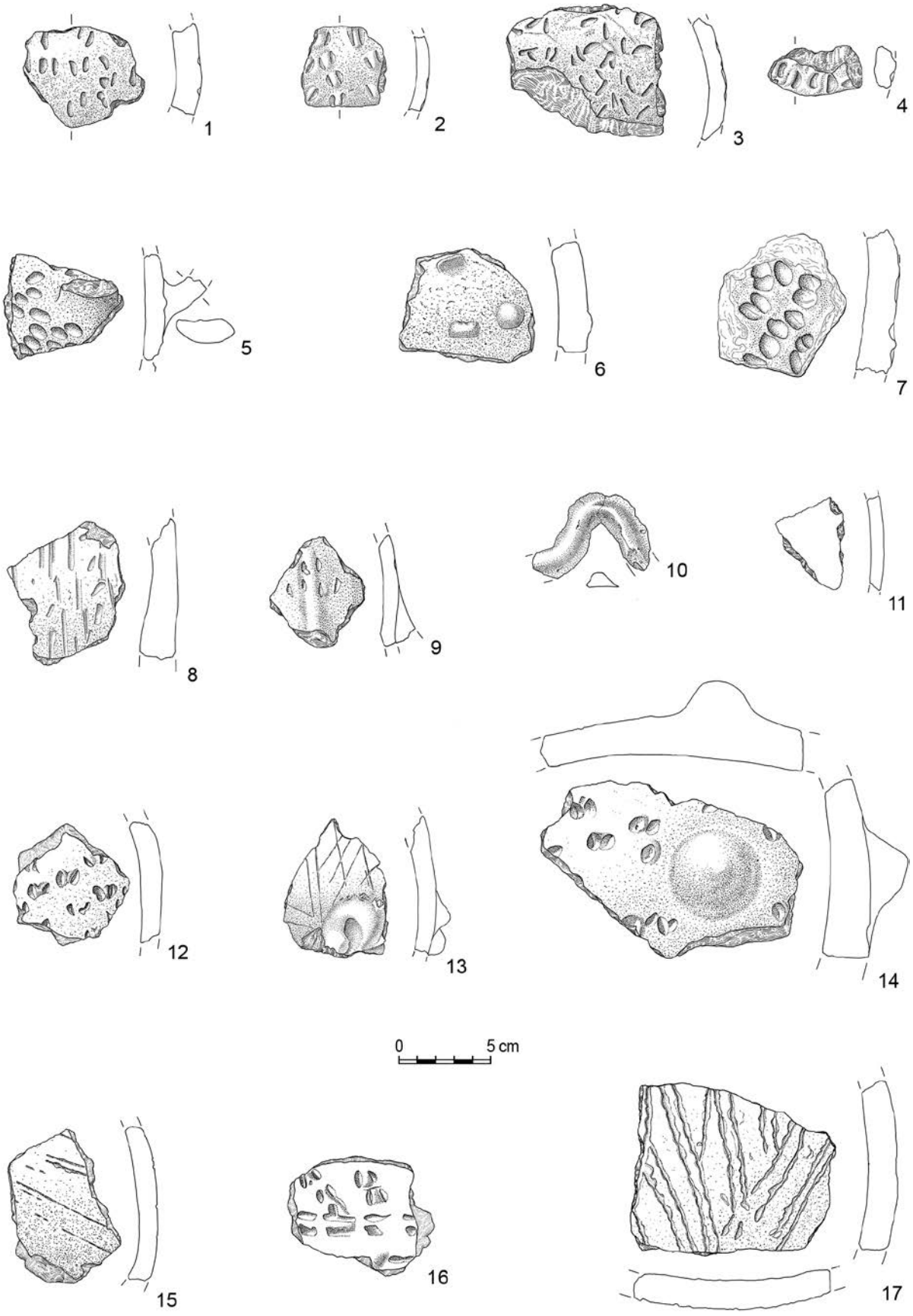


Plate 26

1 DNr 518; ID 23986; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration C5.

2 DNr 229; ID 13573; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration C5 andF1.

3 DNr 288b; ID 13605; Feature G9; middle fragment; Fabric Group 1; surface untreated; decoration B4.

4 DNr 268b; ID 13584; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration B3.

5 DNr 269d; ID 13576; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration B5e.

6 DNr 269f; ID 13579; Feature G7; middle fragment; Fabric Group 1; surface untreated; decoration B3.

7 DNr 196; ID 13689; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration C5 and F1.

8 DNr 303; ID 13600; Feature G8; middle fragment; Fabric Group 1; surface untreated; decoration E1 and F2.

9 DNr 288c; Feature G9; middle fragment; surface untreated; decoration E2 and F5.

10 DNr 184; ID 13697; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration C4 and F4.

11 DNr 187a; ID 13602; Feature G10; middle fragment; Fabric Group 1; Pot; surface untreated; decoration B3, C5, and F6c.

12 DNr 493; ID 16191; Feature G9; middle fragment; Fabric Group 1; surface untreated; decoration C2.

13 DNr 195; ID 13555; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration F4.

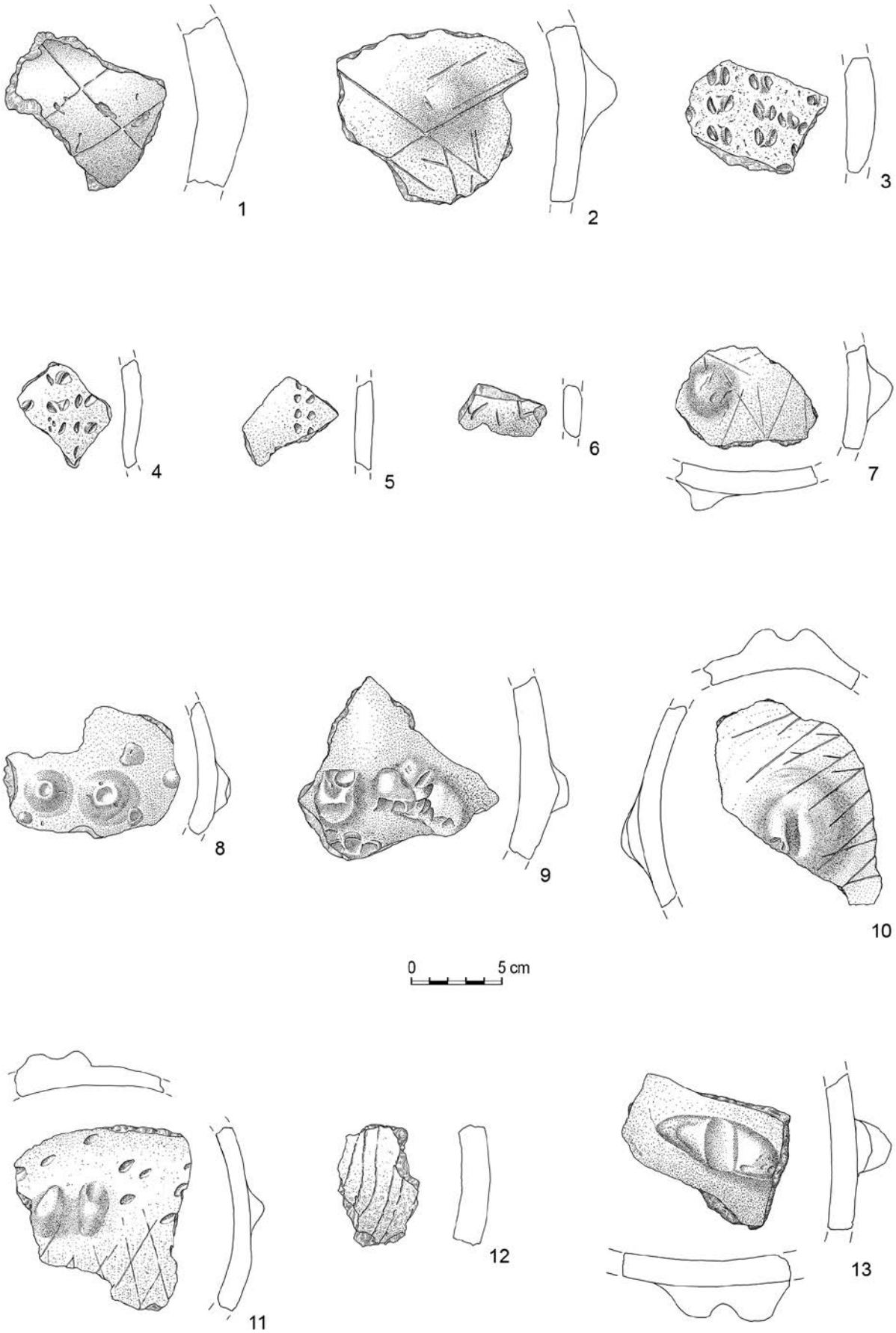


Plate 27

1 DNr 187b; ID 13603; Feature G10; middle fragment; Fabric Group 1; Pot; surface untreated; fingernail tracks, decoration B5 and D3.

2 DNr 232; ID 13695; Feature G10; middle fragment; Fabric Group 1; Pot; surface untreated; decoration B4 and D3.

3 DNr 292; ID 13701; Feature G10; middle fragment; Fabric Group 1; cord loop; surface untreated; undecorated.

4 DNr 206; ID 13568; Feature G6; middle fragment; Fabric Group 1; surface untreated; decoration B3.

5 DNr 274c; ID 13691; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration B4.

6 DNr 256; ID 13608; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration B6.

7 DNr 288a; ID 13604; Feature G9; middle fragment; Fabric Group 1; surface untreated; decoration B3.

8 DNr 301; ID 13698; Feature G10; middle fragment; Fabric Group 1; cord loop; surface untreated; undecorated.

9 DNr 300; ID 13703; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration F2.

10 DNr 255; ID 13694; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration B3.

11 DNr 274b; ID 13692; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration B3 and B4.

12 DNr 302; ID 13706; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration F4.

13 DNr 259; ID 13687; Feature G10; middle fragment; Fabric Group 1; surface untreated; decoration E1.

Plate 28

1 DNr 495; ID 23984; Feature G10; middle fragment; Fabric Group 1; Pot, surface untreated; decoration C4.

2 DNr 242; ID 13413; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; Pot; decoration F1; diameter at mouth 22.60 cm.

3 DNr 239b; ID 13419; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; decoration B5 and E1.

4 DNr 197; ID 13705; Feature G10; middle fragment; Fabric Group 1; Small Pot 3; surface untreated; undecorated; diameter at mouth 14.50 cm.

5 DNr 240; ID 13409; Feature G-H1; middle fragment; Fabric Group 1; corded loop; surface untreated; undecorated; diameter at mouth 12.70 cm.

6 DNr 249; ID 13407; Feature G-H1; Bottom 7; Fabric Group 1; surface untreated; undecorated.

7 DNr 238; ID 13408; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; decoration B5.

8 DNr 304; ID 13707; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; decoration F6.

9 DNr 248; ID 13699; Feature G10; Bottom 7; Fabric Group 1; surface untreated; undecorated.

10 DNr 273; ID 13416; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; decoration B3.

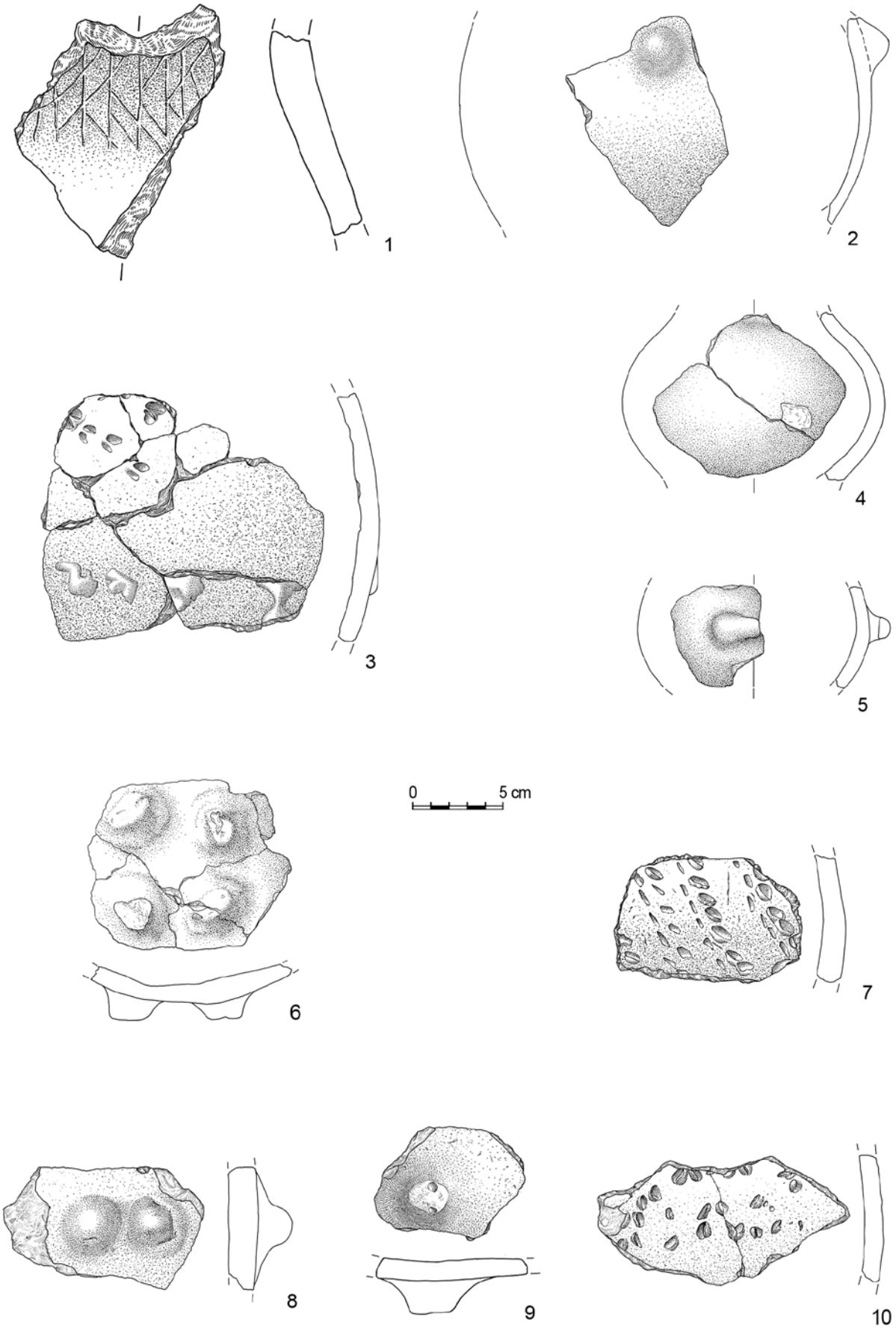


Plate 29

1 DNr 586; ID 24624; Feature G-H1; Storage Pot, middle fragment; Fabric Group 1; roughened surface; decoration E3 and F9.

2 DNr 375; ID 16098; Feature G-H1; middle fragment; Fabric Group 1; surface untreated; decoration B6 and D2.

3 DNr 271; ID 13421; Feature G-H1; rim fragment; Fabric Group 1; Pot 4; surface untreated; decoration A1.

4 DNr 239a; ID 13420; Feature G-H1; rim fragment; Fabric Group 1; Bowl 2; surface untreated; undecorated.

5 DNr 225; ID 13702; Feature G10; rim fragment; Pot 4; Fabric Group 1; surface untreated; undecorated.

6 DNr 252; ID 13704; Feature G10; rim fragment; Fabric Group 1; Big Bowl 3; surface untreated; decoration A1 and E1.

7 DNr 573; ID 5171; Feature G10NW; rim fragment; Fabric Group 1; Big Bowl 3; surface untreated; decoration A1 and E3.

8 DNr 537; Feature G6; rim fragment; Fabric Group 1; surface with red slip; undecorated.

9 DNr 577; ID 4741; Feature G6; rim fragment; Fabric Group 1; Miniature Vessel; surface untreated; undecorated.

10 DNr 269c; ID 13574; Feature G7; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration B3.

11 DNr 269h; ID 13578; Feature G7; rim fragment; Fabric Group 1; surface untreated; undecorated.

12 DNr 254; ID 13582; Feature G7; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1.

13 DNr 269a; ID 13575; Feature G7; rim fragment; Fabric Group 1; surface untreated; decoration A1.

14 DNr 199; ID 13569; Feature G6; rim fragment; Fabric Group 1; Pot 1; surface untreated; decoration B4.

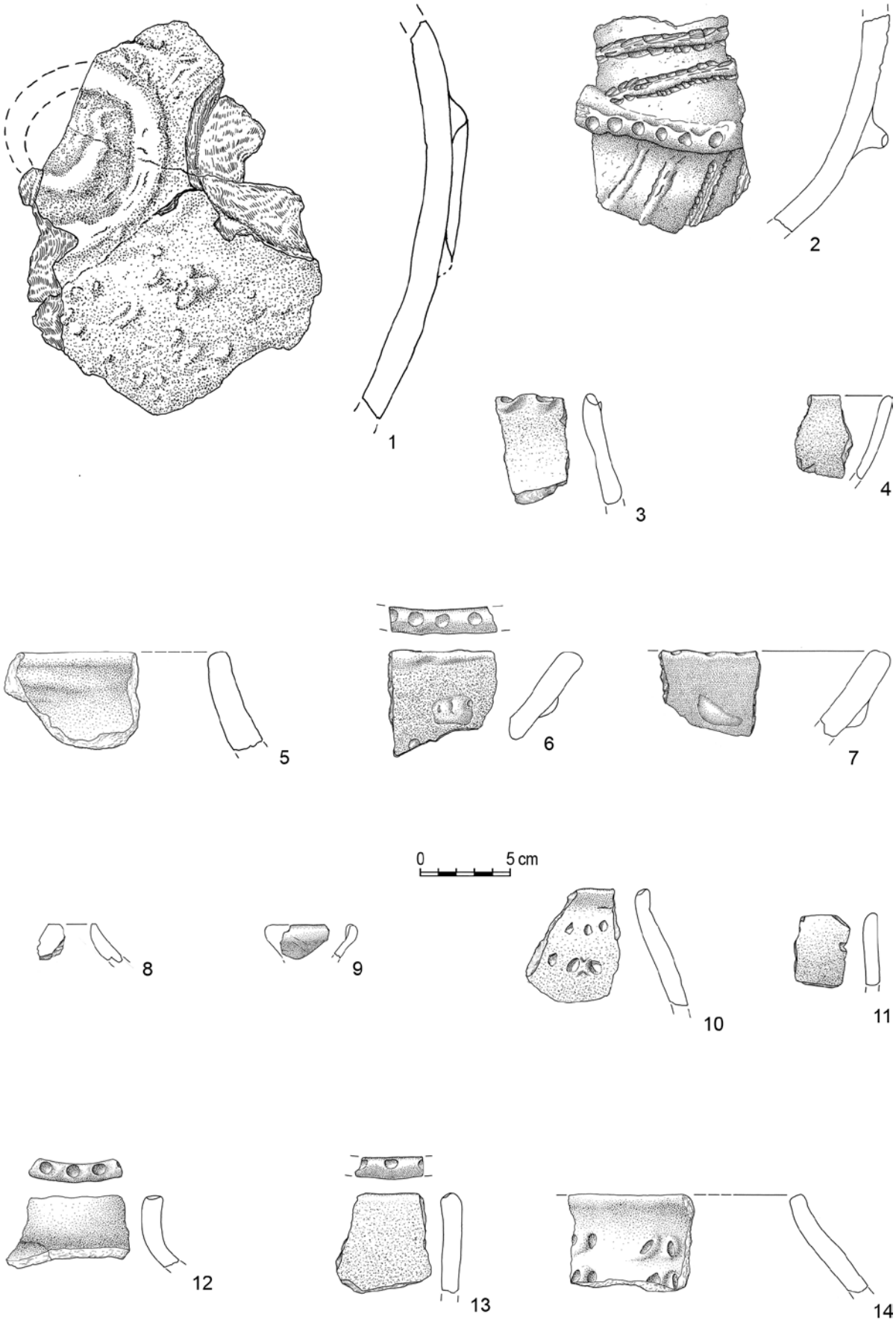


Plate 30

1 DNr 72c; Feature G2; rim fragment; Bowl 4; Fabric Group 1; surface untreated; undecorated.

2 DNr 72d; Feature G2; rim fragment; Bowl 1; Fabric Group 1; surface untreated; undecorated.

3 DNr 72e; Feature G2; rim fragment; Pot; Fabric Group 1; surface untreated; undecorated.

4 DNr 350; Feature G2; rim fragment; Pot; Fabric Group 1; surface untreated; undecorated.

5 DNr 201; ID 13547; Feature G6; rim fragment; Small Pot 1; Fabric Group 1; Closed Bowl; surface untreated; double secondary perforation; diameter at mouth 20.80 cm; max. diameter 22.70 cm.

6 DNr 222; ID 13606; Feature G9; rim fragment; Fabric Group 1; Small Pot 3; surface untreated; undecorated; diameter at mouth 13.80 cm.

7 DNr 205; ID 13554; Feature G6; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated.

8 DNr 228; ID 13552; Feature G6; rim fragment; Fabric Group 1; Jug 1; surface untreated; undecorated; diameter at mouth 11.70 cm.

9 DNr 9127; 24359; Feature G10; Miniature Vessel (Mug 2); Fabric Group 1; surface untreated; undecorated; height complete vessel 6 cm; diameter at mouth 6 cm; max. diameter 6.20 cm.

10 DNr 6732/7638; ID 24357; Feature G10; Bowl 3; Fabric Group 1; surface untreated; undecorated; height complete vessel 6 cm; diameter at mouth 12.20 cm.

11 DNr 7636; ID 24356; Feature G6; Small Pot 2; Fabric Group 1; remains of a circumferential zig-zag band painted with dark paint; height complete vessel 5.50 cm; diameter at mouth 11.40 cm; max. diameter 12.50 cm.

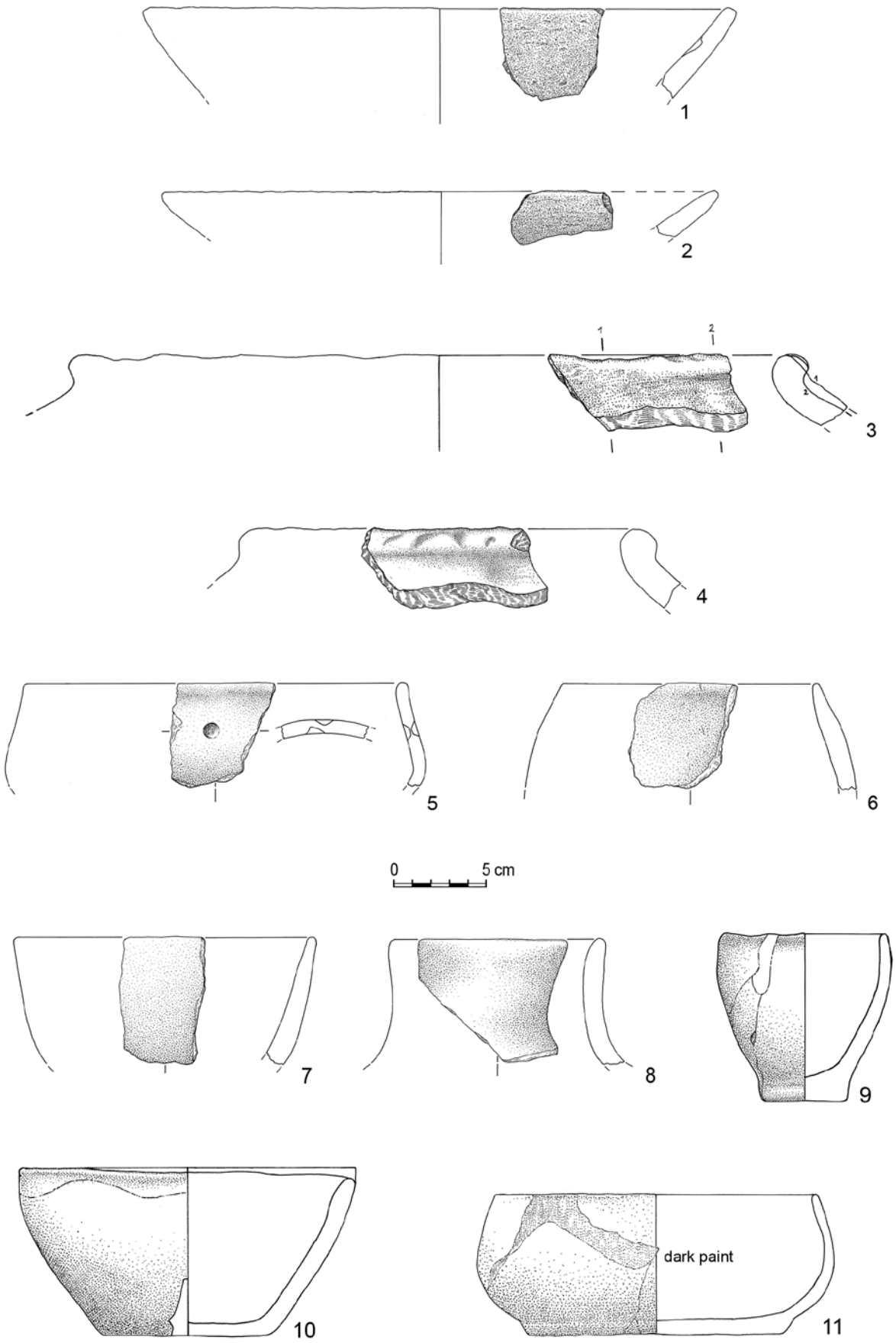


Plate 31

1 DNr 501; ID 24034; Feature G10; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 12 cm.

2 DNr 579; ID 4666; Feature G6; rim fragment; Fabric Group 1; Small Pot 4; smoothed surface; undecorated; diameter at mouth 18 cm.

3 DNr 569; ID 24028; Feature G6; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 32 cm.

4 DNr 269e; Feature G7; rim fragment; Pot 2; surface untreated; decoration B3.

5 DNr 574; ID 24027; Feature H1; rim fragment; Fabric Group 1; Bowl 2; surface untreated; undecorated; diameter at mouth 14 cm.

6 DNr 245; ID 13588; Feature G8; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and B3; diameter at mouth 14.80 cm.

7 DNr 191; ID 13686; Feature G10; rim fragment; Fabric Group 1; Pot 1; surface untreated; undecorated; diameter at mouth 14.40 cm; max. diameter 18.50 cm.

8 DNr 485; ID 24031; Feature G10; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 30 cm.

9 DNr 212; ID 13607; Feature G10; rim fragment; Fabric Group 1; Bowl 4; smoothed surface; undecorated; diameter at mouth 27 cm.

10 DNr 608; Feature G6; rim fragment; Pot 3; surface untreated; undecorated.

11 DNr 274a; ID 13693; Feature G10; rim fragment; Fabric Group 1; Pot 2; surface untreated; undecorated; diameter at mouth 14 cm; max. diameter 17.50 cm.

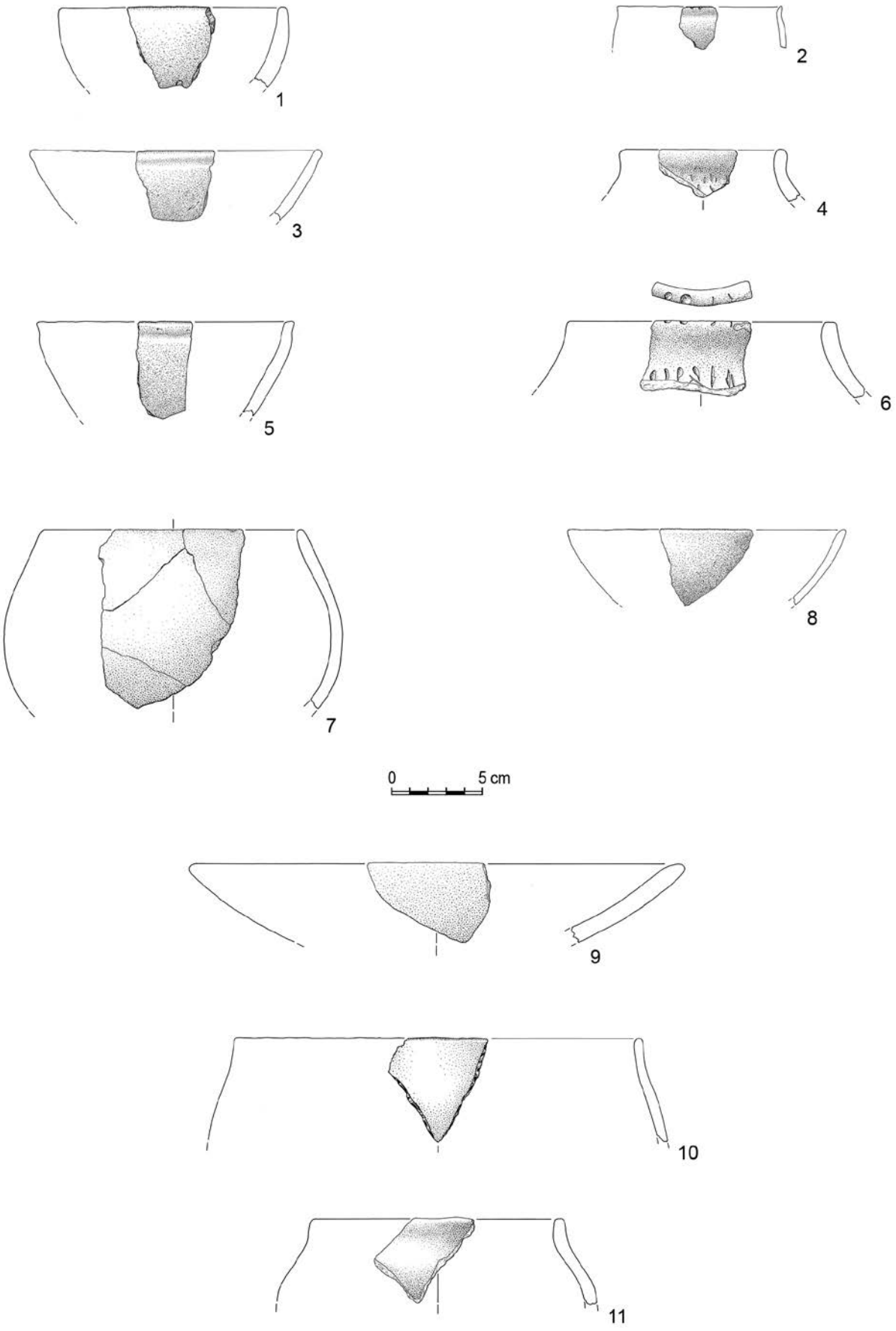


Plate 32

1 DNr 399; ID 14009; Feature G11; rim fragment; Fabric Group 1; Pot 1; surface untreated; decoration B3; diameter at mouth 30 cm.

2 DNr 494; ID 23967; Feature G10; rim fragment; Fabric Group 1; Pot 2; surface untreated; undecorated; diameter at mouth 16 cm.

3 DNr 310; Feature G10; rim fragment; Bowl 1; surface untreated; undecorated.

4 DNr 333; ID 16094; Feature G-H1; rim fragment; Fabric Group 1; Bowl 1; surface untreated; undecorated; diameter at mouth 45 cm.

5 DNr 395; ID 16100; Feature G-H1; rim fragment; Fabric Group 1; Bowl 1; surface untreated; undecorated; diameter at mouth 35 cm.

6 DNr 9897; ID 24379; Feature G-H1; Fabric Group 1; Bowl 2; Bottom 4; surface untreated; undecorated; height complete vessel 8.60 cm; diameter at mouth 17.60 cm.

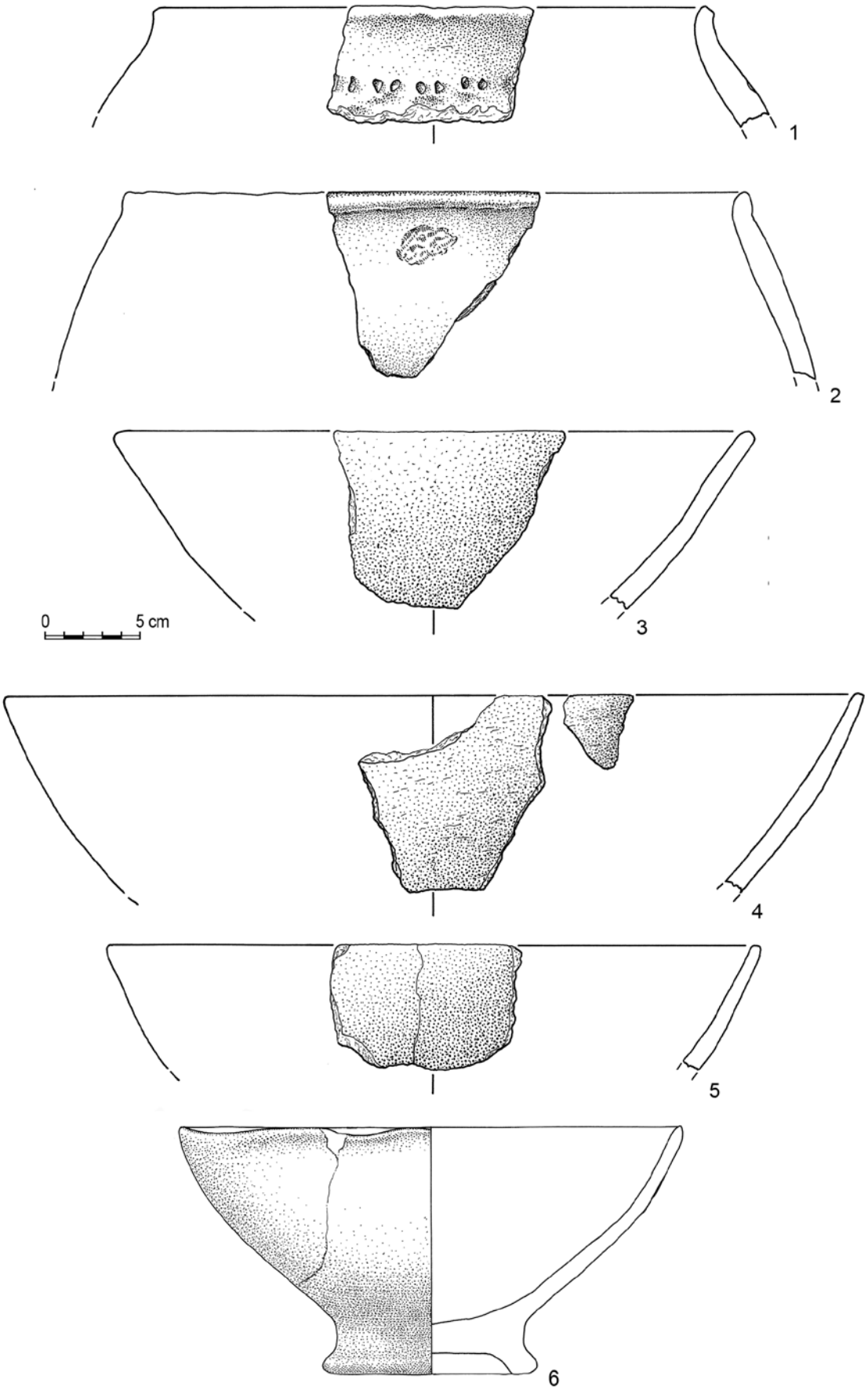


Plate 33

1 DNr 309; ID 13570; Feature G6; rim fragment; Fabric Group 1; Big Bowl 4; surface untreated; decoration A1; diameter at mouth 57 cm.

2 DNr 230; ID 24362; Feature G10; rim fragment; Fabric Group 1; Storage Pot 2; surface untreated; decoration A1, C4 and F1; diameter at mouth 26 cm.

3 DNr 9785; ID 24360; Feature G-H1; Fabric Group 1; Bowl 2; Bottom 7; surface untreated; undecorated; height 10.20 cm.

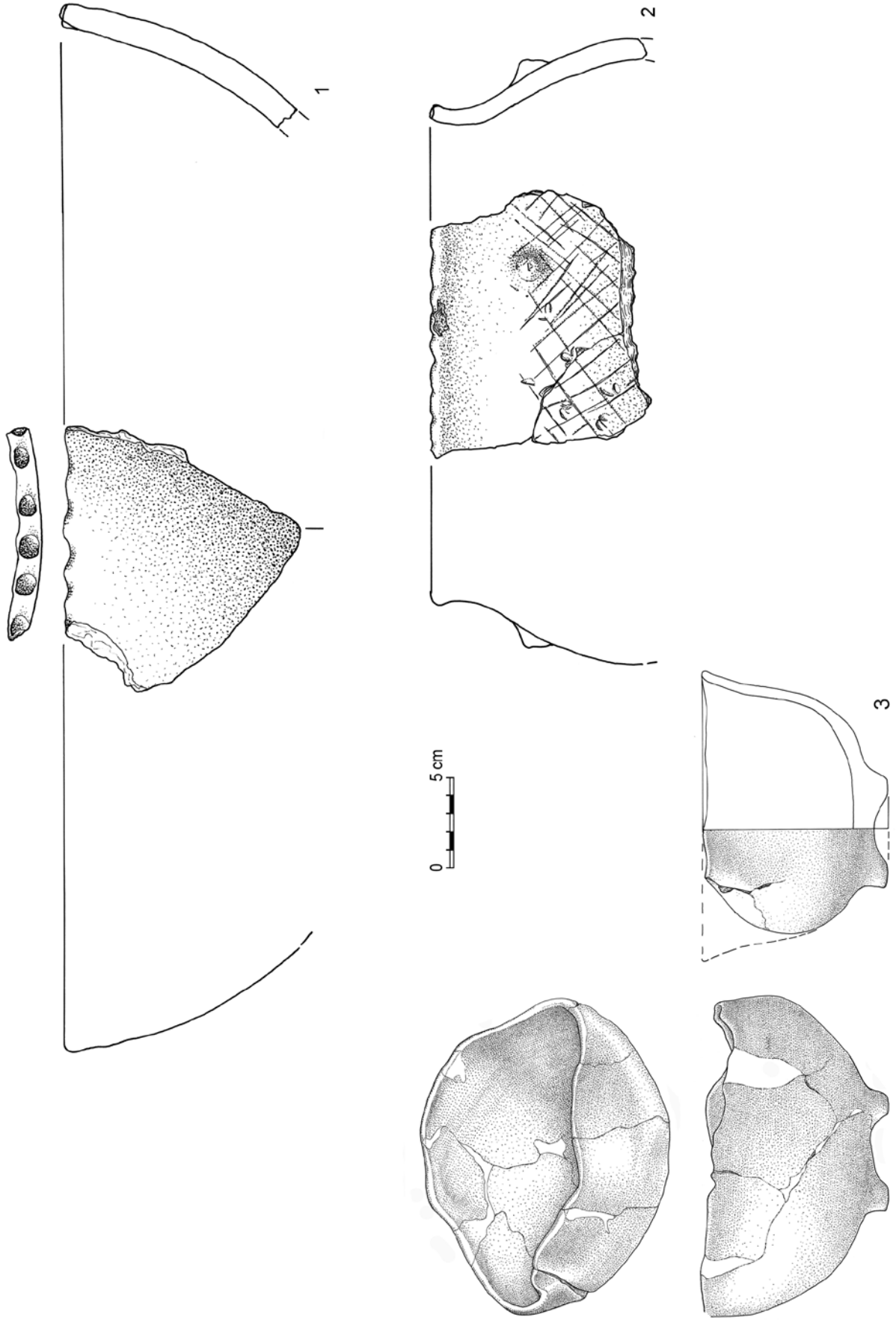


Plate 34

1 DNr 72a; ID 3992; Feature G2; Bottom 4; Fabric Group 1; surface untreated; undecorated.

2 DNr 72b; ID 3991; Feature G2; Bottom 2; Fabric Group 1; surface untreated; undecorated.

3 DNr 215; ID 13560; Feature G6; Bottom 1; Fabric Group 1; Pot; surface untreated; decoration B3.

4 DNr 257; ID 13567; Feature G6; Bottom 4; Fabric Group 1; surface untreated; undecorated.

5 DNr 253; ID 13583; Feature G7; Bottom 1; Fabric Group 1; surface untreated; undecorated.

6 DNr 269g; ID 13580; Feature G7; Bottom 1; Fabric Group 1; surface untreated; undecorated.

7 DNr 189; ID 13688; Feature G10; Bottom 4; Fabric Group 1; surface untreated; undecorated.

8 DNr 262; ID 13700; Feature G10; Bottom 3; Fabric Group 1; surface untreated; undecorated.

9 DNr 311; ID 13572; Feature G7; Bottom 1; Fabric Group 1; Mug; surface untreated; undecorated.

10 DNr 351; ID 16158; Feature G10; Bottom 1; Fabric Group 1; Pot; surface untreated; decoration B4.

11 DNr 235; ID 13403; Feature G-H1; Bottom 1; Fabric Group 1; surface untreated; undecorated.

12 DNr 194; ID 13551; Feature G6; Bottom 1; Fabric Group 1; surface untreated; undecorated.

13 DNr 182; ID 13696; Feature G10; Bottom 6; Fabric Group 1; surface untreated; decoration C4.

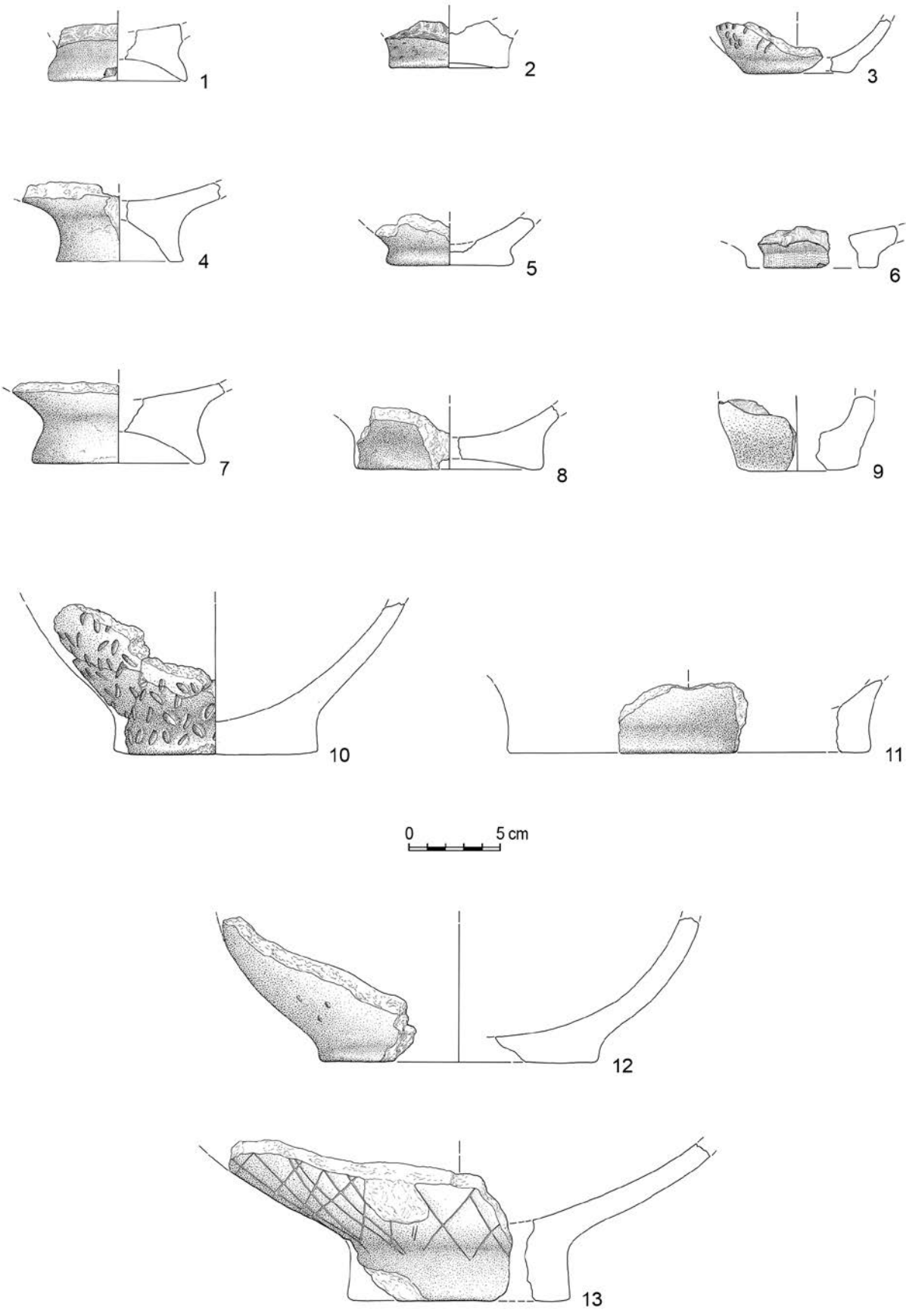


Plate 35

1 DNr 519; ID 24015; Feature G10; Bottom 3; Fabric Group 1; surface untreated; decoration C5 on the standing surface.

2 DNr 628; ID 16209; Feature G10; Bottom 1; Fabric Group 1; surface untreated; decoration C4.

3 DNr 246; ID 13411; Feature G-H1; Bottom 1; Fabric Group 1; surface untreated; undecorated.

4 DNr 236; ID 13415; Feature G-H1; Bottom 1; Fabric Group 1; surface untreated; undecorated.

5 DNr 180; ID 24364; Feature G-H9; Bottom 4; Fabric Group 1; Bowl; surface untreated; undecorated.

6 DNr 341; ID 16095; Feature G-H1; Bottom 6; Fabric Group 1; Pot; surface untreated; decoration B4; diameter at mouth 13 cm.

7 DNr 270; ID 13426; Feature G-H1; Bottom 3; Fabric Group 1; surface untreated; undecorated.

8 DNr 248; ID 13699; Feature G10; Bottom 1; Fabric Group 1; surface untreated; undecorated.

9 DNr 551; Feature G6; Bottom 3; surface untreated; undecorated.

10 DNr 354; Feature GHI; Bottom 7 or decoration F4; surface untreated.

11 DNr 125; ID 24559; Feature G2; Bottom 7; Fabric Group 1; surface untreated; undecorated.

12 DNr 263; Feature G2; Bottom 7; surface untreated; undecorated.

13 DNr 279; ID 13414; Feature G-H1; Bottom 7; Fabric Group 1; surface untreated; undecorated.

14 DNr 85; ID 13553; Feature G2; Bottom 7; Fabric Group 1; surface untreated; undecorated.

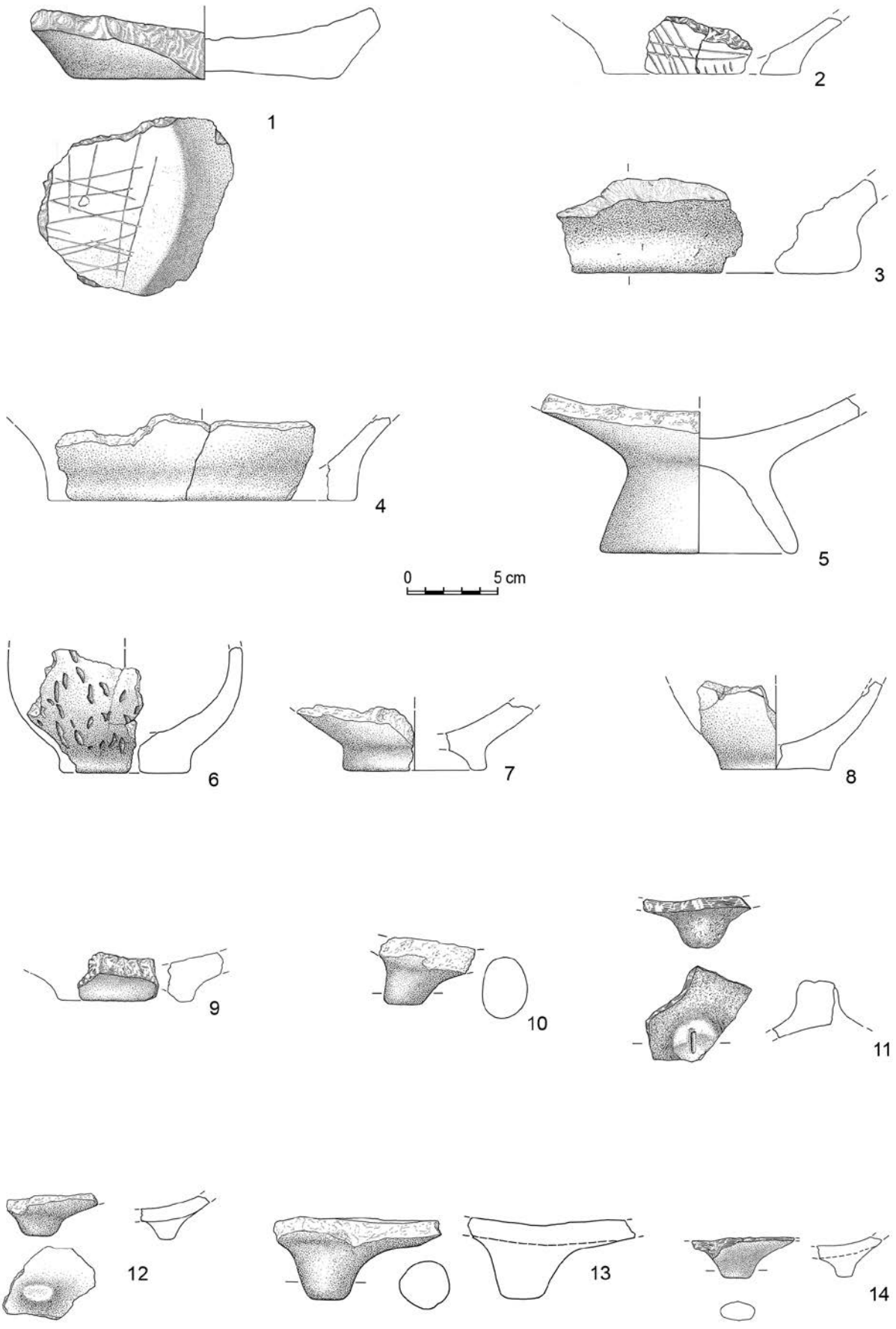


Plate 36

1 DNr 111a; ID 24573; Feature H1; middle fragment; Fabric Group 1; surface untreated; decoration B6.

2 DNr 111b; Feature H1; middle fragment; surface untreated; decoration B3.

3 DNr 166b; ID 24558; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

4 DNr 112g; ID 23940; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration E1 and F6.

5 DNr 112h; ID 23983; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration C4.

6 DNr 112b; ID 23996; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B3.

7 DNr 112j; ID 23947; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration E2.

8 DNr 112n; ID 23981; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B6.

9 DNr 112i; ID 23999; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B3.

10 DNr 112p; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration E3.

11 DNr 112 m; ID 23985; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration C3.

12 DNr 112o; ID 24000; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B6.

13 DNr 163; ID 24540; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B4.

14 DNr 164b; ID 24542; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B3 and F1.

15 DNr 165a; Feature H2; middle fragment; surface untreated; decoration B5.

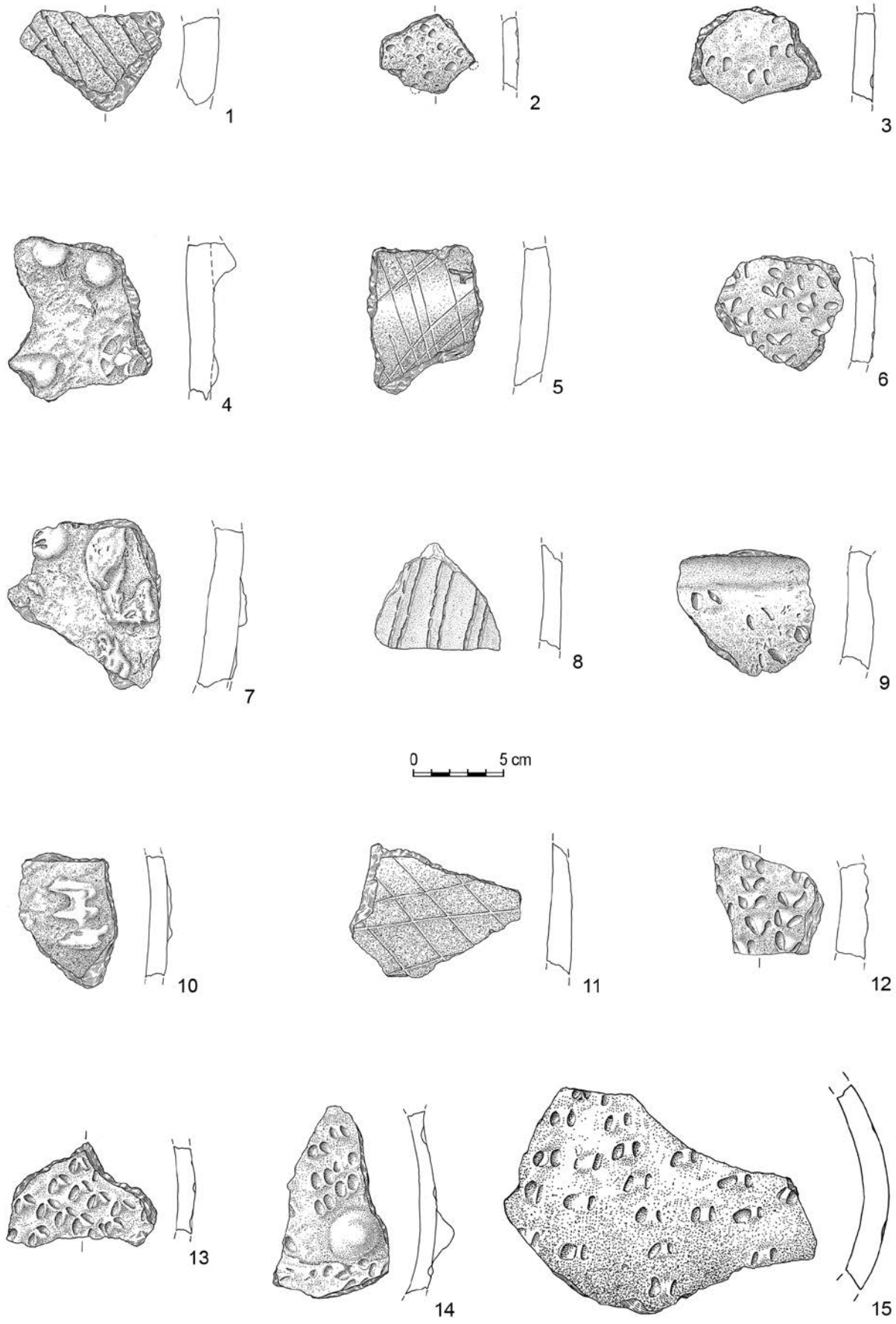


Plate 37

1 DNr 165d; Feature H2; middle fragment; surface untreated; decoration C4.

2 DNr 318; ID 16133; Feature H9; Bottom 7; Fabric Group 1; surface untreated; undecorated.

3 DNr 203c; ID 16490; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration D2.

4 DNr 203h; ID 16491; Feature H2; middle fragment; Fabric Group 1; handle fragment (?); surface untreated; undecorated.

5 DNr 324; ID 16117; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration F4.

6 DNr 353; ID 16105; Feature H8; middle fragment; Fabric Group 1; cord loop; surface untreated; undecorated.

7 DNr 317; ID 16118; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration F6.

8 DNr 319; Feature H8; middle fragment; surface untreated; decoration C4.

9 DNr 320; ID 16120; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration F6.

10 DNr 325; ID 16107; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration C4.

11 DNr 337; ID 16102; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration C2.

12 DNr 345; Feature H8; middle fragment; surface untreated; decoration C4.

13 DNr 366; ID 16113; Feature H8; middle fragment; Fabric Group 1; cord loop; surface untreated; undecorated.

14 DNr 570; ID 6517; Feature H8; middle fragment; Fabric Group 1; surface untreated; decoration D4.

15 DNr 635; Feature H2; middle fragment; surface untreated; decoration C4.

16 DNr 112q; Feature H2; middle fragment; surface untreated; decoration D2.

17 DNr 112r; ID 7151; Feature H2; middle fragment; Fabric Group 1; surface untreated; decoration B5 and E2.

18 DNr 343; ID 16157; Feature H9; middle fragment; Fabric Group 1; surface untreated; decoration B6.

19 DNr 378; ID 16135; feature H9; middle fragment; Fabric Group 1; surface untreated; decoration F6.

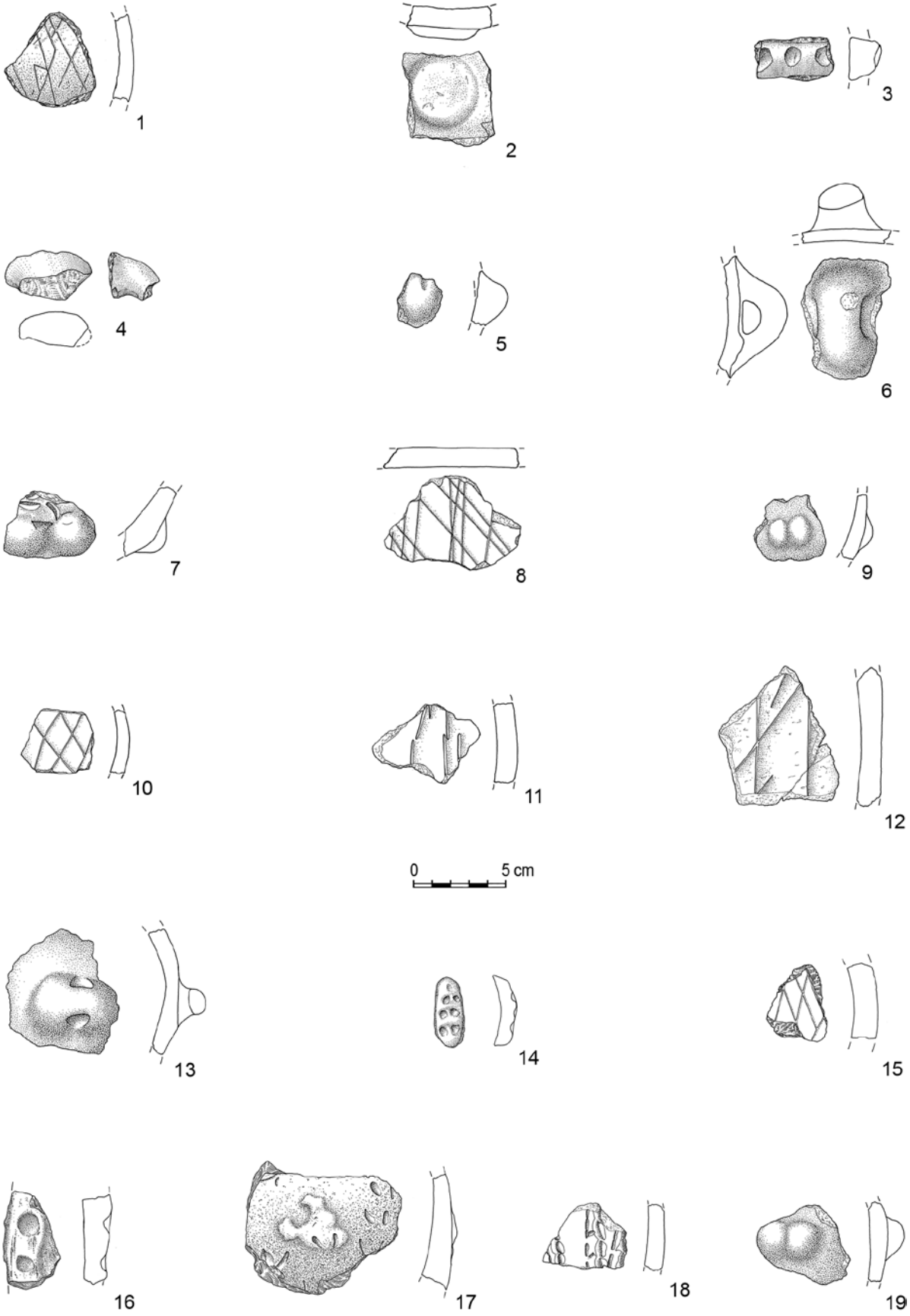


Plate 38

1 DNr 609; Feature H9; middle fragment; Pot; surface untreated; decoration B3, B6 and D3.

2 DNr 334; ID 16142; Feature H9; middle fragment; Fabric Group 1; cord loop; Jug 2; surface untreated; undecorated.

3 DNr 435; ID 13519; Feature H9; middle fragment; Fabric Group 1; surface untreated; decoration C3.

4 DNr 446; ID 13433; Feature H9; middle fragment; Fabric Group 1; surface untreated; decoration B4 and F2.

5 DNr 449; Feature H9; Bottom 4 but square shaped; surface untreated; undecorated.

6 DNr 112c; ID 23995; Feature H2; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and B4.

7 DNr 626; Feature H8; rim fragment; Miniature Vessel; surface untreated; decoration B3.

8 DNr 203g; ID 16492; Feature H2; rim fragment; Fabric Group 1; surface untreated; decoration A1.

9 DNr 165b; Feature H2; rim fragment; Pot 3; surface untreated; undecorated.

10 DNr 165c; Feature H2; rim fragment; Pot 2; surface untreated; decoration A1.

11 DNr 387; ID 16128; Feature H9; rim fragment; Fabric Group 1; Bowl 1; smoothed surface; secondary perforation.

12 DNr 326; ID 16114; Feature H8; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B4.

13 DNr 336; ID 16103; Feature H8; rim fragment; Pot 2; Fabric Group 1; surface untreated; decoration A1 and B3.

14 DNr 396; ID 16146; Feature H9; rim fragment; Fabric Group 1; Small Pot 2; surface untreated; undecorated.

15 DNr 335; ID 16146; Feature H9; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and B4.

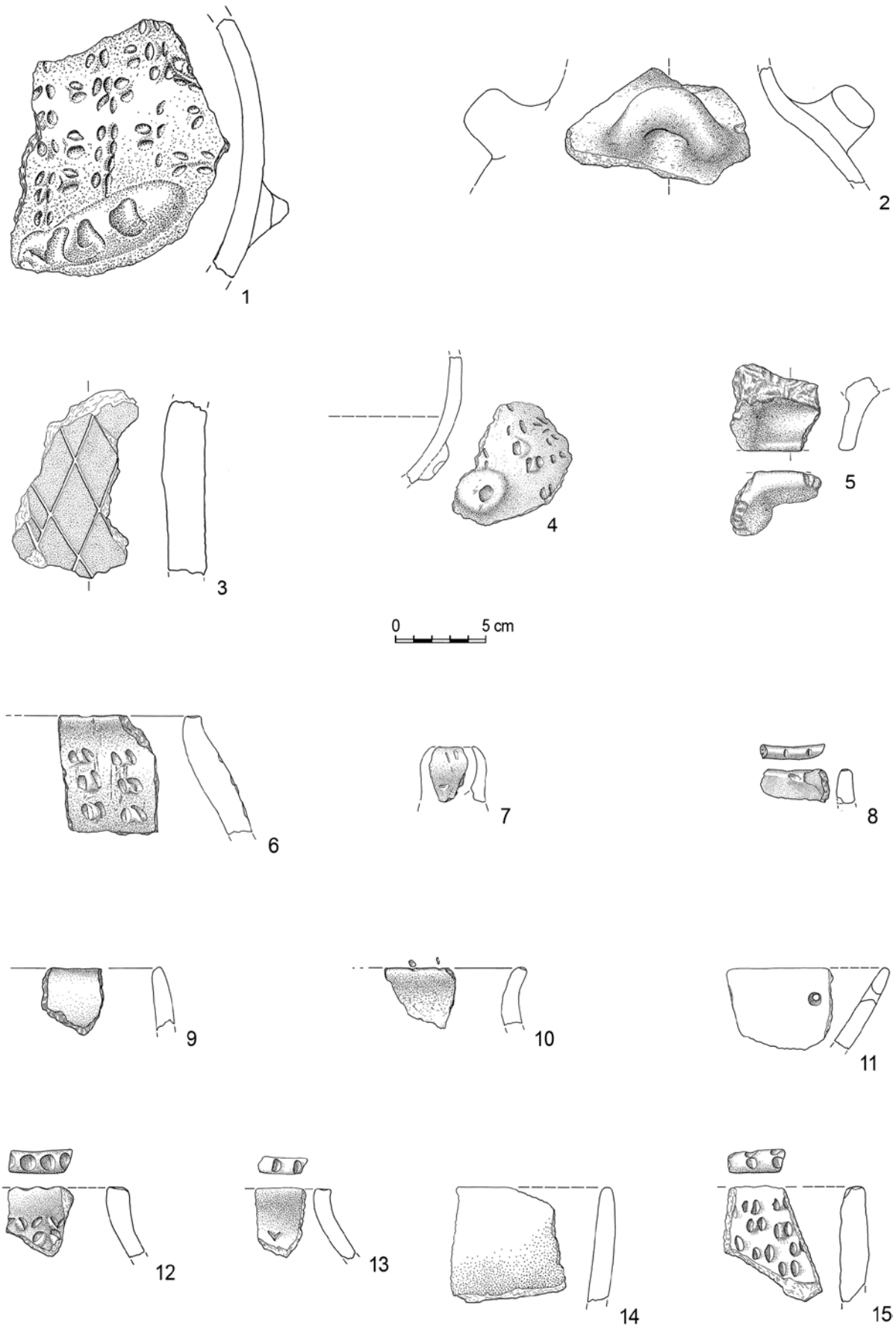


Plate 39

1 DNr 112l; ID 23997; Feature H2; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration B5; diameter at mouth 16 cm.

2 DNr 203b; ID 16488; Feature H2; rim fragment; Fabric Group 1; Pot 4; surface untreated; decoration A1; diameter at mouth 21.60 cm.

3 DNr 112k; ID 23966; Feature H2; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration B4; diameter at mouth 13 cm.

4 DNr 203f; ID 16489; Feature H2; rim fragment; Fabric Group 1; Bowl 1; surface untreated; undecorated; diameter at mouth 22.80 cm.

5 DNr 164a; ID 24541; Feature H2; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1; diameter at mouth 17 cm.

6 DNr 358; ID 16111; Feature H8; rim fragment; Fabric Group 1; Small Pot 2; surface untreated; undecorated; diameter at mouth 12 cm; max. diameter 15.50 cm.

7 DNr 505; ID 23962; Feature H3; rim fragment; Fabric Group 1; Pot 4; surface untreated; decoration B3; diameter at mouth 17 cm; max. diameter 17.60 cm.

8 DNr 552; Feature H8; rim fragment; surface untreated; undecorated.

9 DNr 374; ID 16104; Feature H8; rim fragment; Pot 2; Fabric Group 1; surface untreated; decoration A1 and B3; diameter at mouth 13 cm; max. diameter 18 cm.

10 DNr 406; ID 16143; Feature H9; rim fragment; Fabric Group 1; Bowl 4; smoothed surface; undecorated; diameter at mouth 16 cm.

11 DNr 330; ID 16145; Feature H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 14 cm.

12 DNr 323; ID 16121; Feature H9; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B3; diameter at mouth 16.50 cm.

13 DNr 359; ID 16110; Feature H8; rim fragment; Pot 2; Fabric Group 1; surface untreated; decoration B4; diameter at mouth 20 cm.

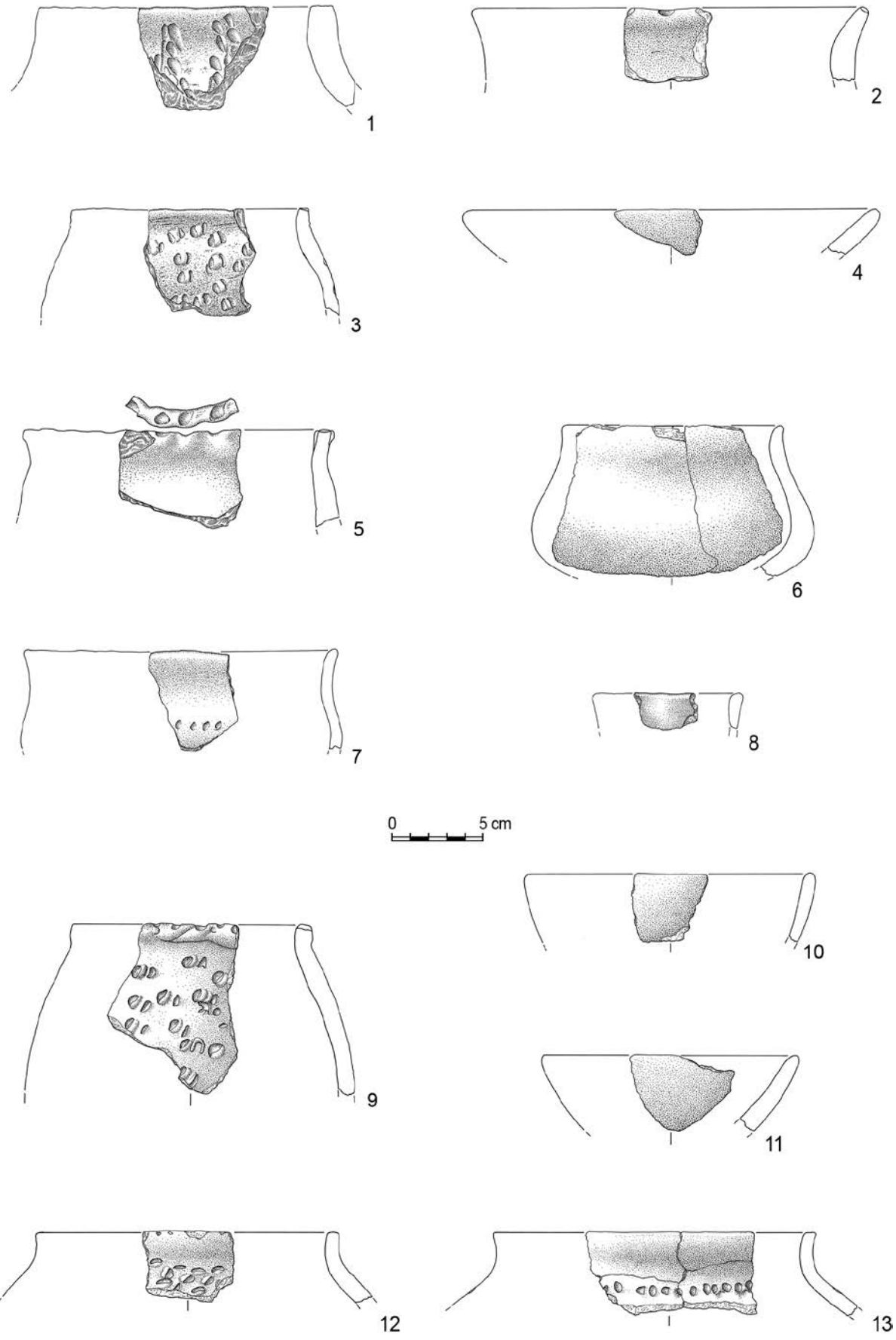


Plate 40

1 DNr 362; ID 16138; Feature H9; rim fragment; Fabric Group 1; Small Pot 4; surface untreated; decoration F1; diameter at mouth 9.70 cm; max. diameter 13.60 cm.

2 DNr 291; ID 16517; Feature H8; rim fragment; Fabric Group 1; Jug 2; cord loop; smoothed surface; undecorated.

3 DNr 342; ID 16155; Feature H9; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B3; diameter at mouth 16 cm.

4 DNr 344; ID 16147; Feature H9; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration B4; diameter at mouth 13 cm; max. diameter 16 cm.

5 DNr 352; ID 16144; Feature H9; rim fragment; Fabric Group 1; Bowl 4; smoothed surface; undecorated; diameter at mouth 11.70 cm.

6 DNr 394; ID 16151; Feature H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 25.80 cm.

7 DNr 376; ID 16132; Feature H9; rim fragment; Fabric Group 1; Small Pot 3; smoothed surface; undecorated; diameter at mouth 10 cm; max. diameter 10.50 cm.

8 DNr 510; ID 24032; Feature G-H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; secondary perforation; diameter at mouth 18.80 cm; max. diameter; 19.10 cm.

9 DNr 382; ID 16137; Feature H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 18.80 cm; max diameter 19.10 cm.

10 DNr 429; ID 16124; Feature H9; rim fragment; Fabric Group 1; Small Pot; surface untreated; undecorated; diameter at mouth 22.50 cm.

11 DNr 576; ID 6106; Feature H9; rim fragment; Fabric Group 1; Miniature Bowl; polished surface; undecorated; diameter at mouth 10 cm.

12 DNr 357; ID 16125; Feature H9; rim fragment; Fabric Group 1; Small Pot 2; surface untreated; undecorated; diameter at mouth 15.50 cm; max. diameter 16.40 cm.

13 DNr 578; I D 24029; Feature H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 30 cm.

14 DNr 272; ID 13720; Feature G-H1; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1.

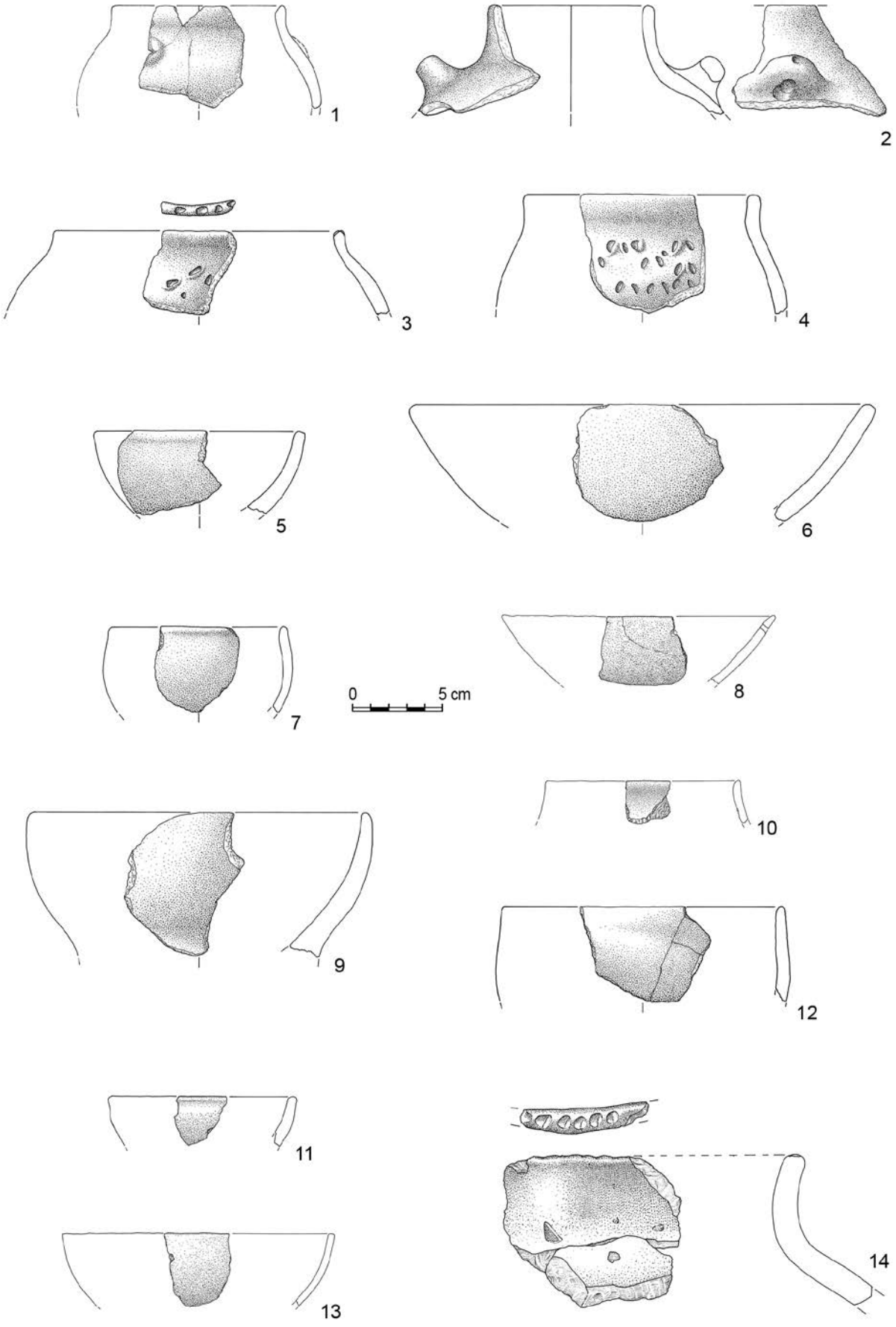


Plate 41

1 DNr 401; ID 16141; Feature H9; Fabric Group 1; Bowl 4; polished surface; undecorated; diameter at mouth 32 cm.

2 DNr 575; ID 24030; Feature H9; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 16 cm.

3 DNr 385; ID 16126; Feature H9; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 23 cm.

4 DNr 391; ID 16150; Feature H9; rim fragment; Fabric Group 1; Pot 4; surface untreated; undecorated; diameter at mouth 23 cm; max. diameter 25.60 cm.

5 DNr 607; Feature H9; rim fragment; Bowl 3; surface untreated; undecorated.

6 DNr 384; ID 16139; Feature H9; rim fragment; Fabric Group 1; Bowl 2; surface untreated; undecorated; diameter at mouth 15.20.

7 DNr 397; ID 16154; Feature H9; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 41 cm.

8 DNr 392; ID 16156; Feature H9; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 33 cm.

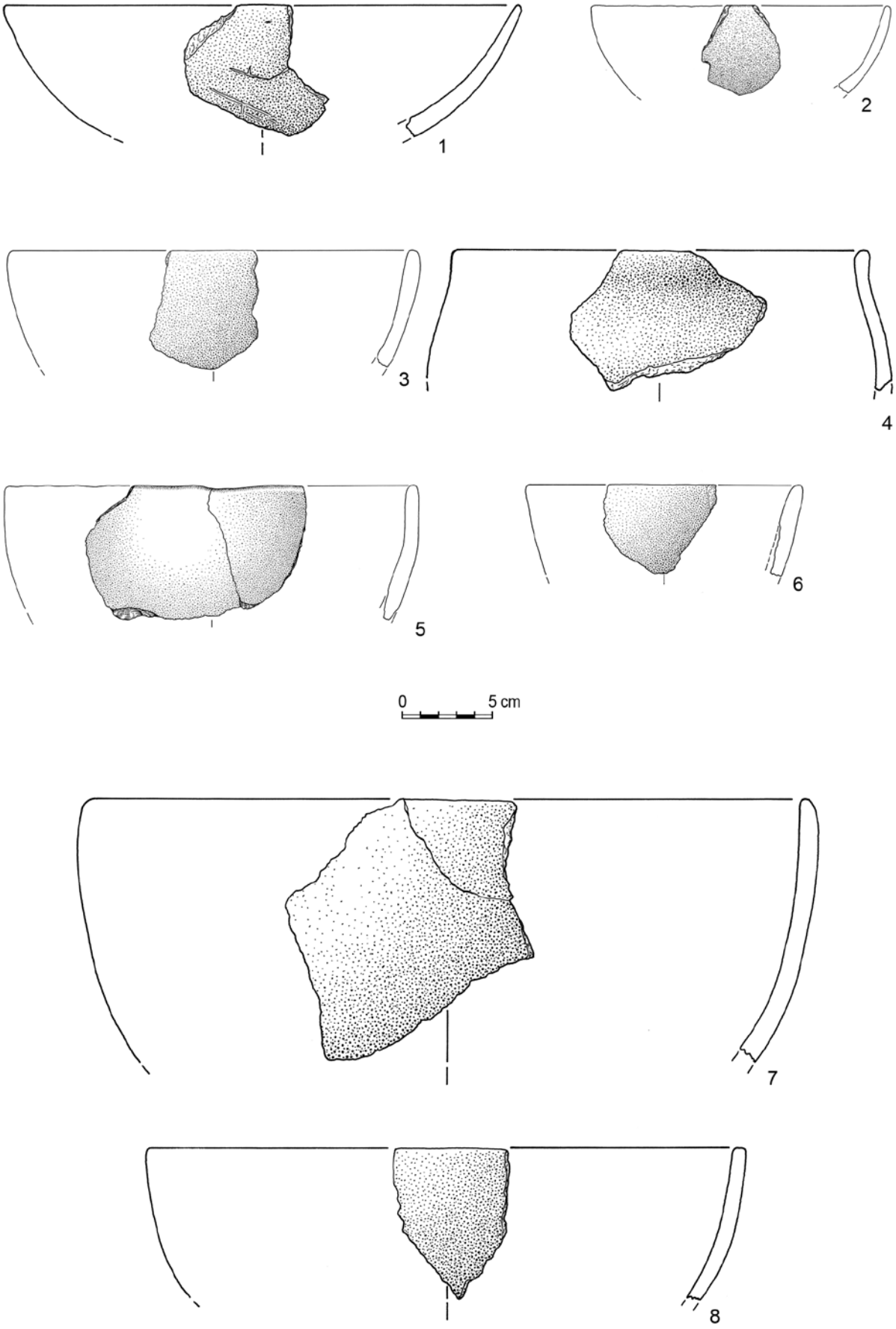


Plate 42

1 DNr 349; ID 16106; Feature H8; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1; diameter at mouth 27 cm.

2 DNr 321; ID 16116; Feature H8; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1; diameter at mouth 23 cm.

3 DNr 365; ID 16109; Feature H8; rim fragment; Fabric Group 1; Bowl; surface untreated; decoration A1 and B3; diameter at mouth 24 cm.

4 DNr 393; Feature H8; rim fragment; Pot 3; surface untreated; decoration B4.

5 DNr 405; ID 16115; Feature H8; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 35 cm.

6 DNr 322; ID 16134; Feature H9; rim fragment; Fabric Group 1; Bowl 4; polished surface; undecorated; diameter at mouth 36.80.

7 DNr 331; ID 16152; Feature H9; rim fragment; Fabric Group 1; Bowl 3; polished surface; undecorated; diameter at mouth 32 cm.

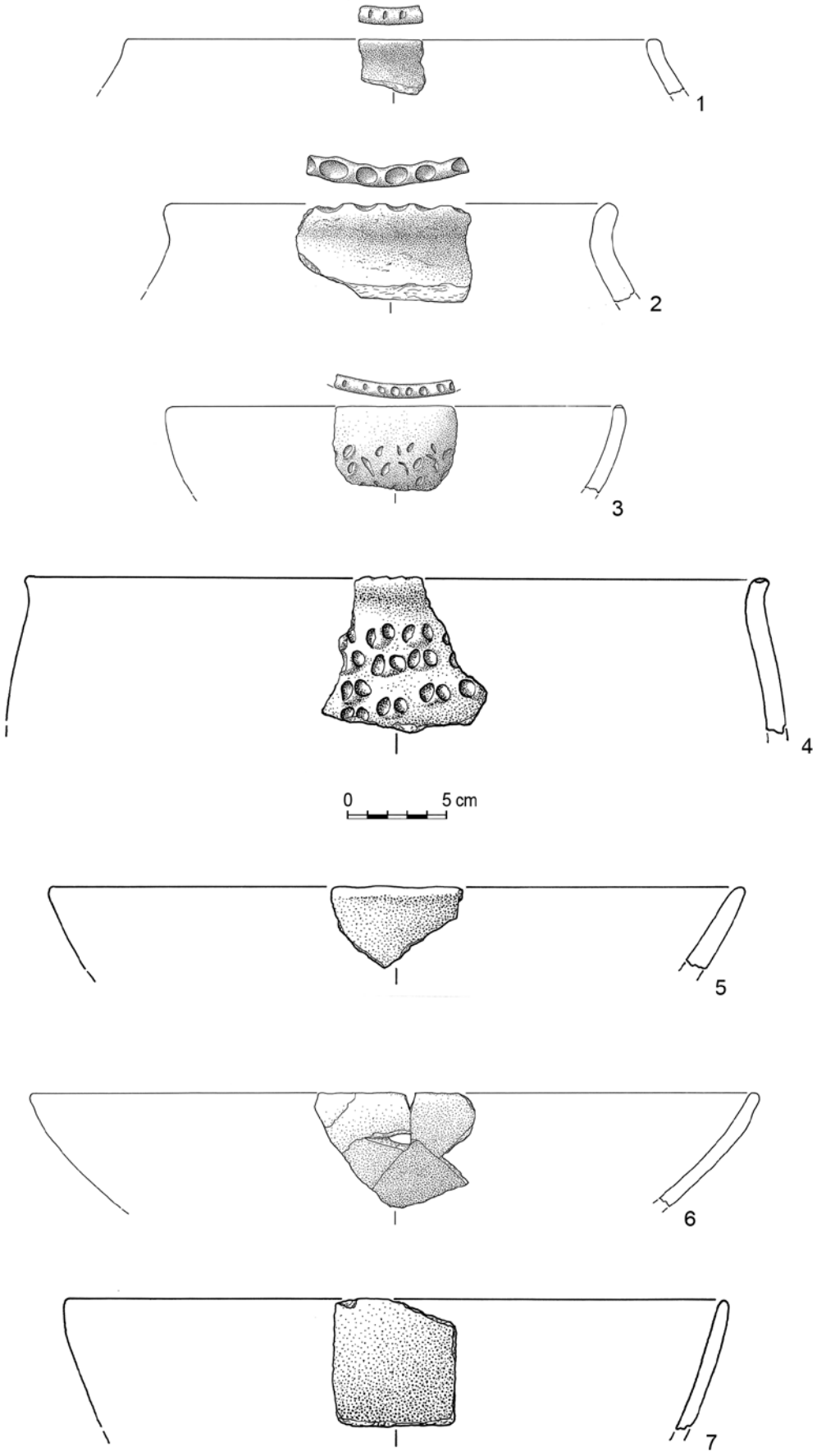


Plate 43

1 DNr 332; ID 16130; Feature H9; rim fragment; Fabric Group 1; Bowl 3; smoothed surface; undecorated; diameter at mouth 33.60 cm.

2 DNr 356; ID 16153; Feature H9; rim fragment; Fabric Group 1; Pot 4; surface untreated; undecorated; diameter at mouth 41 cm.

3 DNr 364; ID 16148; Feature H9; rim fragment; Fabric Group 1; Bowl 4; smoothed surface; undecorated; diameter at mouth 30.80 cm.

4 DNr 379; ID 16140; Feature H9; rim fragment; Fabric Group 1; Bowl 2; surface untreated; decoration A1 and B4.

5 DNr 383; ID 16123; Feature H9; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B3; diameter at mouth 25 cm; max. diameter 28.50 cm.

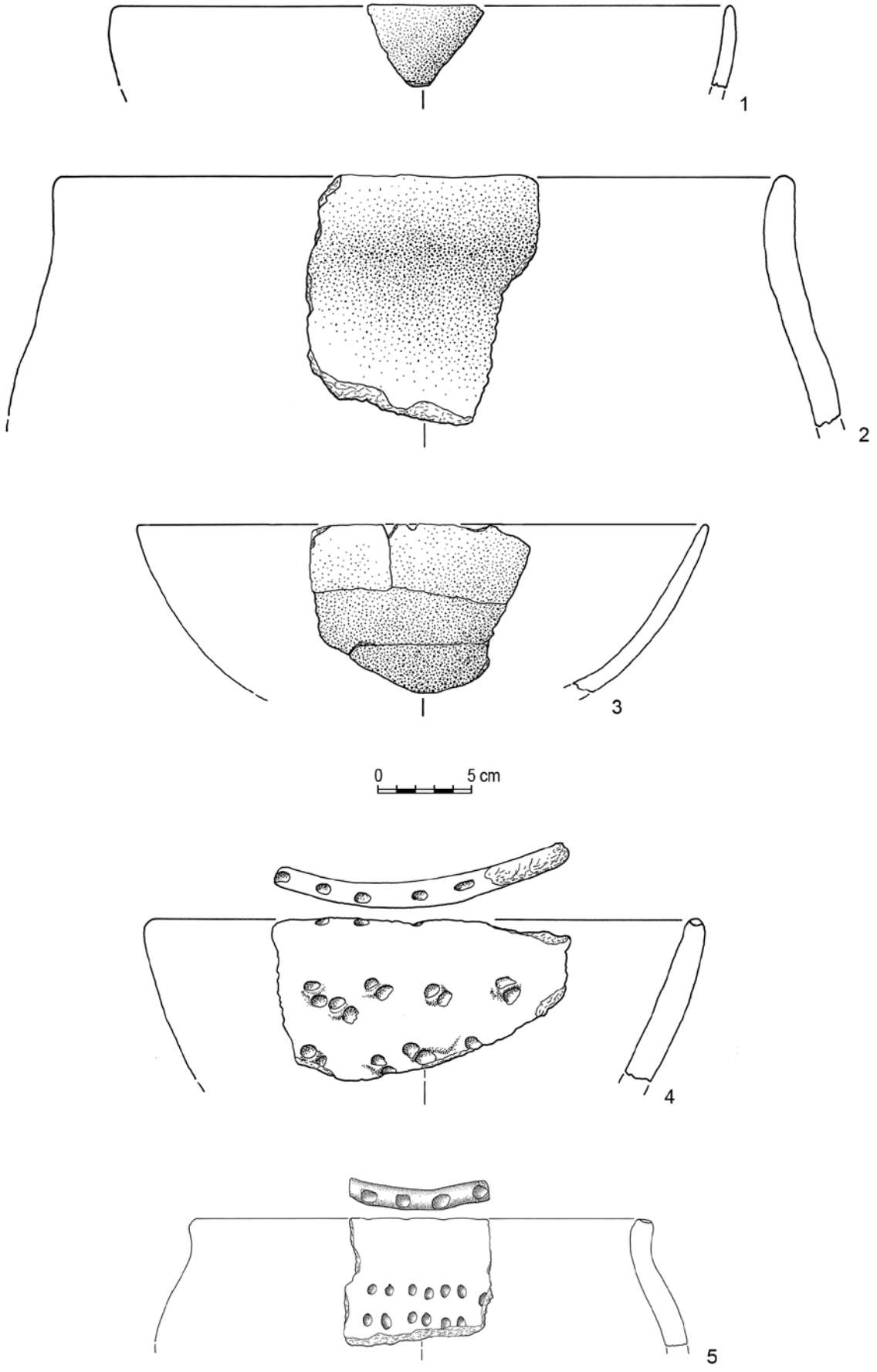


Plate 44

1 DNr 112d; ID 23960; Feature H2; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B3; diameter at mouth 22 cm.

2 DNr 112e; ID 23955; Feature H2; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration B3 and C3.

3 DNr 112f; ID 7153; Feature H2; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 27 cm.

4 DNr 402; ID 16149; Feature H9; rim fragment; Fabric Group 1; Bowl 4; smoothed surface; undecorated; diameter at mouth 39 cm.

5 DNr 360; ID 16112; Feature H8; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration F7; diameter at mouth 30 cm.

6 DNr 363; ID 16108; Feature H8; rim fragment; Fabric Group 1; Bowl 3; surface untreated; decoration A1; diameter at mouth 46 cm.

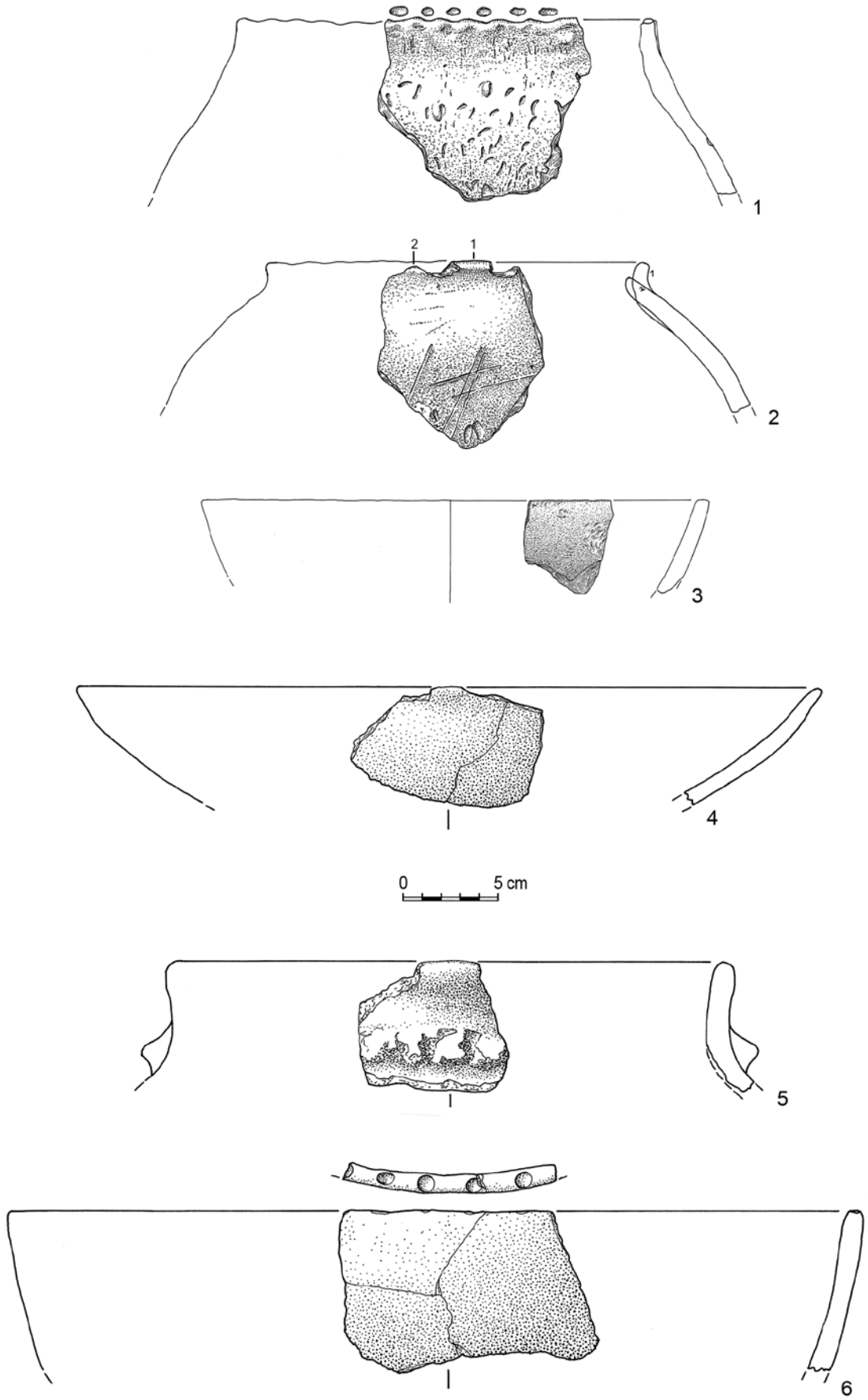


Plate 45

1 DNr 346; ID 16129; Feature H9; Bottom 3; Fabric Group 1; smoothed surface; undecorated.

2 DNr 437; ID 13528; Feature H9; Bottom 1; Fabric Group 1; Miniature Vessel; surface untreated; undecorated.

3 DNr 386; ID 16131; Feature H9; Bottom 2; Fabric Group 1; smoothed surface; undecorated.

4 DNr 432; ID 13464; Feature H9; Bottom 6b; Fabric Group 1; surface untreated; undecorated.

5 DNr 381; ID 16096; Feature H9; Bottom 7; Fabric Group 1; surface untreated; undecorated.

6 DNr 203e; ID 16487; Feature H2; Bottom 3; Fabric Group 1; surface untreated; decoration B3.

7 DNr 203d; ID 16486; Feature H2; Bottom 1; Fabric Group 1; surface untreated; decoration E1.

8 DNr 355; ID 16122; Feature H9; Bottom 7; Fabric Group 1; surface untreated; undecorated.

9 DNr 166a; ID 24557; Feature H2; Bottom 7; Fabric Group 1; surface untreated; undecorated.

10 DNr 380; ID 16099; Feature G-H1; Fabric Group 1; Bowl 3; Bottom 7; surface untreated; undecorated; height 7 cm; diameter at mouth 12.70 cm.

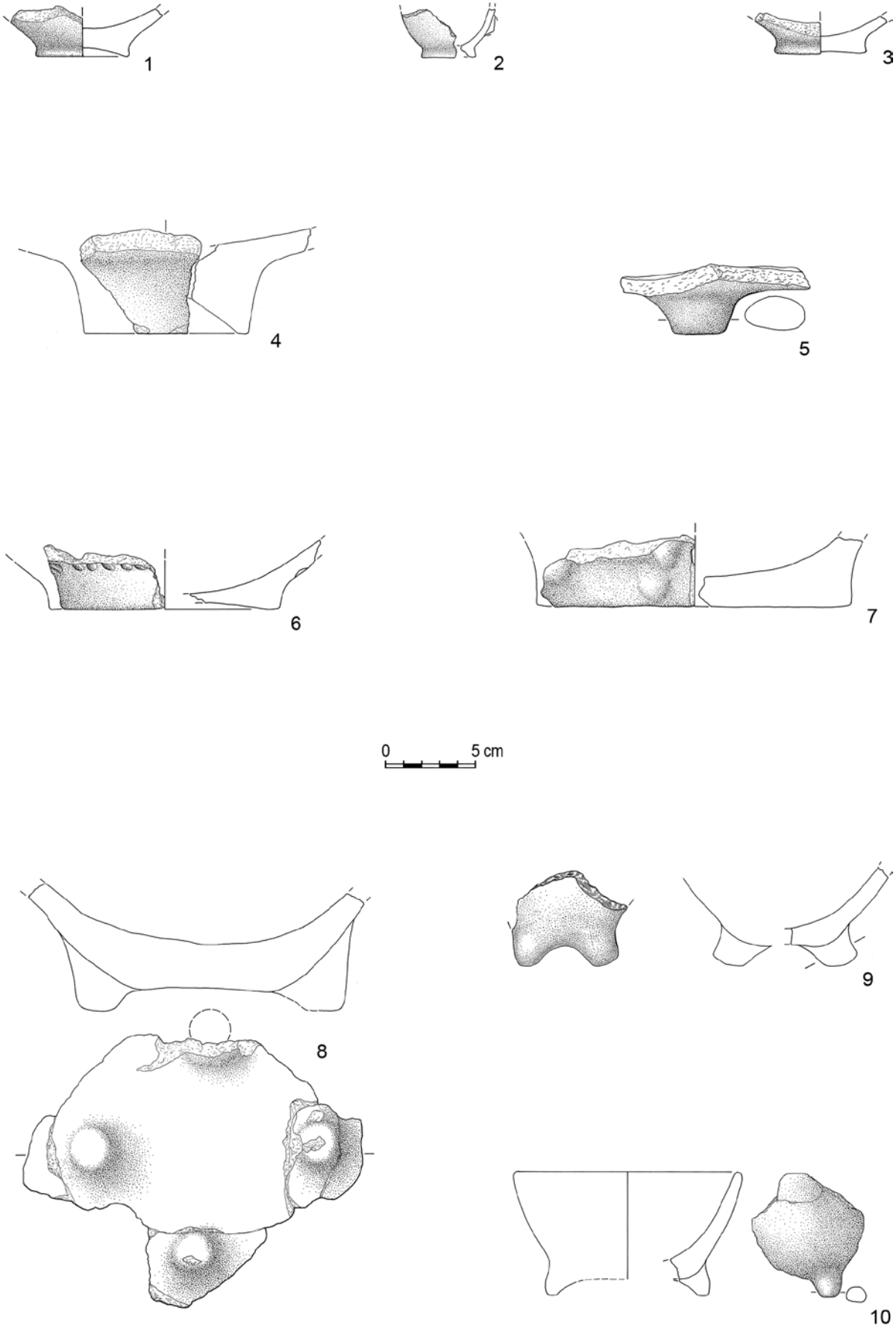


Plate 46

1 DNr 414b; ID 16411; Feature I7; middle fragment; Fabric Group 1; cord loop; surface untreated; undecorated.

2 DNr 536; Feature I-J1; middle fragment; surface untreated; undecorated.

3 DNr 414j; ID 7761; Feature I7; middle fragment; Fabric Group 1; surface untreated; decoration B3 and F6.

4 DNr 414h; ID 23968; Feature I7; middle fragment; Fabric Group 1; Jug; cord loop; surface untreated; undecorated.

5 DNr 422b; ID 7412; Feature I4; rim fragment; Fabric Group 1; Bowl 3; surface untreated; undecorated; diameter at mouth 10 cm.

6 DNr 434; ID 16160; Feature I-J1; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and C4; diameter at mouth 20 cm.

7 DNr 440b; ID 8378; Feature I-J4; rim fragment; Fabric Group 1; Small Pot 3; surface untreated; undecorated; diameter at mouth 9.90 cm; max. diameter 12 cm.

8 DNr 430b; ID 16406; Feature I5; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 15.20 cm.

9 DNr 430a; ID 16405; Feature I5; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and B3; diameter at mouth 23 cm.

10 DNr 422a; ID 7415; Feature I4; rim fragment; Fabric Group 1; Jug 3; surface untreated; undecorated; diameter at mouth 10 cm.

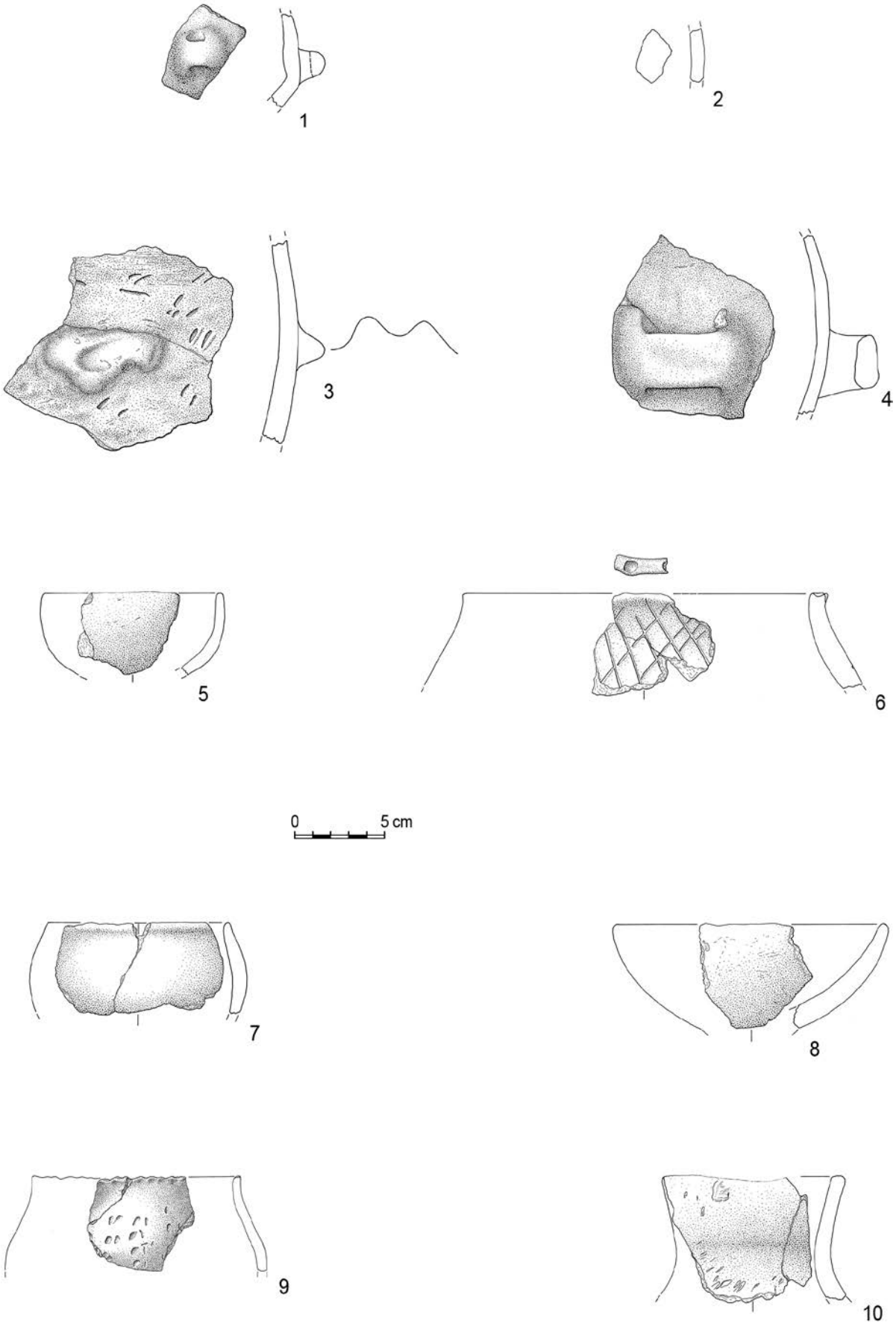


Plate 47

1 DNr 414d; ID 7785; Feature 17; rim fragment; Fabric Group 1; Bowl 3; surface untreated; secondary perforation; diameter at mouth 26 cm.

2 DNr 414a; ID 23961; Feature 17; rim fragment; Fabric Group 1; Pot 4; surface untreated; decoration B6; diameter at mouth 18 cm.

3 DNr 414e; ID 23964; Feature 17; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B4; diameter at mouth 18 cm; max. diameter 26.50 cm.

4 DNr 414f; ID 7760; Feature 17; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration B5; diameter at mouth 17 cm; max. diameter 28.50 cm.

5 DNr 416a; Feature 16; rim fragment; Fabric Group 1; Bowl 4; surface untreated; fingernail tricks.

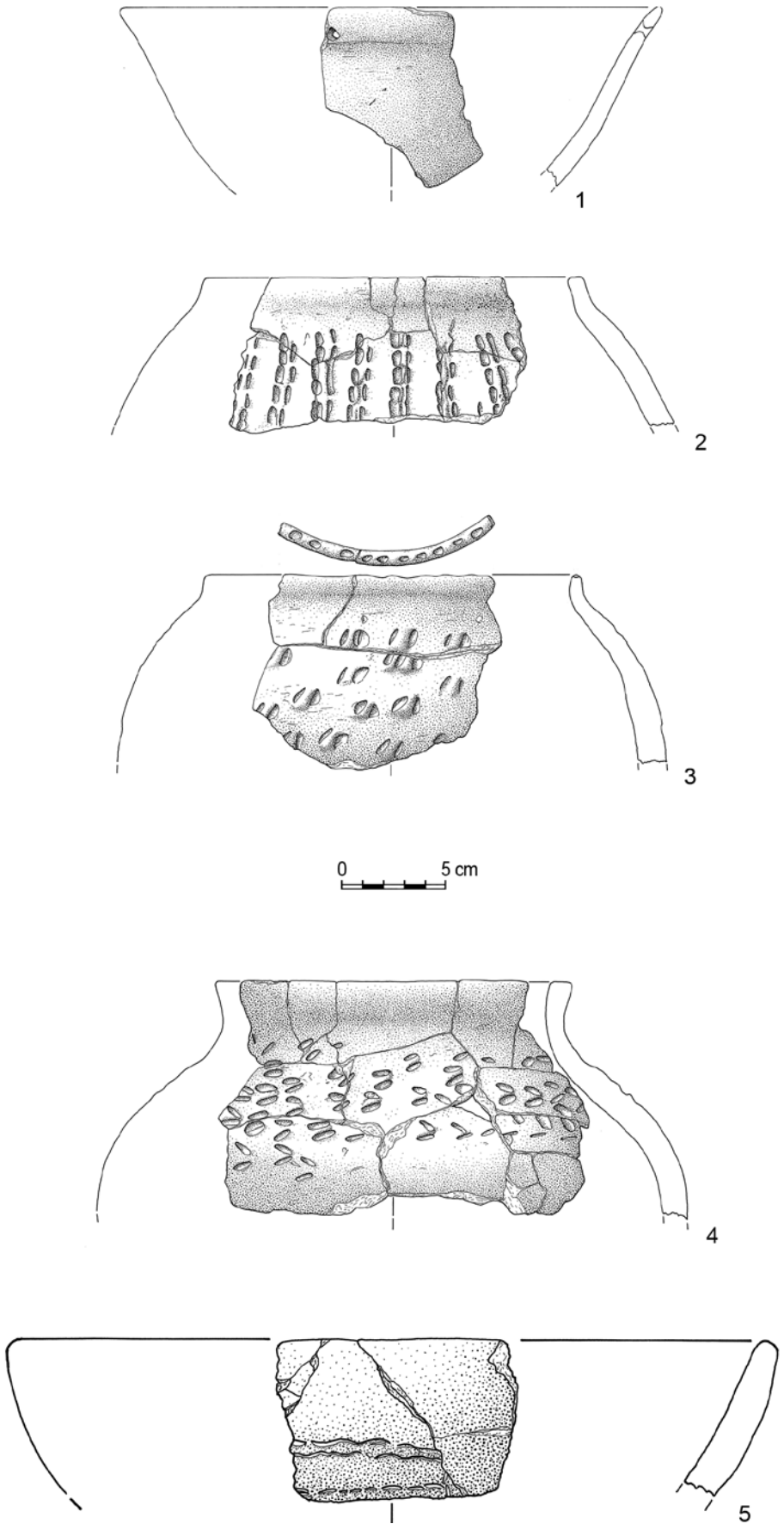


Plate 48

1 DNr 414g; ID 23957; Feature I7; rim fragment; Fabric Group 1; Pot 3; surface untreated; decoration A1 and B4.

2 DNr 457; ID 24355; Feature I-J5; rim fragment; Fabric Group 1; Pot 1; surface untreated; decoration B4; diameter at mouth 18 cm; max. diameter 25.40 cm.

3 DNr 414i; ID 23963; Feature I7; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1; diameter at mouth 16 cm; max. diameter 23.40 cm.

4 DNr 514; ID 24625; Feature I-J10; rim fragment; Fabric Group 1; Storage Pot 2; surface untreated; decoration A1 and E3; diameter at mouth 30 cm.

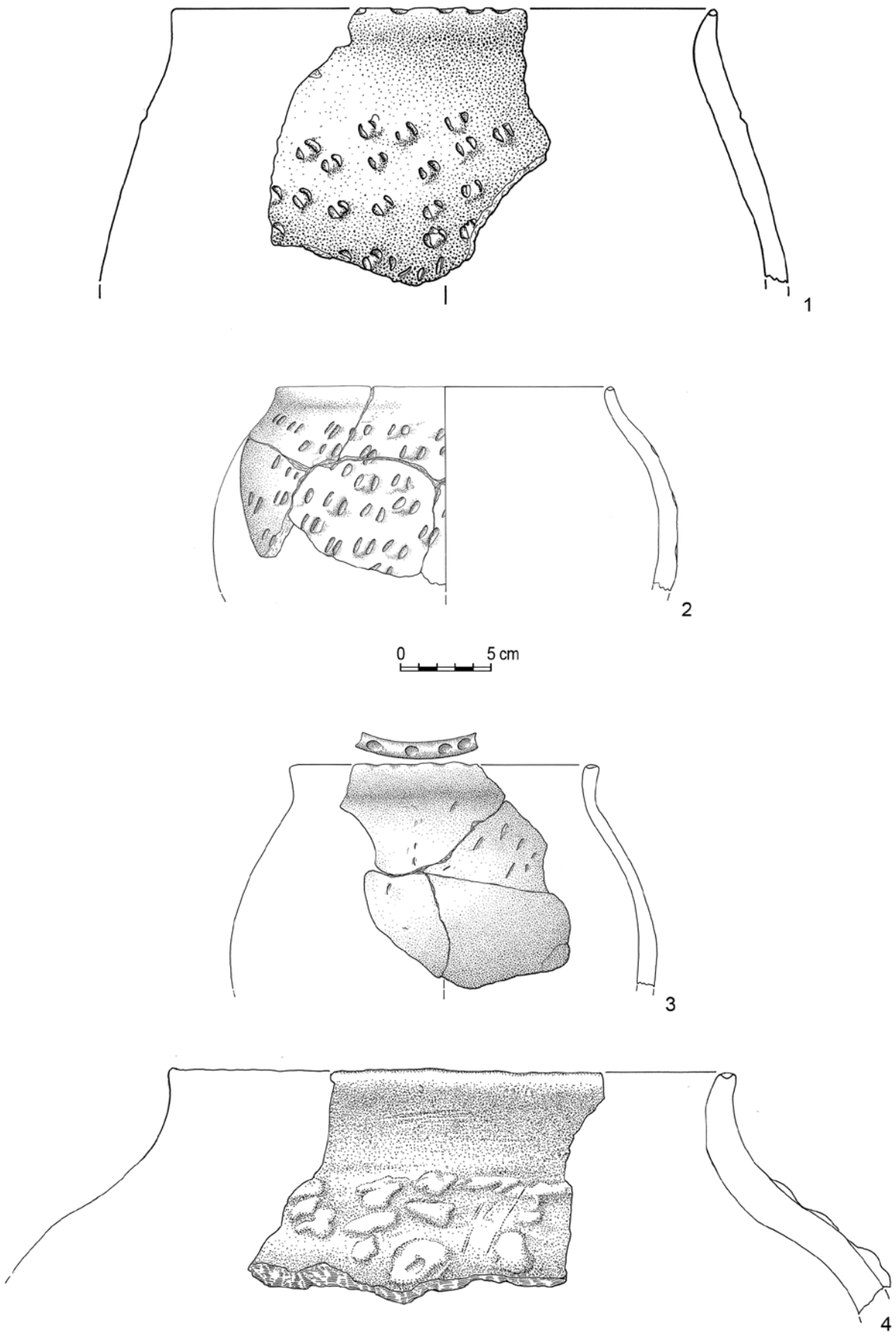


Plate 49

1 DNr 430c; ID 16407; Feature 15; Small Pot; Bottom 1; Fabric Group 1; surface untreated; decoration B3 and F6; max. diameter 10.40 cm.

2 DNr 416b; ID 16410; Feature 16; rim fragment; Fabric Group 1; Bottom 7; surface untreated; undecorated.

3 DNr 431a; Feature 18; Bottom 6; surface untreated; undecorated.

4 DNr 431b; Feature 18; Bottom 1; surface untreated; decoration B5.

5 DNr 440a; ID 8379; Feature I-J4; Bottom 1; Fabric Group 1; Miniature Mug; surface untreated; undecorated; max. diameter 6 cm.

6 DNr 424; Feature I-J8; Bottom 4; surface untreated; undecorated.

7 DNr 284; ID 24361; Feature I-J13; Fabric Group 1; Mug 1; Bottom 4; smoothed surface; secondary perforation at the bottom; height 13 cm; diameter at mouth 17.50 cm.

8 DNr 414c; ID 16518; Feature 17; Bottom 2; Fabric Group 1; Jug; cord loop; surface untreated; undecorated.

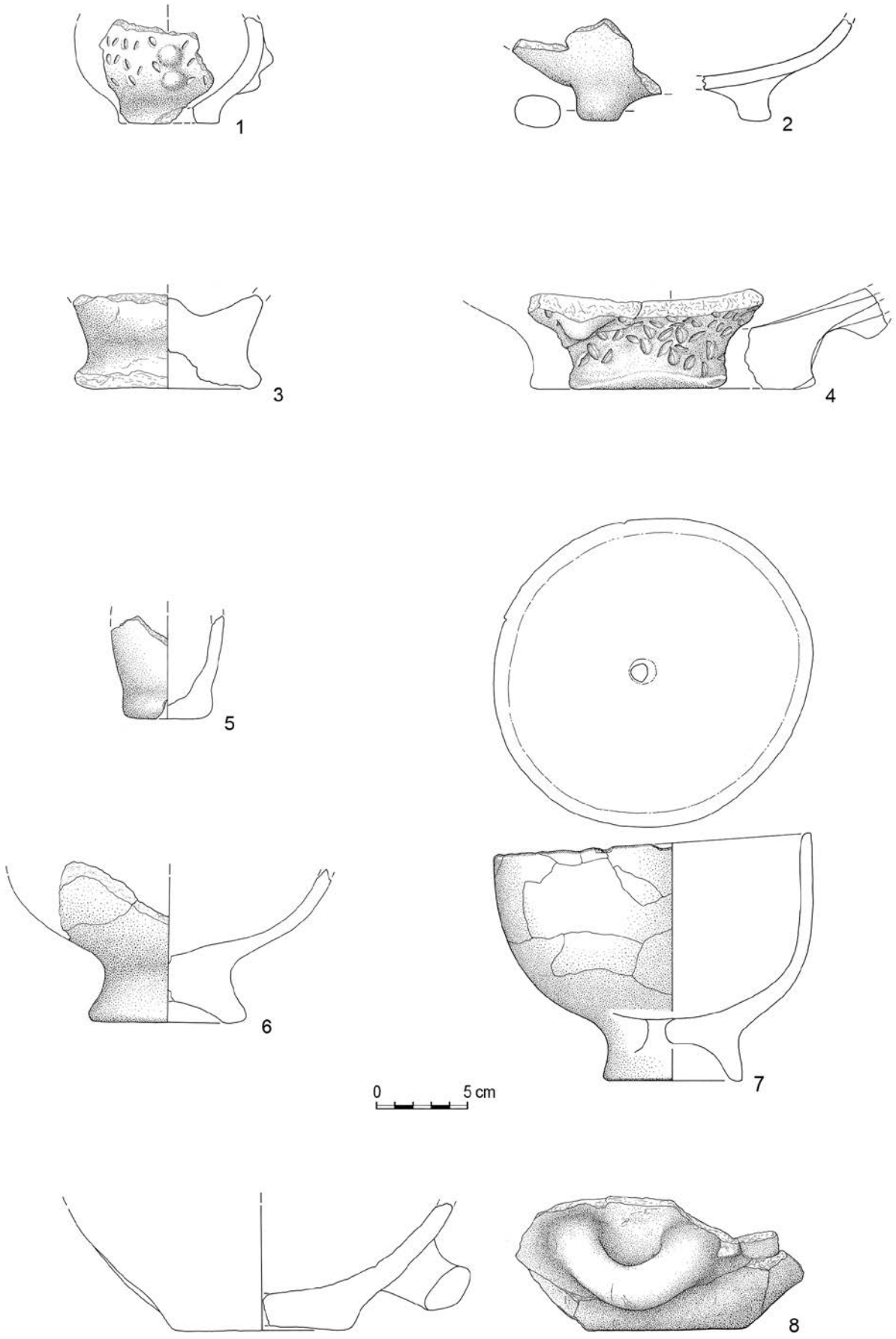


Plate 50

1 DNr 436; ID 23988; Feature J4; middle fragment; Fabric Group 1; surface untreated; decoration C3.

2 DNr 423; ID 9063; Feature J4; Bottom 4; Fabric Group 1; Bowl; surface untreated; undecorated.

3 DNr 509; ID 23958; Feature J1; rim fragment; Fabric Group 1; Pot 1; surface untreated; decoration E1.

4 DNr 443; ID 9135; Feature J8; Bottom 4; Fabric Group 1; Bowl; surface untreated; undecorated.

5 DNr 459; ID 24001; Feature K12; middle fragment; Fabric Group 1; surface untreated; decoration B5.

6 DNr 441; ID 10744; Feature K12; middle fragment; Fabric Group 1; cord loop with groove; surface untreated; undecorated.

7 DNr 458; ID 11857; Feature K12; rim fragment; Fabric Group 1; Storage Pot 2; surface untreated; decoration A1; diameter at mouth 24 cm.

8 DNr 512; ID 9449; Feature K4; rim fragment; Fabric Group 1; Pot 2; smoothed surface; decoration A1 and parallel grooves under the rim fragment; diameter at mouth 9.40 cm.

9 DNr 285; ID 24366; Feature K12; Fabric Group 1; Miniature Bowl; Bottom 1; surface untreated; decoration F1; height 3.50 cm; diameter at mouth 5.80 cm.

10 DNr 373; Feature K20; Miniature Pot; surface untreated; decoration B3 and F1.

11 DNr 390; ID 24960; Feature K20; rim fragment; Fabric Group 1; Miniature Pot; surface untreated; undecorated.

12 DNr 534; ID 11979; Feature K20; Fabric Group 1; Miniature Pot; surface untreated; decoration B3 and F1; height 6.30 cm; diameter at mouth 5.20 cm; max. diameter 6.20 cm.

13 DNr 442; ID 23974; Feature K6; Bottom 1; Fabric Group 1; Pot; surface untreated; decoration C4 and F6b; max. diameter 10.90 cm.

14 DNr 535; Feature K8; Bottom 5; surface untreated; undecorated.

15 DNr 433; ID 10445; Feature K10; Bottom 1; Fabric Group 1; Pot; surface untreated; decoration B4.

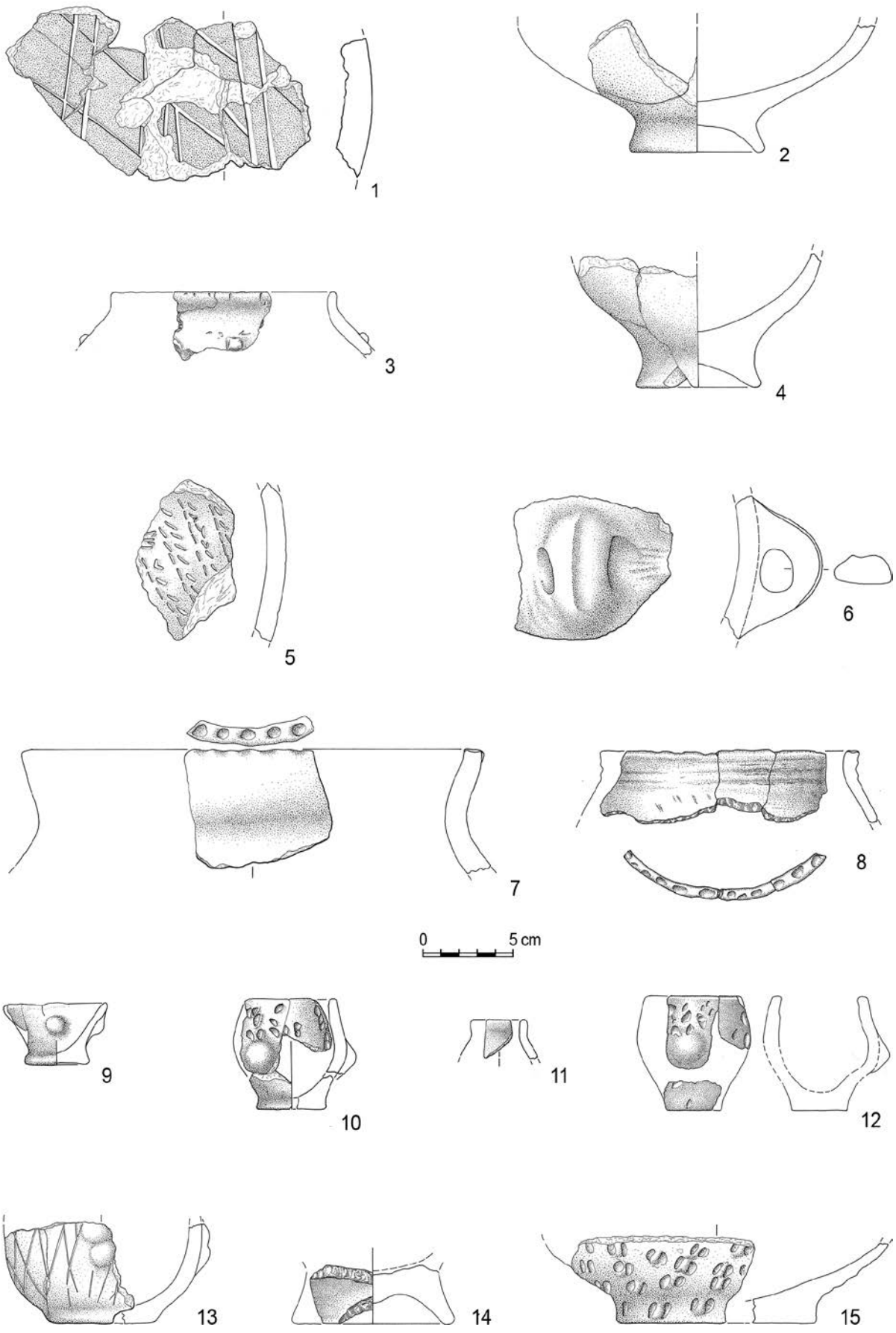


Plate 51

1 DNr 553; Feature L2; rim fragment; surface untreated; undecorated.

2 DNr 462; ID 23975; Feature L11; middle fragment; Fabric Group 1; surface untreated; decoration C1.

3 DNr 631; Feature L-K; middle fragment; surface untreated; decoration B6.

4 DNr 450; Feature L-K4; Bottom 3 but square shaped; surface untreated; undecorated.

5 DNr 613; ID 13396; Feature L-K13; middle fragment; Fabric Group 1; surface untreated; decoration B1.

6 DNr 244; ID 13406; Feature L-K13; middle fragment; Fabric Group 1; surface untreated; decoration B6.

7 DNr 641; Feature L-K7; Small Pot 1; Bottom 2; surface untreated; undecorated.

8 DNr 472; ID 24368; Feature L9; Fabric Group 1; Miniature Mug; Bottom 1; surface untreated; undecorated; height 6 cm; diameter at mouth 6 cm; max. diameter 6.50 cm.

9 DNr 587; ID 12941; Feature L-K4; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 12 cm.

10 DNr 464; ID 24011; Feature L8; Bottom 8; Fabric Group 1; surface untreated; undecorated.

11 DNr 451; ID 23970; Feature L11; Bottom 7; Fabric Group 1; Jug; cord loop; smooth surface with red slip; undecorated.

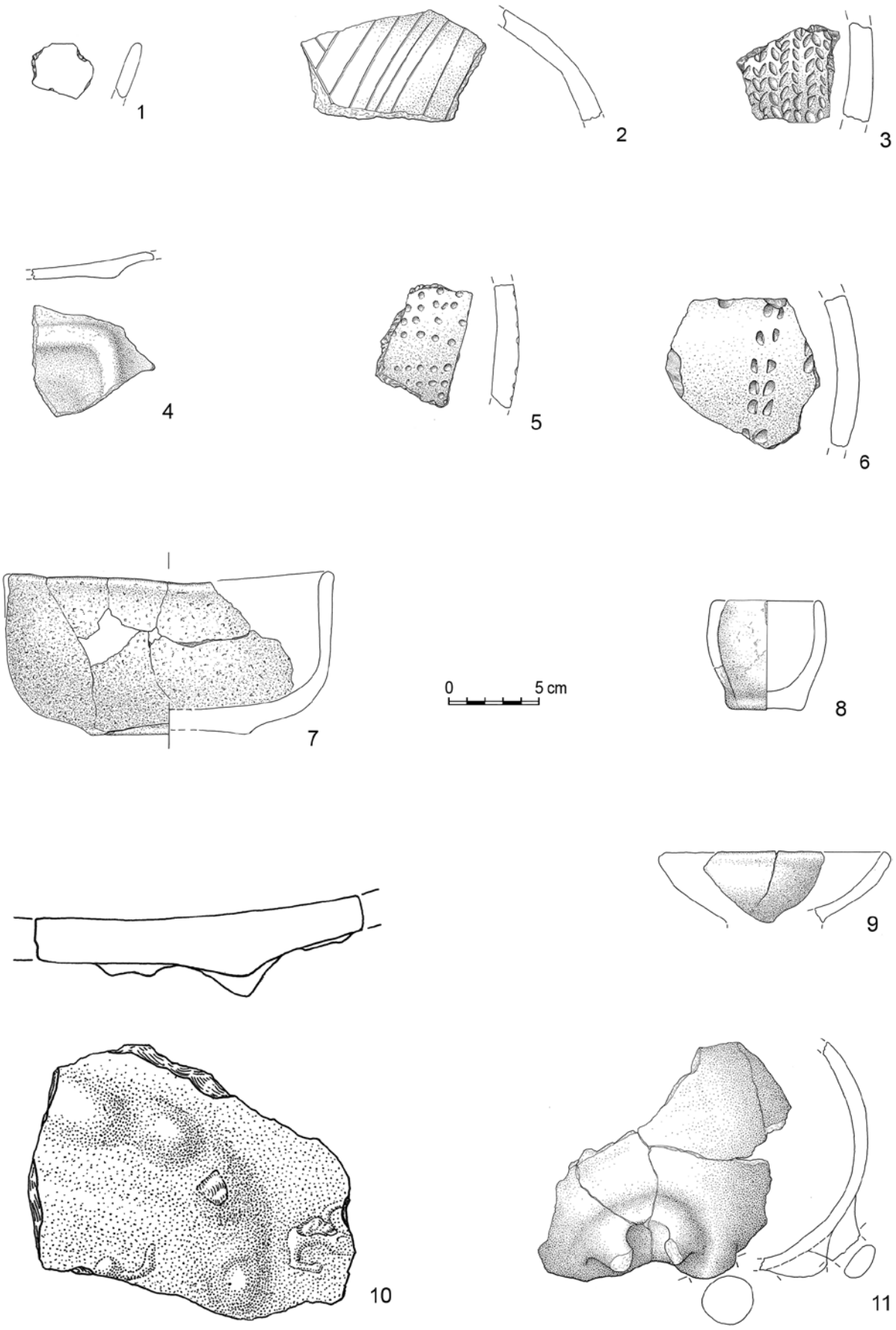


Plate 52

1 DNr 596; ID 24624; Feature G-H1; rim fragment; Fabric Group 1; Pot 4; roughened surface; decoration A1 and B3.

2 DNr 511; Feature M3; Bottom 1; surface untreated; decoration C2 and F1.

3 DNr 470; ID 23977; Feature M3; middle fragment; Fabric Group 1; surface untreated; decoration C4 and F5.

4 DNr 490; ID 11657; Feature L11; rim fragment; Fabric Group 1; surface untreated; decoration A1, B4 and D1b; diameter at mouth 40 cm; max. diameter 46 cm.

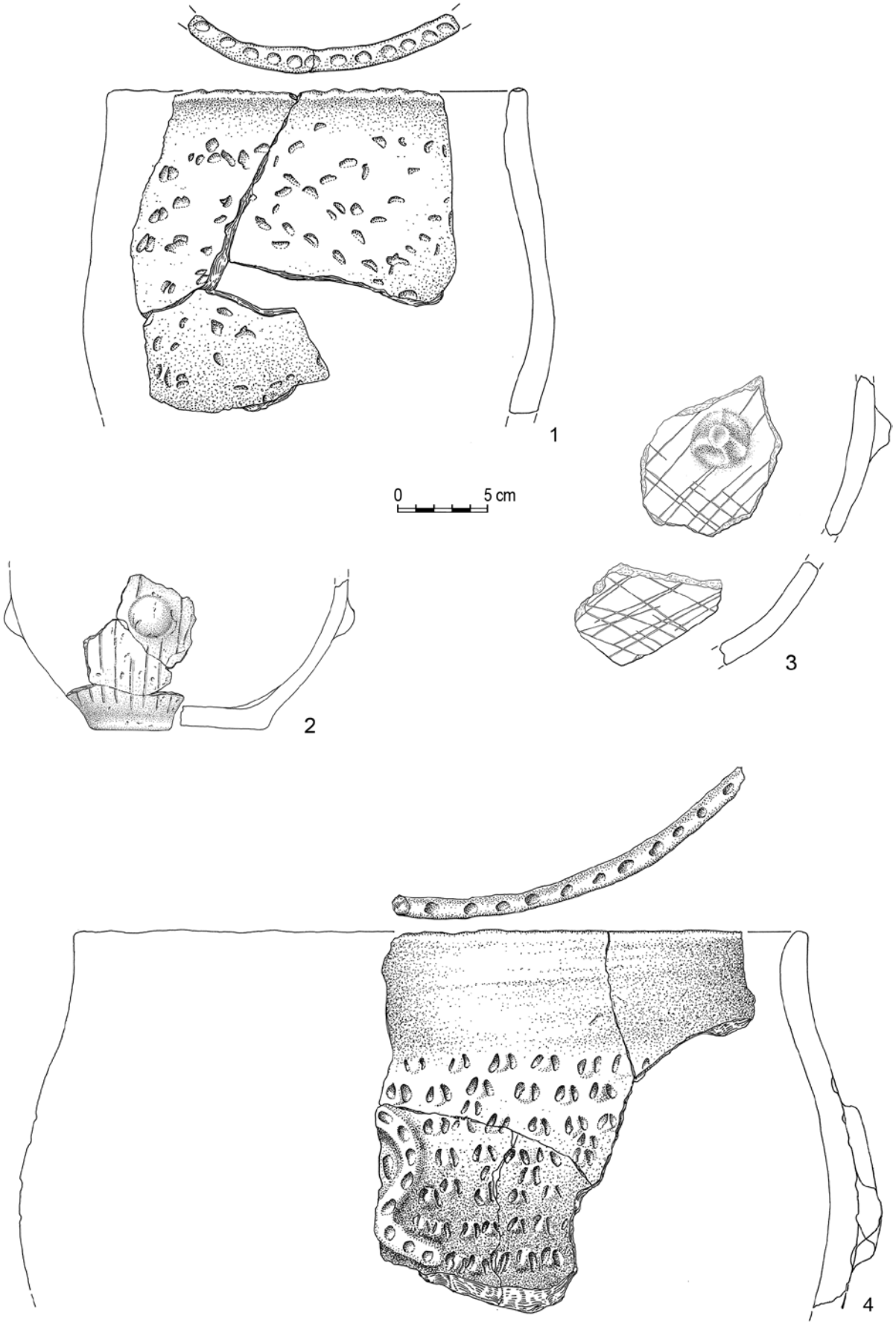


Plate 53

1 DNr 445; ID 15254; Feature N-O2; middle fragment; Fabric Group 1; Jug 2; cord loop; untreated surface; undecorated; max. diameter 16 cm.

2 DNr 448; ID 24004; Feature N3; Bottom 1; Fabric Group 1; surface untreated; decoration B4.

3 DNr 460; ID 12409; Feature M4; middle fragment; Fabric Group 1; surface untreated; incised decoration.

4 DNr 461; ID 12537; Feature M7; Fabric Group 1; cord loop with groove; surface untreated; undecorated.

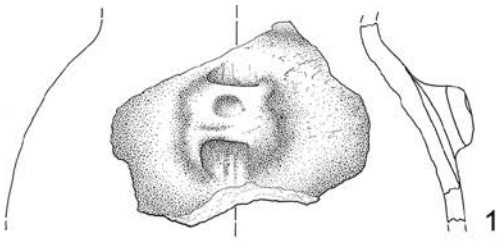
5 DNr 447; ID 15915; Feature O3; middle fragment; Fabric Group 1; cord loop with groove; surface untreated; undecorated.

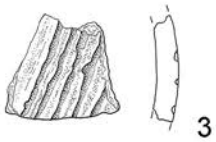
6 DNr 606; ID 16090; Feature O5; Fabric Group 1; cord loop with groove; surface untreated; undecorated.

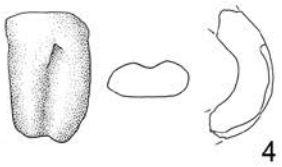
7 DNr 564; ID 15581; Feature O3; Bottom 1; Fabric Group 1; Miniature Vessel; surface untreated; undecorated.

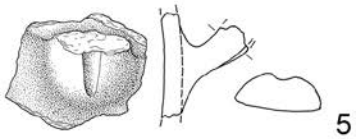
8 DNr 444; ID 24017; Feature O5; Bottom 1; Fabric Group 1; surface untreated; decoration C4 at the bottom.

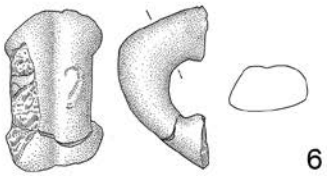
9 DNr 515; ID 24369; Feature O5; Fabric Group 1; Small Pot 1; Bottom 2; surface untreated; undecorated; height 9.50 cm; diameter at mouth 15.50 cm.

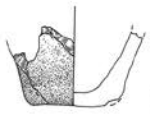


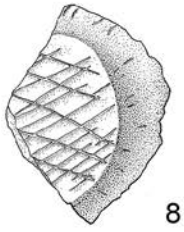












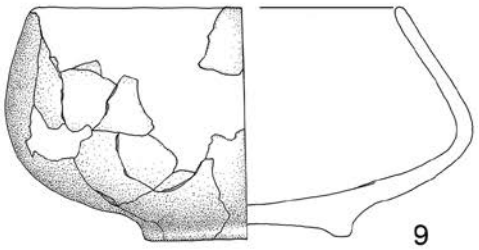


Plate 54

1 DNr 612; ID 22466; Feature P7; middle fragment; Fabric Group 1; surface untreated; decoration D1a.

2 DNr 632; Feature P7; fragment of a disc; surface untreated; undecorated.

3 DNr 627; Feature P6; rim fragment; Bowl 1; surface untreated; undecorated.

4 DNr 629; ID 21210; Feature P3; rim fragment; Fabric Group 1; Small Pot 4; surface untreated; decoration B6.

5 DNr 640; Feature P7; rim fragment; Jug 3; surface untreated; undecorated.

6 DNr 623; ID 21618; Feature P4; rim fragment; Fabric Group 1; Small Pot 4; surface untreated; undecorated.

7 DNr 598; ID 23969; Feature P6; Bottom 7; Fabric Group 1; Jug; surface untreated; undecorated; max. diameter 18.50 cm.

8 DNr 571; ID 20161; Feature P3; Fabric Group 1; Jug; Bottom 7; two cord loops; surface untreated; undecorated.

9 DNr 597; ID 22284; Feature P6; Fabric Group 1; Jug; Bottom 7; cord loop; surface untreated; undecorated.

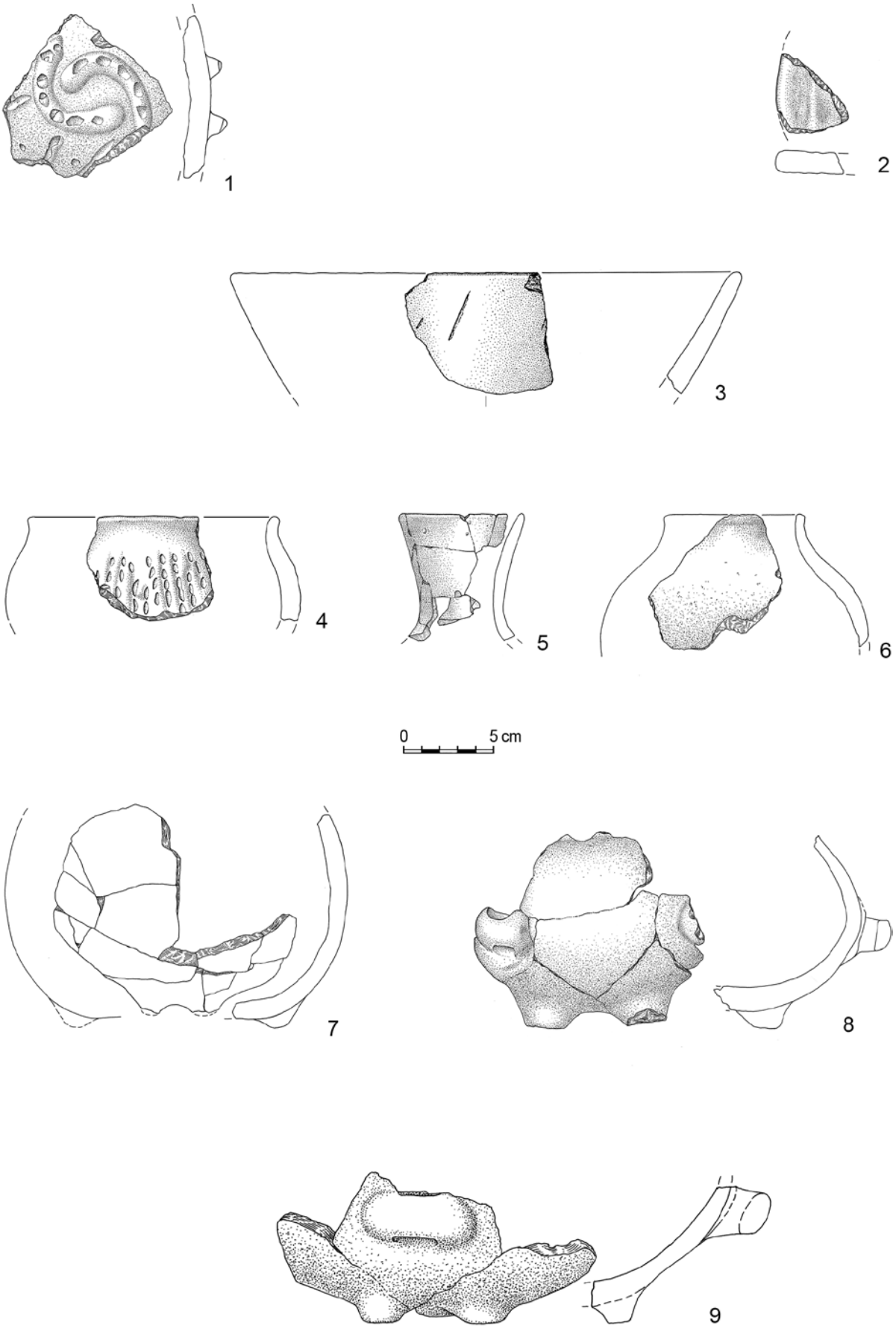


Plate 55

1 DNr 398; ID 13937; Feature G5; rim fragment; Fabric Group 3; Bowl 2; surface untreated; undecorated; diameter at mouth 20 cm.

2 DNr 563; ID 24009; Feature R5; Bottom 6; Fabric Group 1; surface untreated; undecorated.

3 DNr 560; ID 24967; Feature R5; Bottom 1; Fabric Group 1; surface untreated; undecorated.

4 DNr 479; ID 16396; Feature S3; middle fragment; Fabric Group 1; surface untreated; decoration F8.

5 DNr 517; ID 17939; Feature S3; Bottom 7; Fabric Group 1; surface untreated; undecorated.

6 DNr 572; ID 17558; Feature S11; middle fragment; Fabric Group 1; surface untreated; decoration D4.

7 DNr 615; ID 17422; Feature S3; middle fragment; Fabric Group 1; surface untreated; decoration D3.

8 DNr 625; Feature S3; middle fragment; Jug; cord loop; surface untreated; decoration D5.

9 DNr 622; ID 16655; Feature S3; middle fragment; Fabric Group 1; surface untreated; decoration C4.

10 DNr 634; ID 18068; Feature S13; middle fragment; Fabric Group 1; surface untreated; decoration B6.

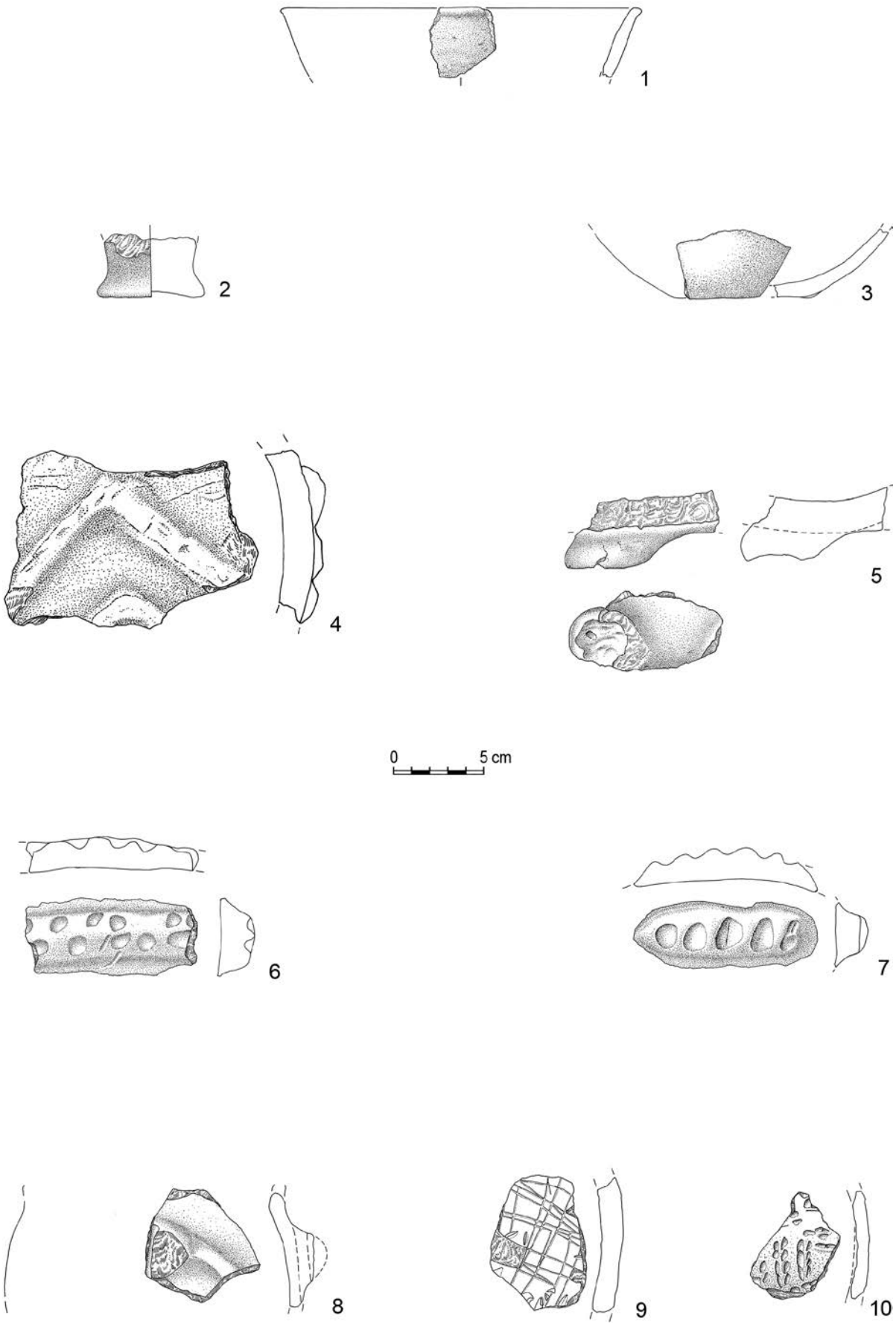


Plate 56

1 DNr 492; ID 16514; Feature S19; rim fragment; Fabric Group 1; Pot 1; surface untreated; decoration A1 and B3; max. diameter 44 cm.

2 DNr 498; ID 23945; Feature S19; rim fragment; Fabric Group 1; Big Bowl 2; surface untreated; decoration B6 and E1; diameter at mouth 44 cm.

3 DNr 491; ID 16515; Feature S13; rim fragment; Fabric Group 1; Big Bowl 2; surface untreated; decoration A1 and B4; diameter at mouth 44 cm.

4 DNr 482; ID 22462; Feature P7; rim fragment; Fabric Group 1; Pot 2; surface untreated; decoration A1 and B4; diameter at mouth 20 cm.

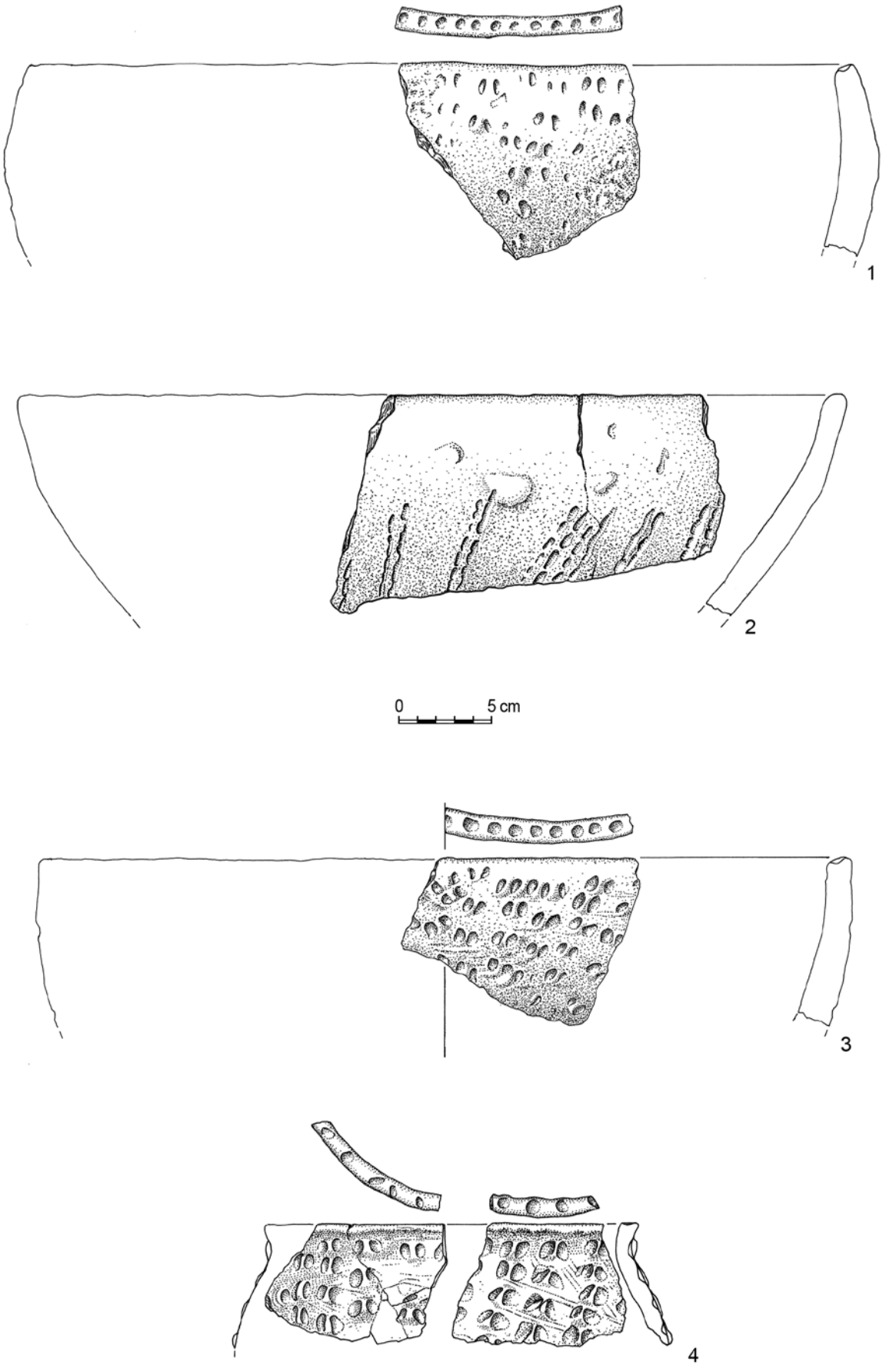


Plate 57

1 DNr 624; Feature S28; rim fragment; Bowl 4; surface untreated; undecorated.

2 DNr 619; ID 19825; Feature S19; rim fragment; Fabric Group 1; Bowl 3; surface untreated; decoration A1.

3 DNr 616; ID 18941; Feature S13; rim fragment; Fabric Group 1; Miniature Pot; surface untreated; decoration B5 and F6b.

4 DNr 633; ID 17424; Feature S3; rim fragment; Fabric Group 1; Small Pot 3; surface untreated; undecorated.

5 DNr 483; ID 24961; Feature S13; rim fragment; Fabric Group 1; Miniature Vessel; surface untreated; undecorated; diameter at mouth 3.50 cm.

6 DNr 568; ID 17936; Feature S3; rim fragment; Fabric Group 1; Bowl 1; surface untreated; decoration A1 and E1.

7 DNr 502; ID 24962; Feature S22; rim fragment; Fabric Group 1; Miniature Vessel; surface untreated; undecorated.

8 DNr 567; ID 20085; Feature S28; Bottom 4; Fabric Group 1; Bowl; surface untreated; undecorated.

9 DNr 610; ID 24663; Feature S19; Bottom 1; Fabric Group 1; surface untreated; decoration C4 at the bottom.

10 DNr 473; ID 16505; Feature S6; Fabric Group 1; Miniature Mug; Bottom 1; surface untreated; undecorated; height 6.30 cm; diameter at mouth 5.20 cm; max. diameter 5.80 cm.

11 DNr 588; ID 24014; Feature S7; Bottom 4; Fabric Group 1; surface untreated; undecorated.

12 Feature S13; middle fragment; Fabric Group 1; surface untreated; undecorated.

13 Feature S26; middle fragment; Fabric Group 1; surface untreated; undecorated.

14 Feature S13; middle fragment; Fabric Group 1; surface untreated; decoration F2.

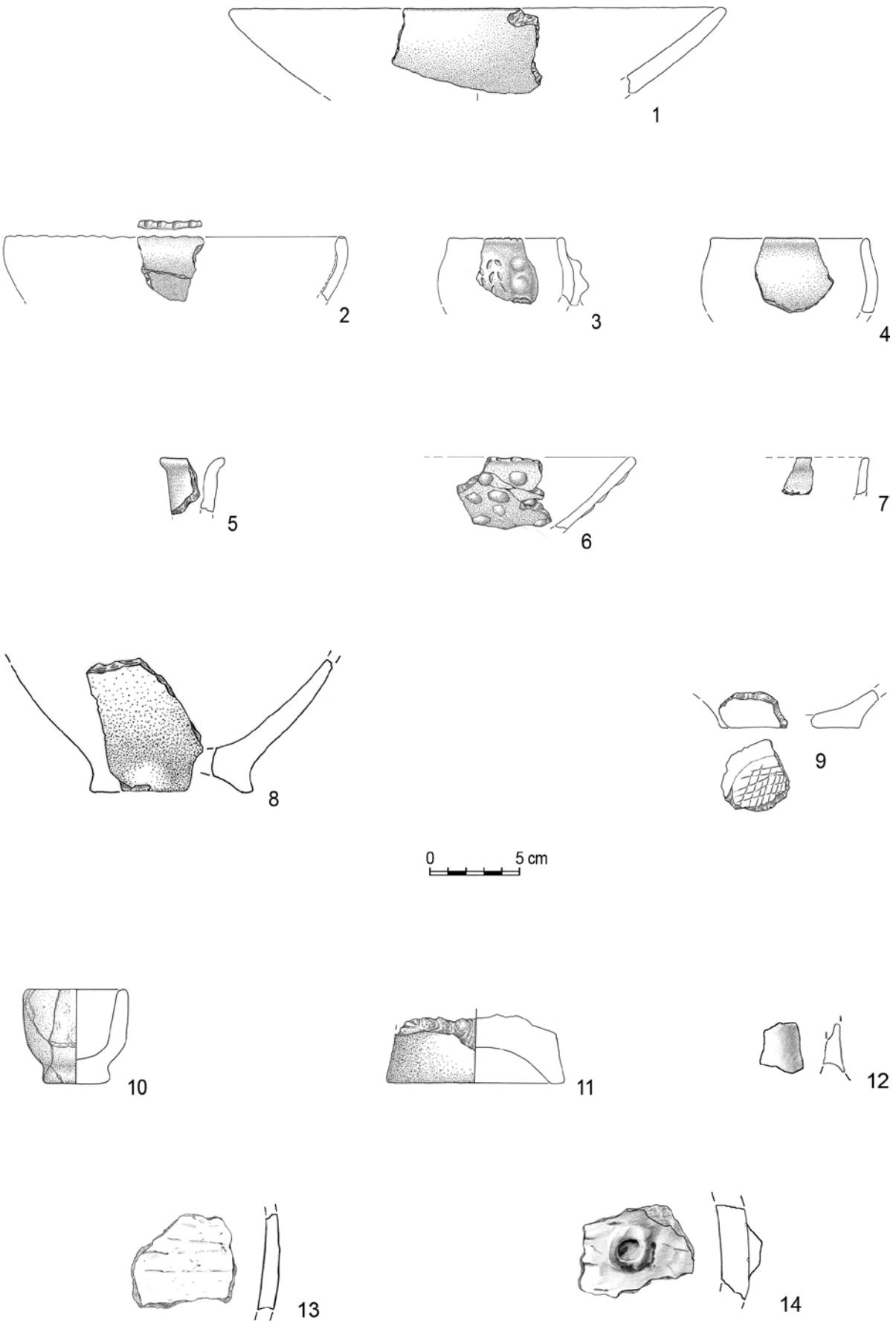


Plate 58

1 DNr 593; ID 23897; Feature T4; middle fragment; Fabric Group 1; surface untreated; decoration D1c.

2 DNr 595; ID 23980; Feature T4; middle fragment; Fabric Group 1; surface untreated; decoration C2.

3 DNr 611; ID 23809; Feature T4; middle fragment; Fabric Group 1; surface polished; decoration F1.

4 DNr 621; ID 23861; Feature T4; middle fragment; Fabric Group 1; Pot 1; surface untreated; decoration A1 and B5.

5 DNr 600; ID 23885; Feature T4; rim fragment; Fabric Group 1; Bowl 4; surface untreated; undecorated; diameter at mouth 19 cm.

6 DNr 599; ID 23846; Feature T4; rim fragment; Fabric Group 1; Bowl 1; surface untreated; undecorated; diameter at mouth 32 cm.

7 DNr 620; Feature T4; rim fragment; Small Pot 3; surface untreated; decoration A1.

8 DNr 481; ID 16516; Feature T6; Fabric Group 1; Small Pot 4; Bottom 1; surface untreated; decoration B4 and F1; height 6,40 cm; diameter at mouth 8 cm; max. diameter 9 cm.

9 DNr 601; ID 24005; Feature T4; Bottom 6; Fabric Group 1; surface untreated; undecorated.

10 DNr 594; ID 23979; Feature T4; middle fragment; Fabric Group 1; surface untreated; decoration C2.

11 ID 24039; Feature T6; Bottom 4; surface untreated; undecorated.

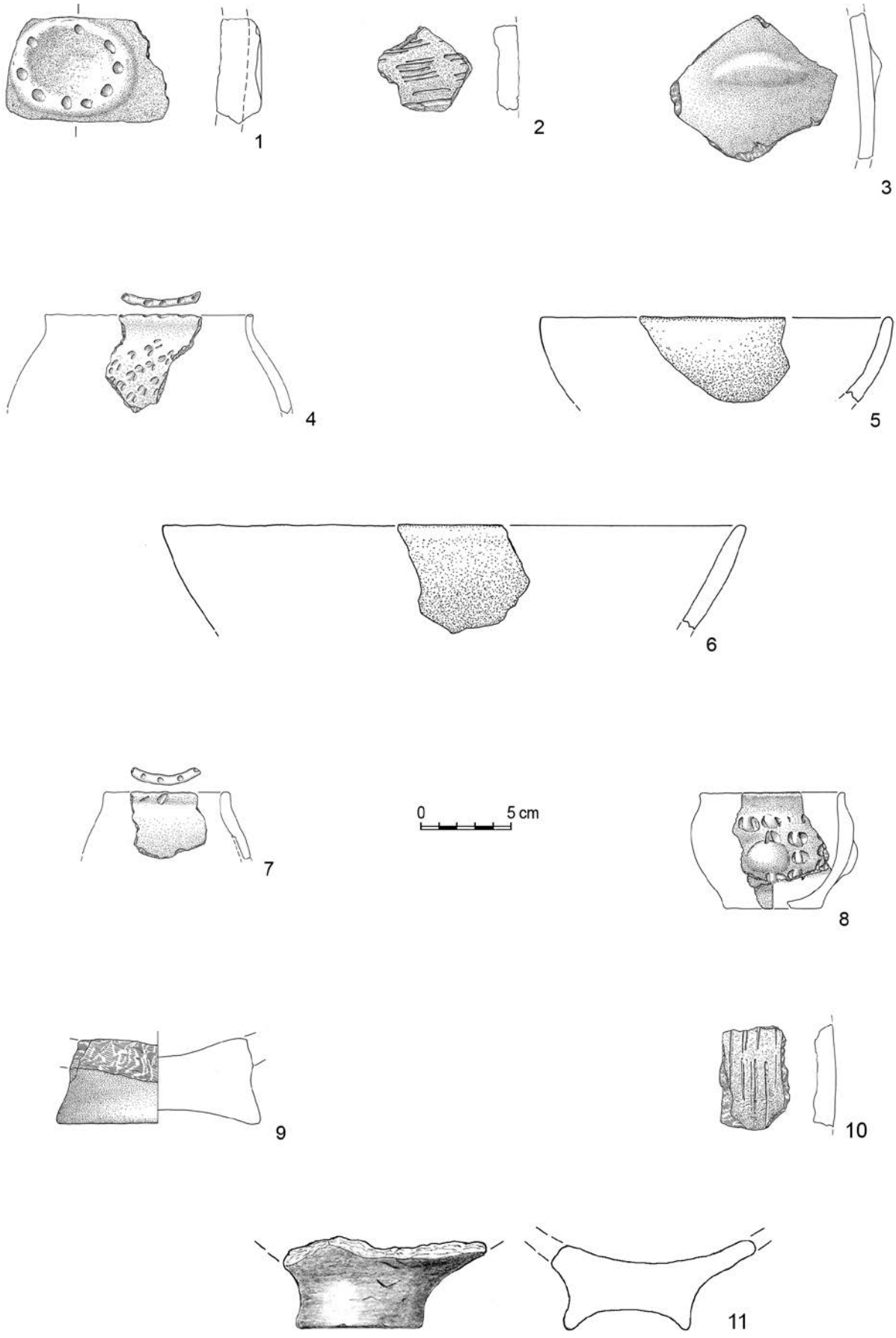


Plate 59

1 DNr 539; ID 15914; Feature 03; rim fragment; Fabric Group 1; surface with red slip; undecorated.

2 DNr 583; ID 12672; Feature M24; rim fragment; Fabric Group 1; surface with red slip; undecorated.

3 DNr 581; ID 12677; Feature M27; middle fragment; Fabric Group 1; surface with red slip; undecorated.

4 DNr 582; ID 12639; Feature M14; middle fragment; Fabric Group 1; surface with red slip; undecorated.

5 DNr 580; ID 12398; Feature M3; middle fragment; Fabric Group 1; surface with red slip; undecorated.

6 DNr 293; ID 10896; Feature L11; middle fragment; Fabric Group 1; surface with red slip; undecorated.

7 DNr 584; Feature P3; middle fragment; surface with red slip; undecorated.

8 DNr 585; Feature P6; middle fragment; surface with red slip; undecorated.

9 Feature T-extention3; middle fragment; surface with red slip; undecorated.

10 Feature S19; middle fragment; surface with red slip; undecorated.

11 DNr 299; ID 24370; Feature I8; middle fragment; Fabric Group 1; Storage Pot; surface untreated; decoration F2 and F10; max. preserved height 26 cm; max. preserved width 26 cm; max. thickness of the sherds wall 2.3 cm.

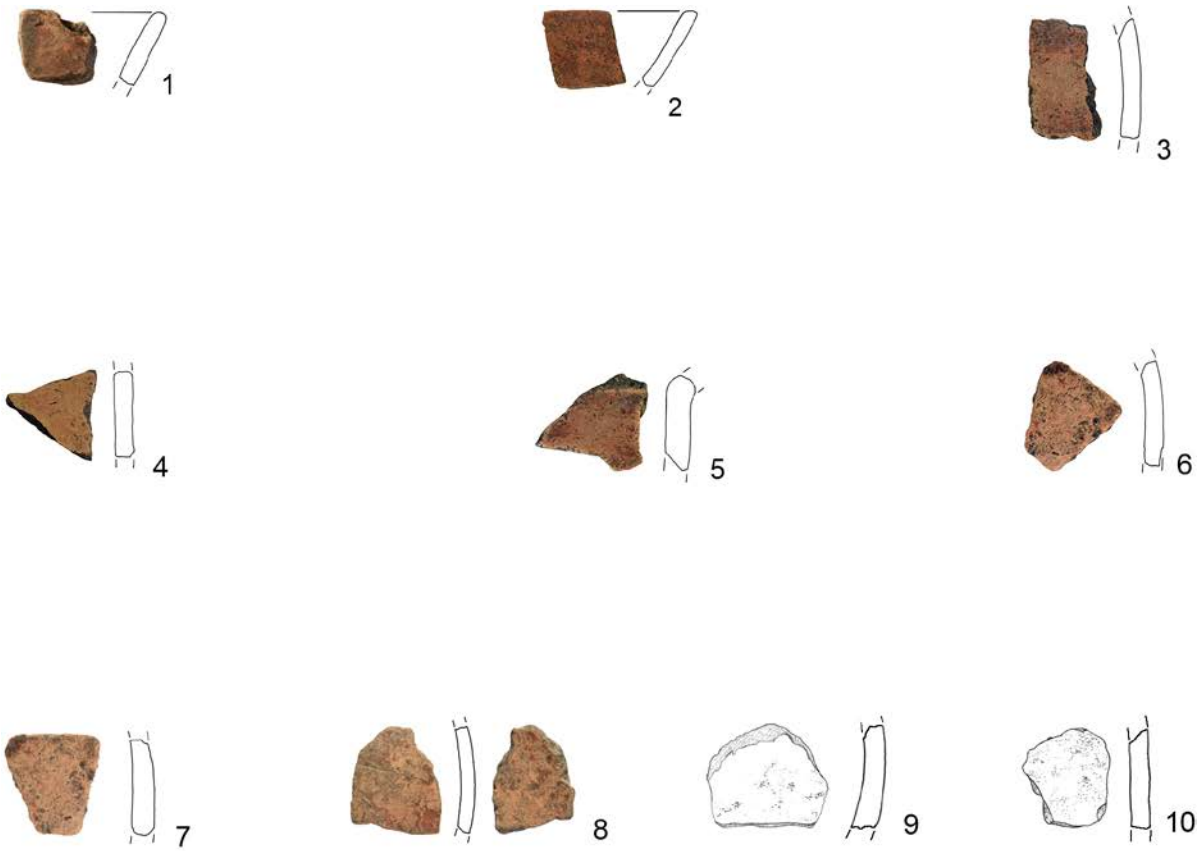


Plate 60

1 DNr 2a; Feature B9; leg of a Table.

2 DNr 2b; Feature B9; leg of a Table.

3 DNr 636; Feature P7; leg of a Table.

4 DNr 178; Feature G6; leg and corner of a Table.

5 DNr 231; leg and corner of a Table.

6 DNr 261; Feature G7; leg of a Table.

7 DNr 3a; Feature B9; leg of a Table.

8 DNr 3b; Feature B9; leg of a Table.

9 DNr 410; Feature H9; leg possibly of a Table.

10 DNr 412; Feature I6; leg possibly of a Table.

11 DNr 408; Feature K3; leg of a Table.

12 DNr 407; Feature P7; leg of a Table.

13 DNr 590; Feature S1; leg of a Table.

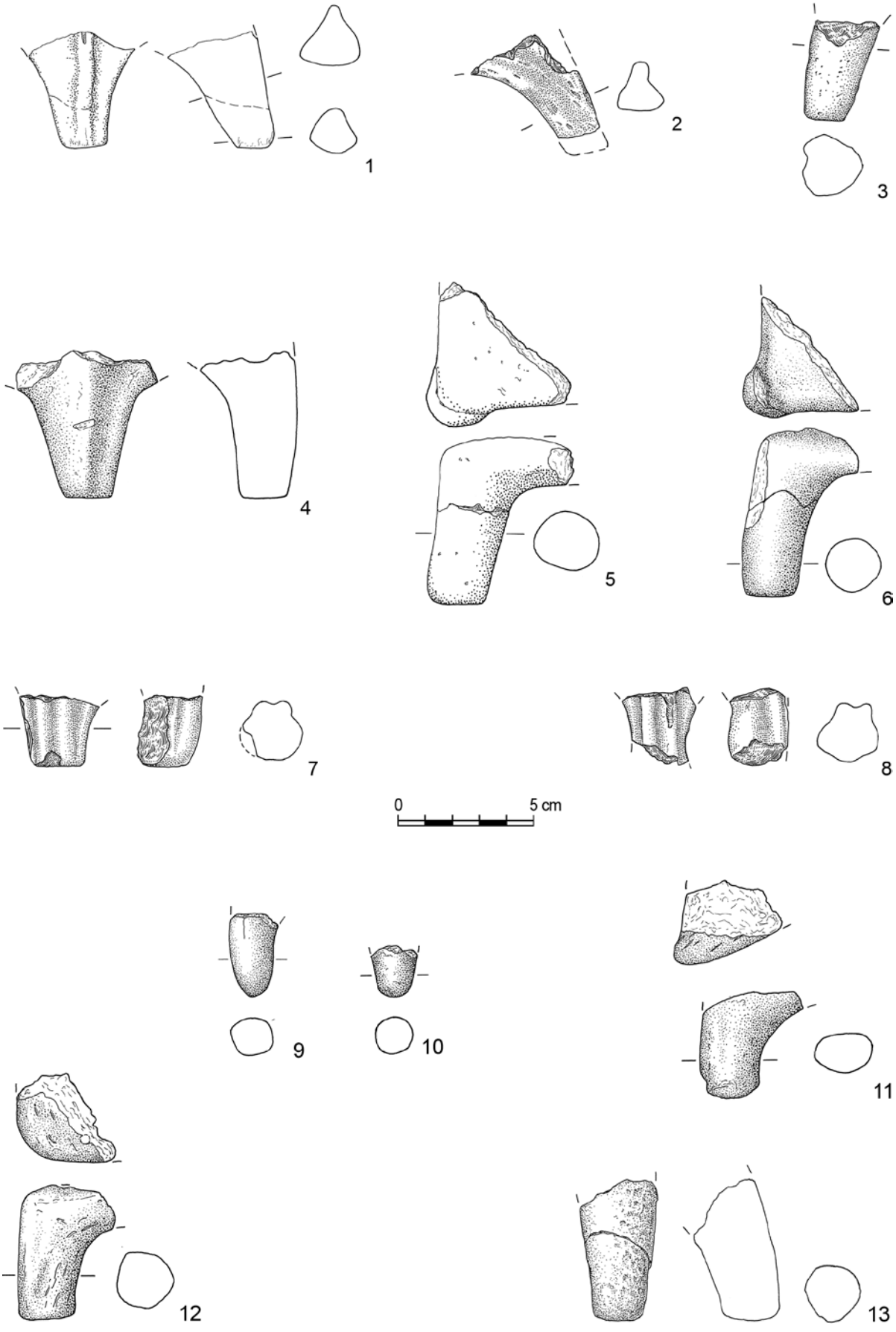


Plate 61

1 DNr 417; Features I7 and I-J 3; fragment of a Four-legged Table with incised decoration on one side; preserved height 4.9 cm; max. width 8.5 cm.

2 DNr 241; Feature G-H1 leg and corner of a Table; preserved height 5.4 cm.

3 DNr 316; Feature K-L8; fragment of a Four-legged Table. Preserved height 6.7 cm; width of the table platform 7.7 cm.

4 DNr 281; Feature G6; Miniature Table with bowl on top; height 2.4 cm; max. width 1.9 cm.

5 DNr 404; Feature I2; fragment of a cube-like object with perforation.

6 DNr 411; Feature L11; fragment of a cube-like object.

7 DNr 409; Feature S13; small cube with incised lines on its surface. The piece is broken at its lower part, possibly a Table; preserved height 2.8 cm; max. width 3.5 cm.

8 DNr 403; Feature K10; fragment of a flat Table with perforation.

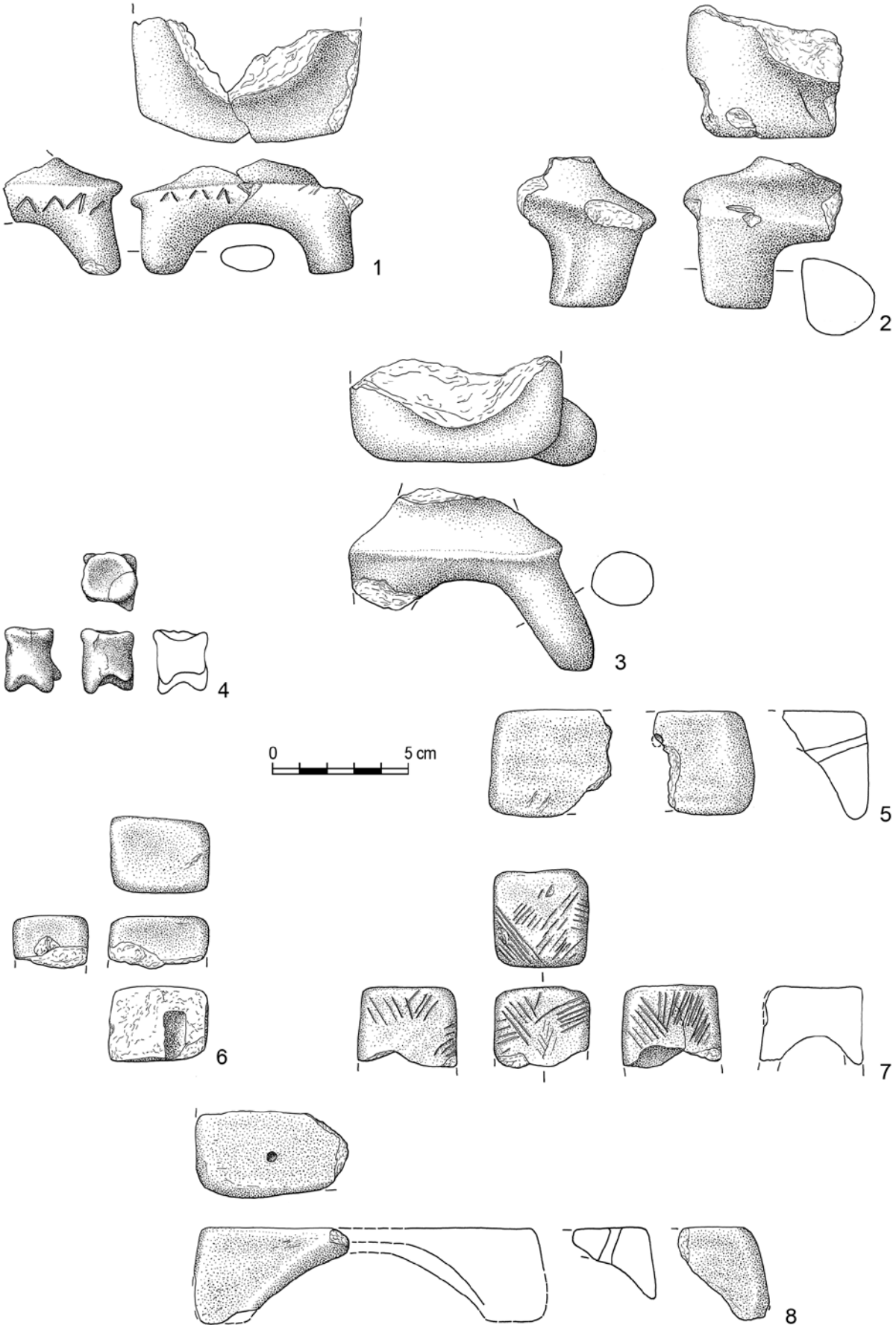


Plate 62

1 Feature I7; clay figurine on a round platform; height 15 cm; max. width of the platform 17 cm; 1308 g.

2 Feature B9; fragment of a big clay item; height 16.5 cm; max. width 8 cm; 588 g.

3 Feature K6; fragment of a big clay item; height 11.5 cm; max. width 8.5 cm; 364 g.

4 Feature T4; fragment of a big clay item; height 13 cm; max. width 11 cm; 1044 g.

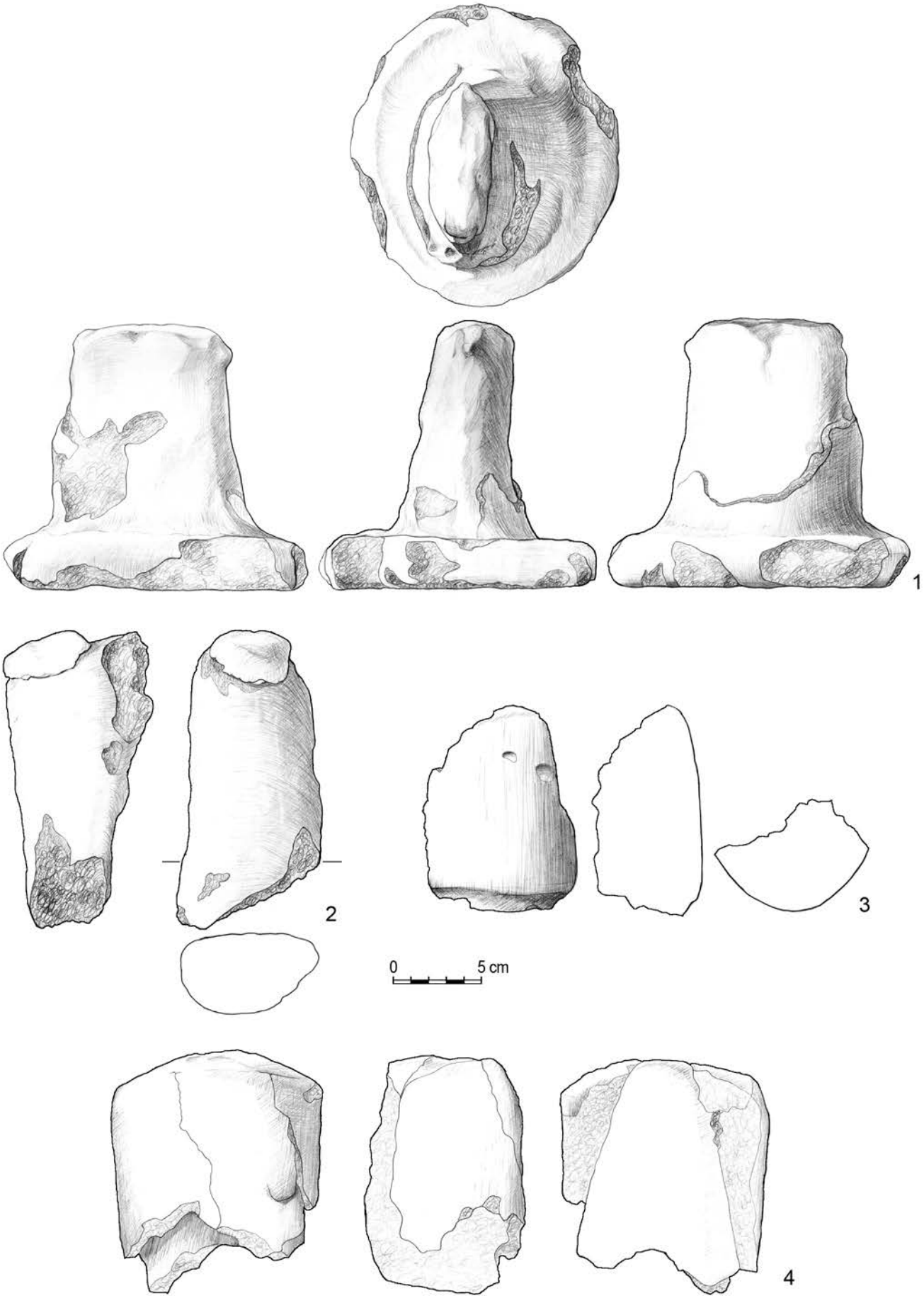


Plate 63

1 DNr 99; Feature B2; torso of an anthropomorphic figurine; preserved height 5.6 cm; max. width at the shoulder 3.4 cm.

2 DNr 100; Feature H3; anthropomorphic figurine with vertical perforation; height 4.9 cm; max. width with arms 3.5 cm.

3 DNr 283; Feature L12; stylised idol; height 5.1 cm; max. width 2.6 cm.

4 DNr 177; Feature G-H1; spindle-like object; height 4 cm; max. width at the base 3.9 cm.

5 DNr 170; Feature G7; stylised "horned" idol; height with the highest horn 4.2 cm; max. width 3.6 cm.

6 DNr 126; Feature G5; small clay pendant with fine incised lines decorated; length 3.2 cm; width 2.3 cm; thickness 1.3 cm.

7 Feature S25; fragment of a stylised "horned" idol; preserved height 4.3 cm; max. width 4.9 cm.

8 Feature S24; fragment of a clay object; possibly the foot of a figurine or from a table; preserved length 3.6 cm; width 2.5 cm.

9 DNr 603; ID 18901; Feature S13; Fabric Group 3; handle-like clay object; surface untreated; undecorated.

10 DNr 617; ID 17400; Feature S3; Fabric Group 3; handle-like clay object; surface untreated; undecorated.

11 DNr 547; ID 24355; Feature I-J5; Fabric Group 1; pottery middle fragment secondary rolled into a token; surface untreated; undecorated.

12 DNr 546; Feature L-K; middle fragment; surface untreated; pottery middle fragment secondary rolled into a token; decoration B3.

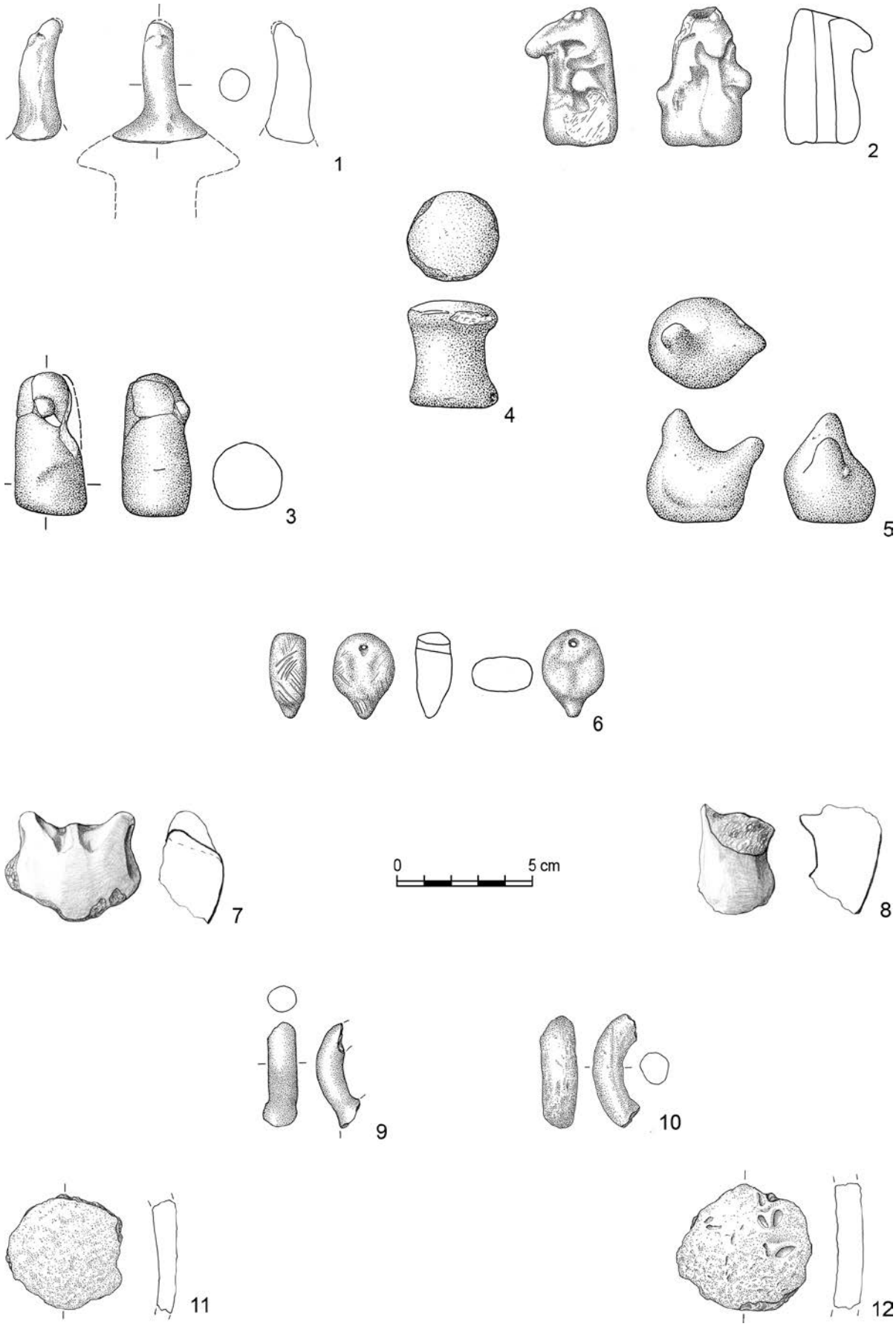


Plate 64

1 DNr 676; Feature L-K4; fragment of a clay "bread".

2 DNr 679; Feature D14; fragment of a clay "bread".

3 DNr 678; Feature S3; fragment of a clay "bread".

4 DNr 677; Feature G5; fragment of a clay "bread".

5 DNr 680; Feature L-K7; fragment of a clay "bread".

6 DNr 681; Feature L11; fragment of a clay "bread".

7 DNr 286; Feature G-H1; fragment of a clay "bread".

8 DNr 181; Feature G6 and H9; three fitting fragments of a clay "bread"; length 15.3 cm; width 8 cm; thickness 3.2 cm; 453 g.

9 ID 1128; DNr 286; Feature G-H 1; two fitting fragments of a clay "bread"; length 14.5 cm; width 7.8 cm; thickness 3.2 cm; 399 g.

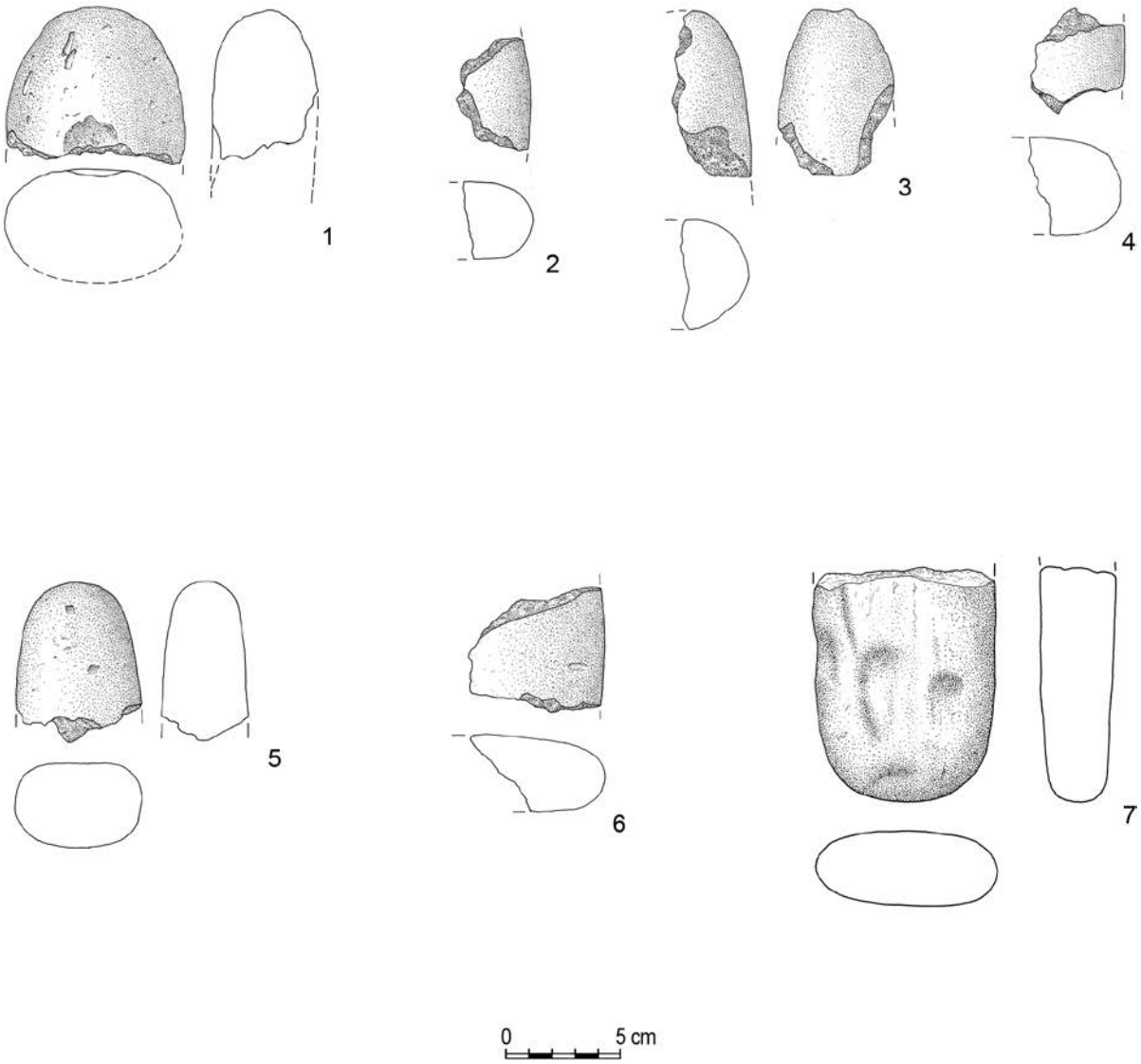


Plate 65

1 DNr 520; Feature I17; red stone; polished; ring fragment; max. diameter 4.1 cm; 6 g.

2 DNr 134; Feature H9; ceramic fragment, reworked into a ring; max. diameter 3.9 cm; 6 g.

3 DNr 644; petrified wood (lignite) or burned antler (cf. Chapter 14, Pl. 4, 5);ring fragment.

4 DNr 521; Feature O3; mussel shell; ring fragment.

5 DNr 467; Feature T3; clay; ring fragment.

6 DNr 171; Feature H9; clay; ring fragment.

7 DNr 172; Feature J4; clay; ring fragment.

8 DNr 131; Feature H9; clay; ring fragment.

9 DNr 173; Feature H9; clay; ring fragment; max. diameter 2.7 cm; 5 g.

10 DNr 274; Feature H9; clay; ring fragment.

11 DNr 294; Feature K6; clay; ring fragment.

12 DNr 295; Feature K12; clay; ring fragment.

13 DNr 296; Feature I7; clay; ring fragment.

14 DNr 486; Feature S11; clay; spindle whorl of wheel model.

15 DNr 550; Feature L11; pottery fragment reworked into a token with central drilling hole.

16 DNr 377; Feature H9; pottery fragment reworked into a token with central drilling hole.

17 DNr 456; Feature S24; pottery fragment reworked into a token with central drilling hole.

18 DNr 466; Feature S13; pottery fragment reworked into a token with central drilling hole.

19 DNr 549; Feature J11; pottery fragment reworked into a token with central drilling hole.

20 DNr 548; Feature K6; pottery fragment reworked into a token with central drilling hole.

21 DNr 361; Feature H9; pottery fragment reworked into a token with central drilling hole.

22 DNr 73; ID 3128; Feature C15/135; fragment of a ceramic disc; Fabric Group 1; surface untreated; undecorated.

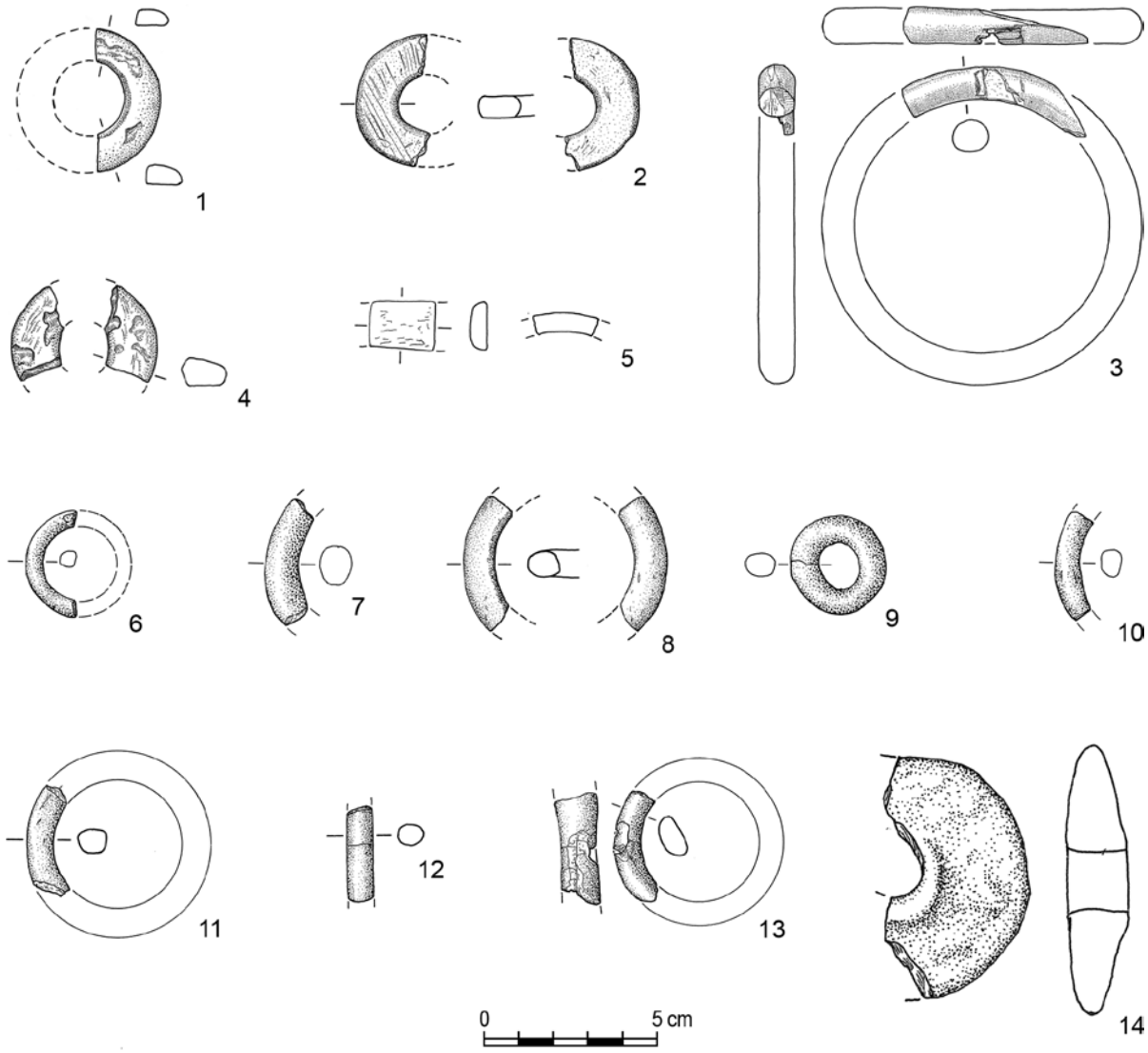


Plate 66

1 DNr 22; ID 70; Feature B9; prolongated clay weight; perforated; weight 666 g.

2 DNr 267; ID 72; Feature 111 prolongated clay weight; lengthwise perforated; weight 1333 g.

3 DNr 21; ID 69; Feature B9; clay weight in the shape of a shamrock; perforated; weight 780 g.

4 DNr 8b; Feature B14; fragment of a small clay ball.

5 DNr 46; ID 165; Feature C14; fragmented clay weight; type B; perforated; weight 283 g.

6 DNr 70; ID 194; Feature D17; fragmented clay weight; partially perforated; weight 396 g.

7 DNr 28; ID 162; Feature C13; fragmented clay weight; perforated; weight 146 g.

8 DNr 53; ID 198; Feature D17; fragmented clay weight; weight 226 g.

9 DNr 55; ID 161; Feature C14; fragmented clay weight; rest of a perforation visible; weight 116 g.

10 Feature K-L8; clay object with three bumps; weight 548 g.

11 DNr 186; ID 329; Feature G-H1; fragmented clay weight; weight 542 g.

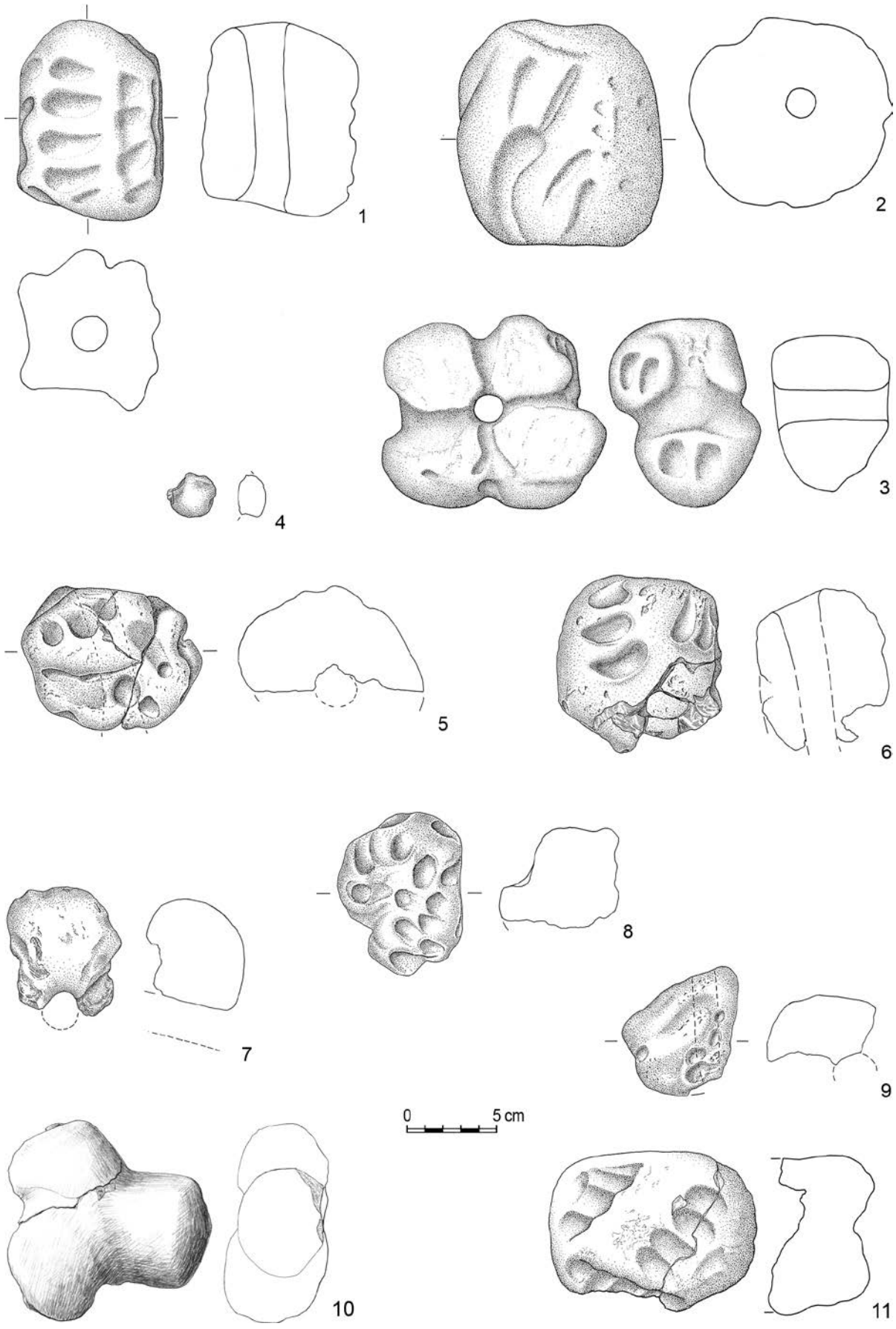


Plate 67

1 DNr 672; Feature I7; round clay weight; perforated; weight 877 g.

2 DNr 168; ID 67; Feature G-H1; fragmented clay weight.

3 DNr 167; ID 73; Feature H9; prolongated clay weight; lengthwise perforated; weight 584 g.

4 DNr 183; ID 387; Feature G-H1; fragmented clay weight; discontinuous perforation; weight 180 g.

5 DNr 29; ID 196; Feature D14; cross-sectionally cross-shaped clay weight; perforated; weight 147 g.

6 DNr 80; ID 197; Feature D17; fragmented clay weight; weight 121 g.

7 DNr 84; ID 269; Feature G2; fragmented prolongated clay weight; lengthwise perforated; weight 81 g.

8 Feature J3; fragmented clay weight.

9 DNr 71; ID 195; Feature D17; round clay weight without perforation; weight 852 g.

10 Feature K29; spherical clay weight of irregular shape with partial perforation; rest weight 264 g.

11 DNr 20; ID 65; Feature B9; fragmented small conical clay weight; horizontally perforated in the upper part; weight 90 g.

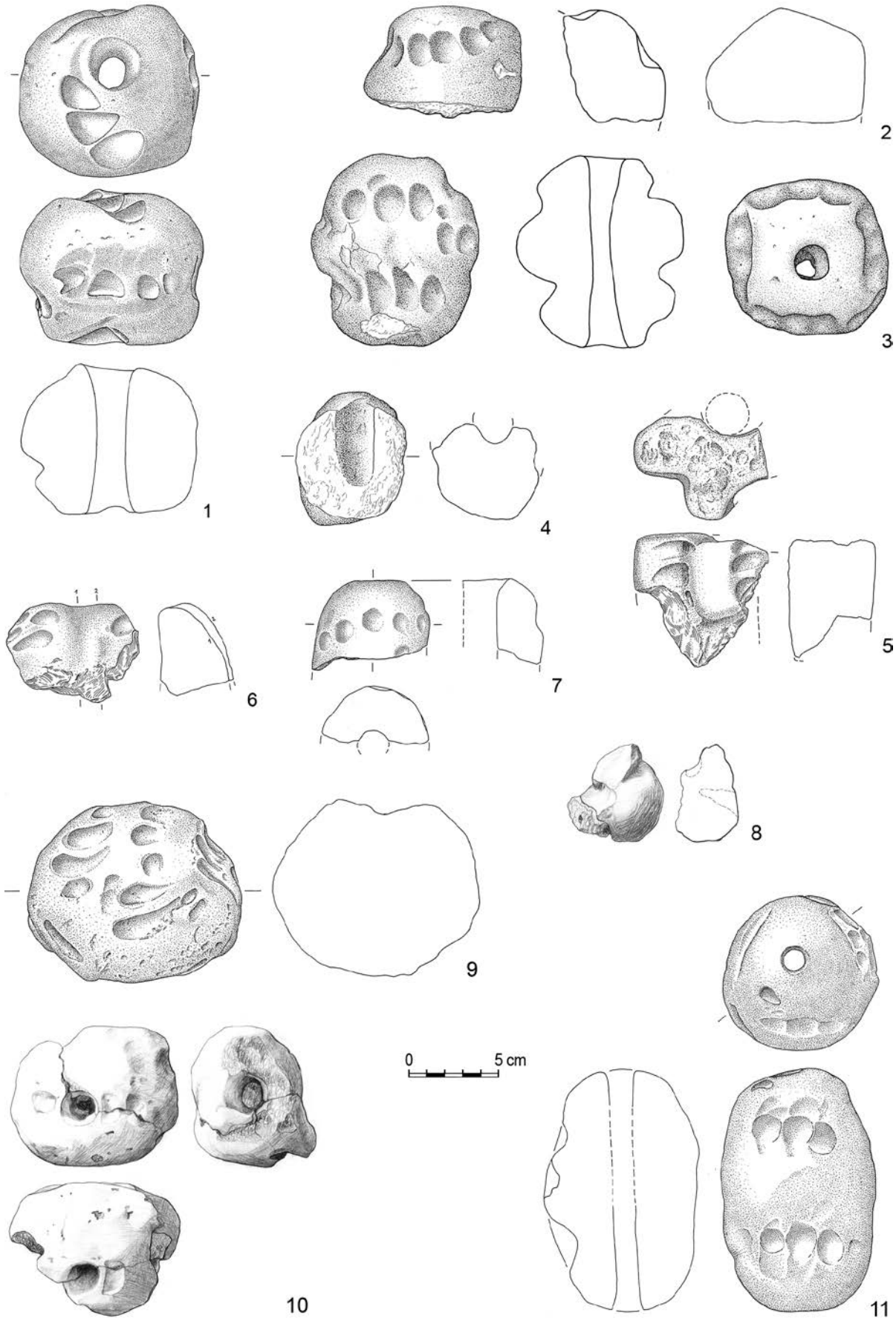


Plate 68

1 DNr 20; ID 65; Feature B9; conical loom weight; perforated in the upper part; weight 90 g.

2 DNr 265; ID 64; Feature I7; conical loom weight; perforated in the upper part; weight 256 g.

3 DNr 247; ID 67; Feature G-H1; conical loom weight; perforated in the upper part; weight 88 g.

4 DNr 266; ID 66; Feature I7; oval loom weight; perforated in the upper part; weight 93 g.

5 DNr 265; ID 64; Feature I7; rectangular loom weight; perforated in the upper part; weight 256 g.

6 Feature I-J9; conical loom weight, slightly damaged at the top; partially perforated in the upper part; weight 84 g.

7 Feature G10NE, level 1; fragmented loom weight; rest weight 36 g.

8 Feature S34; oval loom weight; partially perforated in the upper part from two sides; weight 123 g.

9 Feature S19; rectangular loom weight, damaged at the top; perforated in the upper part; rest weight 67 g.

10 Feature S15; conical loom weight; partially perforated in the upper part from two sides; 84 g.

11 Feature S25; conical loom weight; perforated in the upper part; 96 g.

12 Feature S12; broken oval loom weight; perforated in the upper part; rest weight 99 g.

13 Feature S3; oval loom weight; perforated in the upper part; 121 g.

14 ID 145; Feature I7 and I-J9; oval loom weight; perforated in the upper part; weight 128 g.

15 ID 51; Feature I7; oval loom weight; perforated in the upper part; weight 94 g.

16 ID 44; Feature I7; oval loom weight; perforated in the upper part; weight 131 g.

17 ID 45; Feature I7; oval loom weight; perforated in the upper part; weight 114 g.

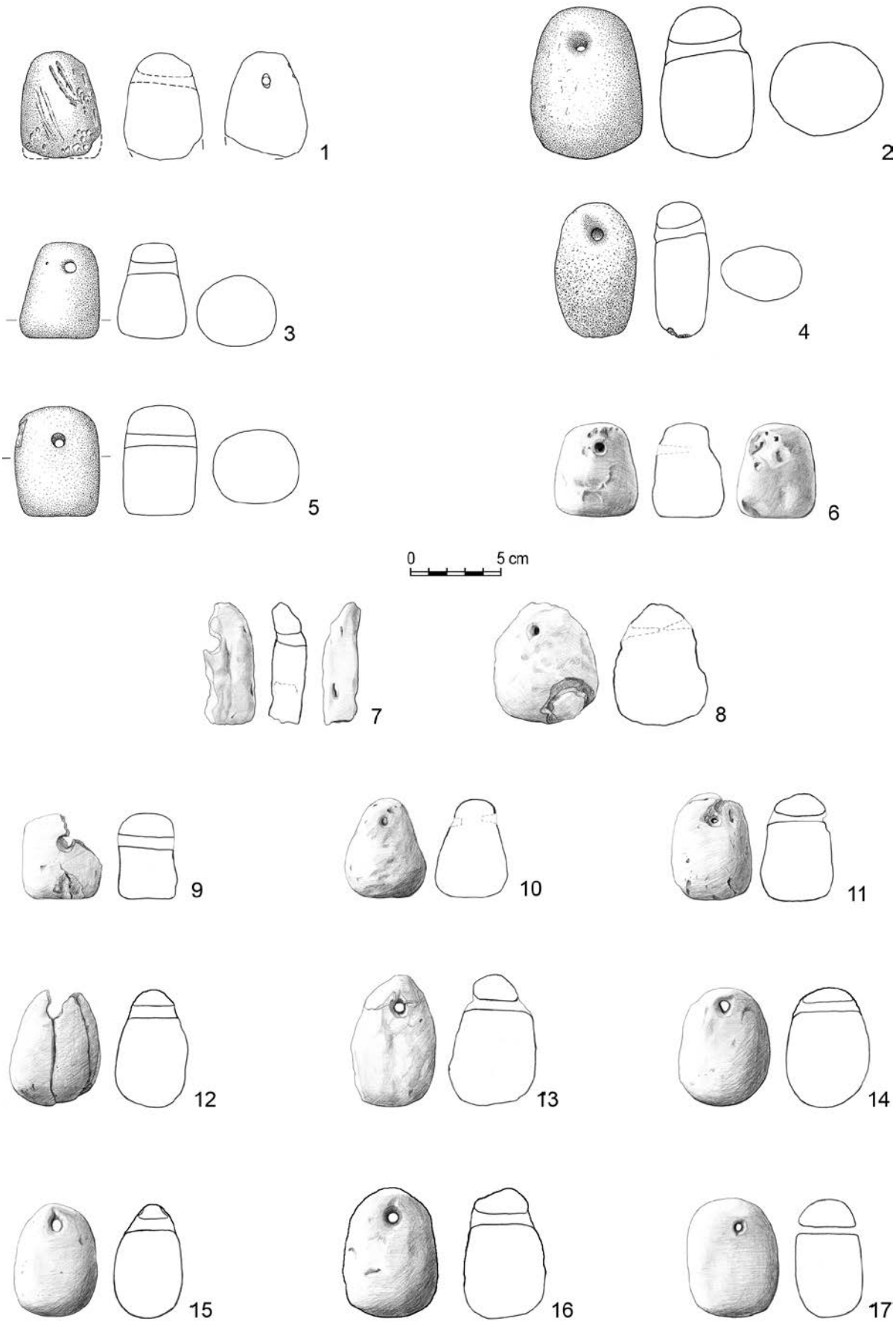


Plate 69

1 DNr 307; Feature G-H4; fragment of a round clay weight.

2 DNr 277; ID 468; Feature G-H1; cross-shaped clay weight; partially perforated from one side; weight 283 g.

3 DNr 190; Feature G10; fragmented; fragment of a round clay weight.

4 DNr 276; ID 529; Feature H9; fragment of a spindle-like clay weight; perforated; weight 237 g.

5 DNr 117; ID 160; Feature C18; fragmented clay weight; weight 88 g.

6 DNr 674; ID 62; Feature S24; round clay weight without perforation.

7 DNr 675; ID 63; Feature S24; workpiece for an elongated clay weight, crushed and perforated lengthwise from one side.

8 ID 144; Feature I-J3; fragmented of a cross-shaped clay weight with perforations; rest weight 66 g.

9 ID 154; Feature L11; fragmented clay weight with perforations from four sides; rest weight 230 g.

10 ID 26; Feature J4; fragmented of a cross-shaped clay weight, partially perforated; rest weight 85 g.

11 Feature S13; fragmented clay weight of irregular shape; rest weight 230 g.

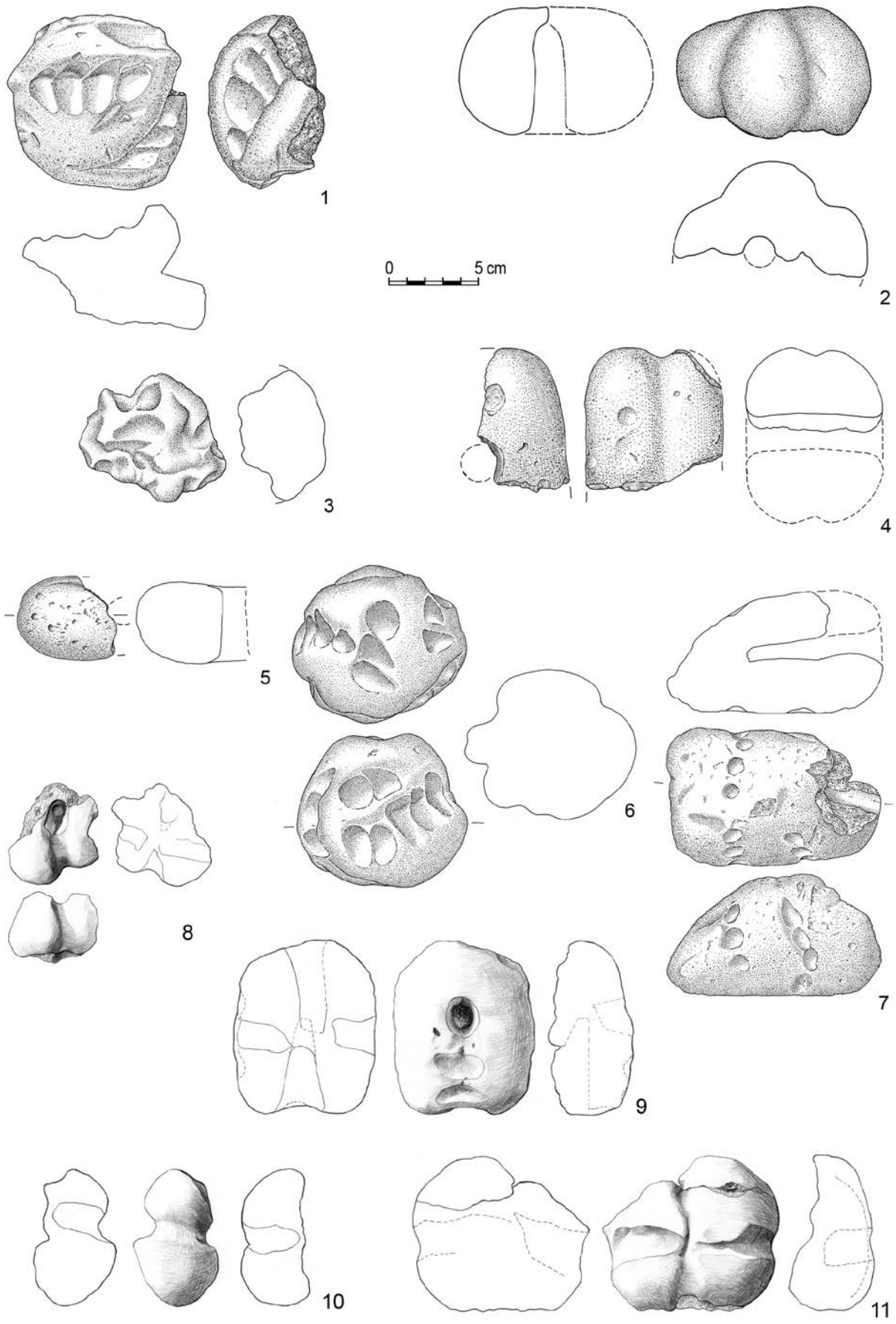


Plate 70

1 DNr 250; ID 71; Feature G-H1; round clay weight without perforation; weight 675 g.

2 DNr 193; Feature G-H1; fragmented of a cross-shaped clay weight with perforations.

3 DNr 169; Feature G-H1; fragment of a round clay weight partially perforated from one side.

4 Feature C18, profile 1; flattened lump of clay, burned; weight 53 g.

5 Feature N-O1; fragmented clay object with two perforations; rest weight 161 g.

6 Feature S13; round clay weight without perforation; weight 341 g.

7 DNr 671; ID 362; Feature G6; cross-shaped clay weight with partial perforation from one side; weight 557 g.

8 DNr 270; Feature G-H1; cross-shaped clay weight with partial perforation from one side; weight 600 g.

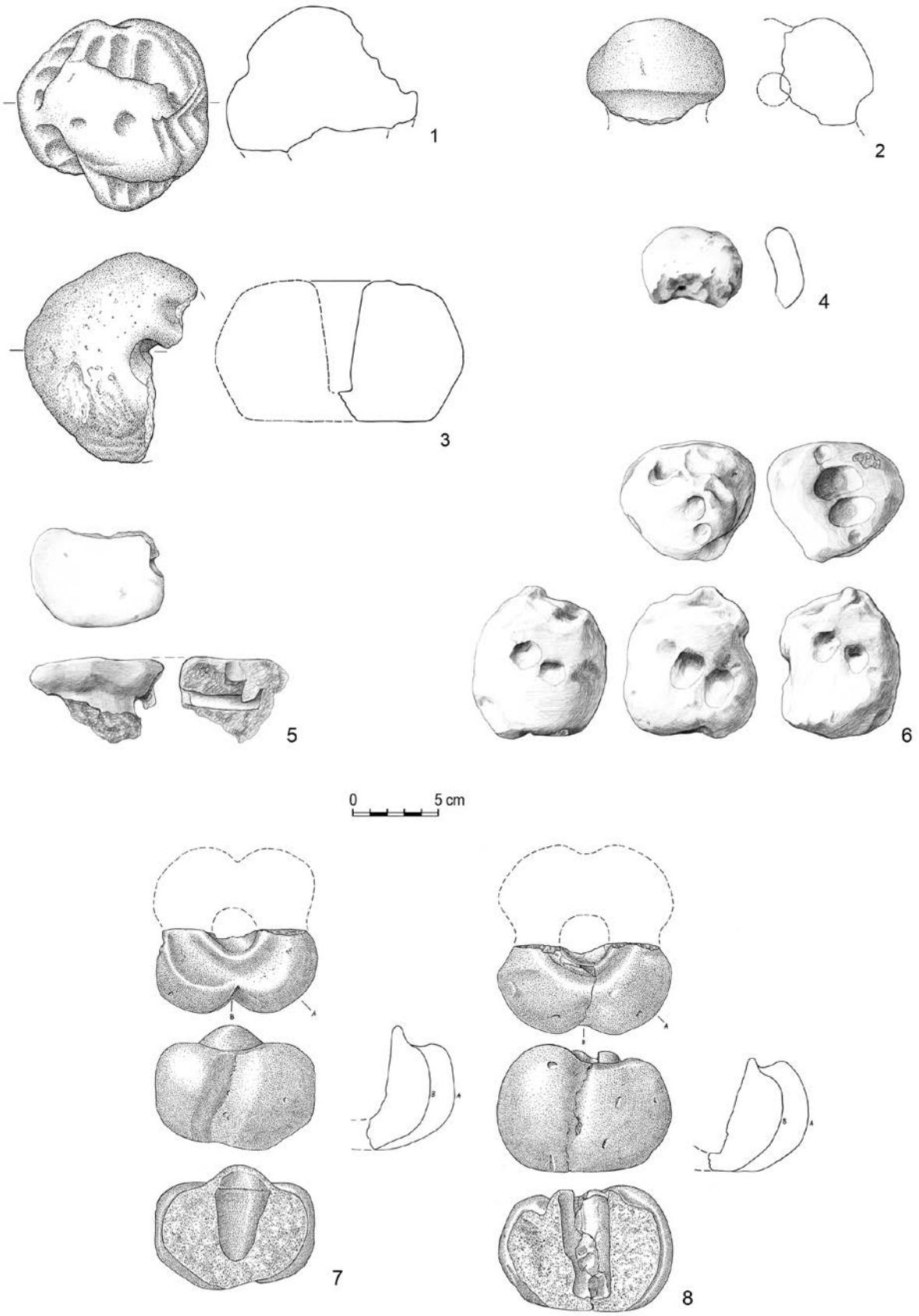


Plate 71

Archaeometric analysis of the pottery from Bucova Pusta IV

Silvia Amicone

Seventeen fragments of pottery from the excavations at Bucova Pusta IV spanning from the Early Neolithic to Iron Age were selected to be analysed via thin section petrography (Tab. 1). The analyses were conducted in the laboratories of the University of Tübingen using a Leica DM 2500P microscope.

The petrographic analysis of archaeological ceramics consists of the description, classification, and interpretation of ceramic materials, adopting techniques used in geology to describe rocks and minerals. Ceramic petrography permits the identification of different technological aspects of production, and helps to define the sources of raw materials used in production, thus providing important information on both the origin and technology of the artefacts (Quinn 2013; Whitbread 1995). The purpose of these analyses is to have an initial understanding of the petrofabric variability at the site of Bucova Pusta IV, and to develop an analytical programme for a larger number of samples from all Early Neolithic sites in the vicinity of Dudeştii Vechi which also integrates different types of analysis. This primarily concerns the Early Neolithic pottery, but also the Chalcolithic and Late Bronze to Iron Age pottery recorded during the excavations.

	Period	Fabric	Description
BP1a	Early Neolithic	A	Organic
BP1b	Early Neolithic	A	Organic
BP1c	Early Neolithic	A	Organic
BP1d	Early Neolithic	A	Organic
BP1e	Early Neolithic	A	Organic
BP4c	Chalcolithic	A	Organic
BP5a	Chalcolithic	A	Organic
BP8	Unknown	A	Organic
BP2	Unknown	B	Organic and grog
BP4b	Unknown	B	Organic and grog, sand?
BP3c	Iron Age	C	Grog
BP5b	Chalcolithic	C	Grog
BP9	Unknown	C	Grog
BP3a	Late Bronze Age to Iron Age	C	Grog
BP3b	Late Bronze Age to Iron Age	D	Sand, Tempered?
BP4a	Chalcolithic	D	Sand, Tempered?
BP6	Early Neolithic	E	Coarse sand

Tab. 1 List of pottery samples (see Chapter 10, Fig. 2).

Results

The assemblage can be divided in four petrofabrics (Tab. 2 and Fig. 1) according to the presence and type of aplastic inclusion

added as a temper, and broadly corresponding to the fabric devised in the hand specimen (see Chapter 10). More precisely, Petrofabric A is tempered with organic material (probably chaff); Petrofabric B is tempered with grog and organic material; Petrofabric C is tempered only with grog, while Petrofabrics D and E are marked by the presence of sand, which could be naturally occurring in D, but is surely added as a temper in E.

All of the samples reflect a similar geology compatible with what it is available in the immediate vicinity of the site (Petrescu/Grigorescu 1962). The inclusions observed are mainly quartz (mono- and polycristalline),

A – Organic	BP1a, BP1b, BP1c, BP1d, BP1e, BP4c, BP5a, BP8
Inclusions:	%40, well sorted to moderately sorted
Dominant:	Quartz: equant to elongate, sub-ungular (max. 0.8 mm, average 0.1 mm) Polycrystalline quartz: equant to elongate and angular to sub-rounded (max. 1 mm, average 0.5 mm)
Frequent:	Muscovite: elongate, sub-angular to sub-rounded (max. 0.20 mm., average 0.10 mm) well-sorted
Common:	Feldspars: elongate to sub-elongate, sub-angular, defuse to clear boundary (Plagioclase, K-feldspar), (max. 0.5 mm, average 0.2 mm)
Few:	Clay pellets: equant to sub-equant, sub-rounded to well-rounded (max. 2 mm, average 0.5 mm)
	Foliated metamorphic rock fragments: sub-angular to angular, defuse to clear boundary (max. 1 mm, average 0.5 mm)
Rare:	Amphibole: altered, with a defuse boundary, sub angular and sub-elongate (max. 0.3–0.4 mm, average 0.2 mm)
Matrix:	Non calcareous with optical activity
Voids:	Elongated left by organic material

B – Organic and grog	BP2, BP4b
Inclusions:	40 %, Moderate to poorly sorted
Dominant:	Quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 0.5 mm, average: 0.1 mm) Polycrystalline quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 2 mm, average: 0.5 mm)
	Grog: sub-equant and sub-rounded to sub-angular, clear boundary (max. 1.5 mm, average: 0.8 mm)
Frequent:	Muscovite: elongate, sub-angular to sub-rounded (max. 0.20 mm, average 0.10 mm) well-sorted
Common:	Feldspar: K-feldspar (max. 0.2 mm, average: 0.1 mm)
Rare-absent:	Amphibole with a defuse boundary, sub-angular, elongate (max. 0.3 mm)
Matrix:	Non-calcareous with optical activity
Voids:	Elongated left by organic material

Tab. 2 Detailed description of the petrographic results.

C – Grog	BP3c, BP5b, BP9, BP3a
Inclusions:	%30, poorly sorted
Dominant:	Quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 0.5 mm, average: 0.1 mm)
	Polycrystalline quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 1 mm, average: 0.5 mm)
Frequent:	Grog: rounded to sub-angular, clear to sharp boundary (max. 4 mm, average: 1 mm)
Common:	Muscovite: elongate, sub-angular to sub-rounded (max. 0.8 mm, average 0.10 mm) well-sorted
	Feldspar: (plagioclase) sub-angular to angular and sub-equant (max. 0.5 mm, average: 0.2 mm)
Few:	Calcite: sub-rounded to rounded, sub-equant (max. 0.40 mm, average: 0.20 mm)
Rare:	Altered amphibole sub-angular, elongate (max. 0.3 mm)
Matrix:	Non-calcareous with optical activity
Voids:	Vesicles

D – Sand	BP3b, BP4a
Inclusions:	%40–45, moderately sorted
Dominant:	Quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 0.5 mm, average: 0.1 mm)
	Polycrystalline quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 1 mm, average: 0.5 mm)
Frequent:	Muscovite: elongate, sub-angular to sub-rounded (max. 0.20 mm, average 0.10 mm) well-sorted
Common:	Feldspar: plagioclase, K-feldspar; sub-angular to angular and sub-equant (max. 0.60 mm)
Few:	Clay pellets: sub-rounded to rounded, equant (max. 0.8 mm)
	Foliated metamorphic rocks: elongate to sub-elongate, sub-rounded (max. 0.8 mm, average: 0.6 mm)
Rare:	Amphibole: sub-angular, elongate (max. 0.40 mm)
	Volcanic rock fragments: elongate to sub-elongate, altered (max. 1 mm, average: 0.8 mm)
Matrix:	Non-calcareous with optical activity
Voids:	Vesicles

E – Coarse sand	BP6
Inclusions:	%45, poorly sorted
Dominant:	Quartz: sub-rounded to sub-ungular, sub-equant to sub-elongate (max. 1.60 mm, average: 0.80 mm)
Frequent:	Muscovite: elongate, sub-angular to sub-rounded (max. 0.40 mm, average 0.10 mm) well-sorted
Common:	Feldspar: plagioclase, K-feldspar; sub-angular to angular and sub-equant (max. 0.80 mm, average: 0.40 mm)
Few:	Clay pellets: sub-rounded to rounded, equant (max. 1.2 mm)
	Foliated metamorphic rocks: elongate to sub-elongate, sub-rounded (max. 1.20 mm, average: 0.8 mm)
Rare:	Amphibole: sub-angular, elongate (max. 0.40 mm)
Matrix:	Non-calcareous with optical activity
Voids:	Vesicles

Tab. 2 Detailed description of the petrographic results.

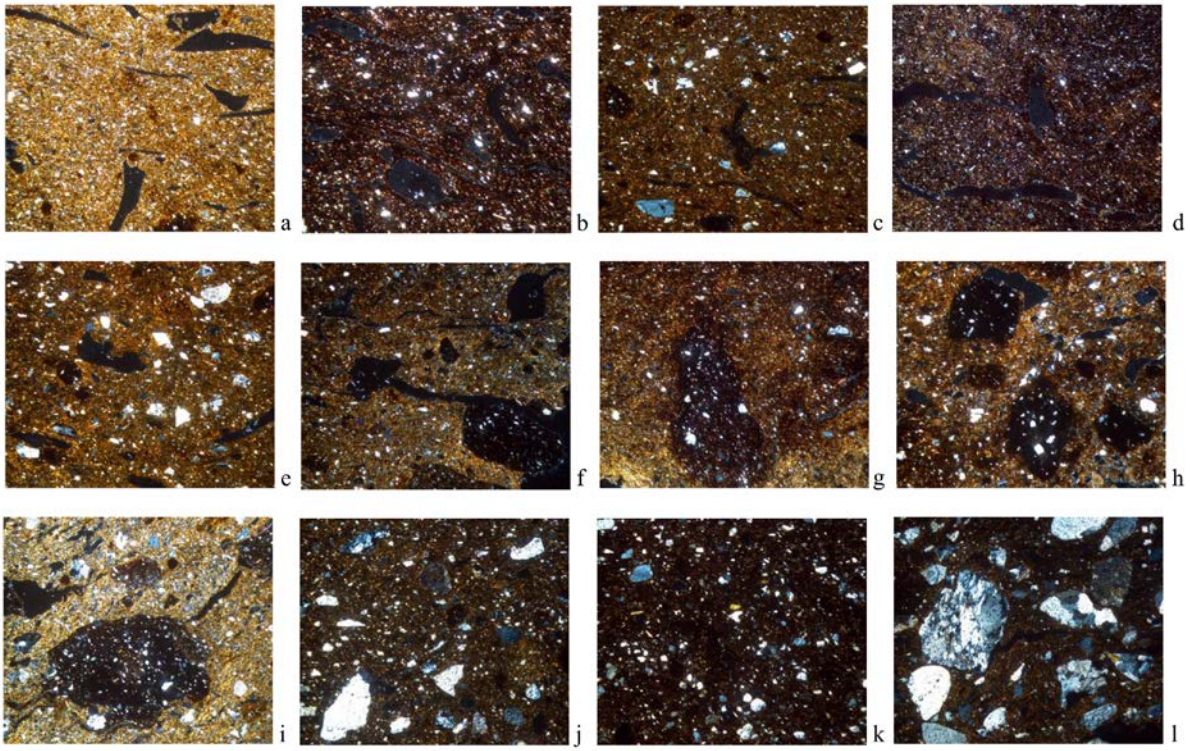


Fig. 1 Thin section micrographs of selected samples from Bucova Pusta IV: a) BP1a XP (A, organic, Early Neolithic); b) BP1c XP (A, organic, Early Neolithic); c) BP1e XP (A, organic, Early Neolithic); d) BP5a XP (A, organic, Chalcolithic); e) BP8 XP (A, organic); f) BP2 XP_2 (B, organic and grog); g) BP5b XP (C, grog, Chalcolithic); h) BP3c XP (C, grog, Iron Age); i) BP9 XP (C, grog); j) BP4a XP (D, Chalcolithic); k) BP3b XP (D, Late Bronze Age to Iron Age); l) BP6 XP (E, sand tempering, Early Neolithic). Field of view 3 mm.

muscovite, and feldspars, and more rarely foliated metamorphic rocks (quartz-shist and mica-schist) and amphiboles. However, specimens might differ in term of inclusion sorting, grain-size distribution, and coarseness.

Discussion and Conclusions

Despite the limited number of samples analysed, some interesting points can be raised. Most of the Early Neolithic pottery is marked by the addition of organic temper (e.g., chaff, domestic cereals). This is a typical feature for pottery of that period in the wider region of South-eastern Europe (Spataro 2019). However, even if less frequently, this type of tempering can also be found in later periods (Amicone et al. 2020). One of the advantages of this type of material is that it is commonly available in the settlements, as it is produced during grain processing; moreover, it makes pottery much lighter (Skibo et al. 1989). Nevertheless, the cultural dynamics behind its wide diffusion over such a large area for most of the Early Neolithic period are still not completely understood.

Another common temper is grog (crushed sherds added into clay paste), which is found both in Fabrics B and C. Grog tempering is a common practice among potters in the Balkans from the end of the Late Neolithic period at the latest (Amicone et al. 2020); but it could also be found more sporadically during the Early Neolithic (Spataro 2017). On account of the lack of extensive research for later periods, it is nonetheless difficult to evaluate whether this tradition continued uninterrupted down to the Late Bronze Age. Nevertheless, it is known as one of the common

tempering agents during the Bronze Age in this area (Earle et al. 2011; Kreiter et al. 2007; Orfanou et al. 2022). At Bucova Pusta IV, it is interesting to note that this practice seems to be attested over different periods. Grog could have been added into clay paste for functional reasons such as improving the vessel's mechanical and thermal properties, but its choice as a temper may also have been driven by cultural and symbolic factors (Rice 2015, 80).

Petrofabric D with medium-fine sand could be made from a local clay, but it is not clear if this has been added as a temper, or if it is naturally occurring. On the other hand, the Early Neolithic sherd representing Petrofabric E is very coarse, and, in this case, sand was added to improve the mechanical properties of this vessel, which also seems to have a thicker wall.

In general, as above observed, specimens might differ in terms of inclusion sorting, grain-size distribution, and coarseness. This could suggest the use of different clay deposits in the area, or various raw materials as well as cleaning, and processing procedures. The latter hypothesis seems to be more plausible.

All the samples analysed display a low optical activity of the matrix, and various colours which could suggest firing temperatures below 800°C under poorly controlled atmospheric conditions.

Overall, a considerable variability marks the seventeen samples analysed. A more systematic analysis carried out on a larger number of samples from Bucova Pusta IV and other sites in the region representing different shapes and periods, as well as geological samples would be necessary to explain this phenomenon. This could be connected to a variety of factors including an intrinsic variability in the geological sources. On the other hand, this could also reflect a non-standardised technology of production. Finally, fabric variability could be connected to different functions of the vessels, and to different technological traditions which changed over time.

Chipped stones of Bucova Pusta IV

Bogdana Milić, Michael Brandl

Introduction

The title chosen for this book may appear somewhat misleading, as stone artefacts discussed here actually come from the Bucova Pusta IV site. However, compared to other Early Neolithic sites in south-east Europe, the number of these items is indeed very small. Among all other find categories, the number of stone artefacts is negligible, making it almost appropriate to describe this period on the site as a „Stone Age without stones." The excavation seasons of 2010, 2012, and 2013-2015 at the Bucova Pusta IV site yielded only 61 chipped stone artifacts. Despite this modest number, our paper aims to explore their context, providing insights into their role and significance for the site interregional connections. Furthermore, a few chipped stones were discovered during the surface survey around Bucova Pusta IV in 2014 and Kalcsov I (Fig. 1)[1]. The Bucova Pusta IV assemblage was unevenly distributed in the archaeological contexts at the site, while

Bucova Pusta IV / Find context (Trench)	Number of pieces	Excavation season
G	1	2013
G/H	1	2014
H	1	2013
I	1	2014
L	2	2014
L/K	1	2014
K	8	2014
M	2	2014
O	2	2014
O-P	1	2014
P	21	2015
Q	1	2015
R	5	2015
S	2	2015
T	3	2015
Addendum Trench A	2	2010
Addendum Trench B	4	2012
Surface finds	3	2015
Other contexts	**Number of pieces**	**Find year**
Kalcsov I survey (CAL)	4	2014–2015
Survey around Bucova Pusta IV	4	2014–2015

Total number of finds: ***69***

Tab. 1 Context of finds from Bucova Pusta IV, survey around the site and Kalcsov I used in the analyses.

1 The finds in the text and accompanying figures and tables are labelled after the site name, i.e. BP (for Bucova Pusta IV) or CAL (for Kalcsov I), context, which is related to the trench name, survey or surface, and the ID number of single artefact according to database entries, e.g. BP-R-1, CAL-1, BP-SURF-1, BP-SURV-1. Feature number is not included in the pieces' names.

Early Neolithic assemblage Main technological categories			**Tools (modified blanks)**
Cores	n=1 (4.76 %)		1 out of 2
Core prep./rejuv. elements	n=1 (4.76 %)		/
Blade products	n=12 (57.15 %)		8 out of 12
Flakes	n=5 (23.81)		3 out of 5
Debris	n=1 (4.76 %)		/
Hammerstones	n=1 (4.76 %)		/
Total	100 % (no=21)		57 % (no=12)
Disturbed assemblage Main technological categories			**Tools (modified blanks)**
Hammerstone on a core	n=1 (2.94 %)		/
Core	n=2 (5.88 %)		/
Core prep./rejuv. elements	n=5 (14.71 %)		1 out of 5
Blade products	n=14 (41.18 %)		9 out of 14
Flakes	n=11 (32.35 %)		6 out of 11
Debris	n=1 (2.94 %)		/
Total	100 % (no=34)		48.5 % (no=16)

Tab. 2 Techno-typological features of the Bucova Pusta IV assemblage (excavations 2013–2015).

the largest number of artefacts belongs to Trench P, and the rest is allocated as given in the table (Tab. 1). The total number of pieces is extremely low, although they were collected by hand – picking and sieving. Different features within the trenches contained chipped stone artefacts, and according to the assignment and interpretation of features, the material was found in relation with the Early Neolithic dwelling structures, pits, filling layers, ovens, and on the surface. A part of the material derives from the recent work connected to older trenches dug by Gyula Kisléghi Nagy in 1904, and from disturbed contexts, which evidenced later intrusions, or were impacted by ploughing activities.

Techno-typological features of the chipped stone assemblage (excavations 2013–2015)

The Early Neolithic assemblage retrieved from the pits, dwellings, and infills during the excavations 2013–2015 is comprised of 21 chipped stone artefacts, which technologically belong to different categories, being divided into cores, core maintenance (preparation and rejuvenation related) elements, blade products (central blades), flakes, and debris. In addition, non-obsidian knappable material (quartz nodules, in particular) was also used for hammerstones. Artefacts discovered in disturbed or mixed contexts, which are still at least partially related to the Early Neolithic trenches, comprise other pieces, and were recorded in the same way (Tab. 2). The documentation of chipped stones follows the methodological approach addressed in Milić 2018; id. 2019, which was used by the author for the studies of the Neolithic material in Anatolia, the Aegean, and the Central Balkans (south Serbia).

Despite the low number of pieces recovered from the site, and, aside from the abundance

of central blades (aimed or targeted blade products with no traces of cortex/natural surface or core reduction maintenance) followed by flakes, the material also evidences cores and technical elements related to core preparation and rejuvenation alongside the minor debris. In total, seven obsidian pieces were documented at Bucova Pusta IV, two from the Early Neolithic features, and another five from disturbed excavation strata and the surface. The rest of the material is attributed to different non-obsidian knappable rock varieties, as given in more detail in the later sections of the text.

Blade products

Central blades are the most numerous in the assemblage, occupying 57 % and 40 % of the Early Neolithic and disturbed material respectively. Those from the secure Early Neolithic contexts are preserved as complete pieces and medial fragments, followed by a few distal and proximal sections. They are mainly detached from the unidirectional cores, with the exception of two pieces, which bear opposite directional negatives; these could be related to knapping of cores with two opposing platforms or "turned" (primarily unidirectional) cores, and cores knapped by direct percussion after being placed on an anvil. According to the regularity of edges, detachment stigmata and negatives on blades, soft direct and indirect percussion, pressure technique and anvil technology are attested. The length of blades ranges between 10–68 mm, and their sections are mainly trapezoidal; edges are parallel, and profiles are straight or slightly convex.

Disturbed and mixed contexts yielded blades which are more fragmented, and preserved mainly in their medial and proximal sections. Apart from one blade with negatives displaying two opposite directions, the rest was knapped from the unidirectional cores. In this assemblage, there is a wider variety in blade regularity, with blades exhibiting parallel, convergent, and divergent sizes, and curved and straight profiles, while mostly showing trapezoidal sections. The lengths occur in ranges between 10–58 mm. Their production techniques are particularly noteworthy, especially concerning the large regular blades, which were most likely produced by indirect percussion or pressure flaking with the use of levers (for more details on recognition criteria for large blades, see Pelegrin 2006; id. 2012).

Flakes

Flakes from the Early Neolithic contexts are divided into thin cortical and non-cortical flakes, and elongated or blade-like-flakes. They are detached from the uni- and multidirectional cores and cores knapped on anvils, generally speaking in favour of reduction of medium-sized and small cores (flake sizes ranging between 7–15 mm). Disturbed layers display a wider range of flakes with sizes between 7–30 mm, and can be attributed to thin cortical and non-cortical flakes, short hinged flakes, and tiny flakes (under 11 mm). Negatives on the dorsal side of flakes attest to the knapping of anvil, opposed platform, and the multidirectional cores. In general, the blade and flake assemblage seems to derive from different core reduction strategies, which can suggest that there were two main aims of production of chipped stone tools at the site. However, the anvil knapping is a common feature for these two assemblages. Furthermore, the general lack of a more solid number of cores limits a full understanding of what might be differing core maintenance strategies, especially regarding mixed reduction of flakes and blades from a single sequence.

Cores and core maintenance elements

A core on a blade (burin-like-core) found in an Early Neolithic feature represents the only core from a secure context, and is informative about the secondary use of primary blanks in an opportunistic manner for the final extraction of tiny blades or blade-like-flakes. Two cores from disturbed layers (surface finds made of obsidian and quartz) are related to the typical knapping of small specimens on an anvil. These pieces can possibly be connected with the Neolithic occupation, while, moreover, fitting to the common elements of the core reduction system known from the Early Neolithic settlements in the Banat, as well as at the other Starčevo sites, as already outlined by Ian Kuijt (1994, 90f., and references therein)[2].

In addition, a secondary use of a multidirectional flake core turned into hammerstone comes from a mixed layer. A quartz hammerstone fragment was also documented in the Early Neolithic trench in the context of a pottery concentration associated with Feature 6 in Trench R (for details on the context, consult the stratigraphy chapter).

Within the group of core maintenance elements, there is an Early Neolithic quartz preparation flake, which can suggest the occasional knapping of this raw material on site. Amongst other core preparation and rejuvenation pieces, there are two lateral (crested) blades in obsidian, an opening flake, a debitage surface correction blade, and a surface rejuvenation blade documented in chert, which are related to the initial preparation of a core and reparations of the knapping directions during the main reduction sequence. Finally, two debris pieces are recorded in both contexts, which are associated with small knapping waste. It is presently clear that the assemblage does not contain exclusively ready-made products, which might be exchanged directly, but also other elements related to core reduction. However, the amounts of cores, maintenance elements, and debris are still very low for suggesting an on-site production of chipped stone artefacts, especially regarding regular blade products knapped from unidirectional cores. On the contrary, knapping of quartz, the anvil knapping of smaller cores or blanks, and the ad-hoc secondary modification of blanks can all be suggested to have been done locally.

Modified blanks – retouched and tools with macroscopically observed use scars

Within the chipped stone assemblage, the percentage of tools is quite high, taking 57 % in the secure Early Neolithic and 48.5 % in disturbed layers, demonstrating that half (or more) of the material produced was modified, likely in order to be used. This is an interesting pattern in contrast to other comparable assemblages (see e.g. Kuijt 1994, 87; Biagi 2011, 75; Šarić 2014; Horejs et al. 2019). Typological analyses of chipped stone tools demonstrate that central blades and non-cortical flakes were mostly used with or without retouch, with the exception of one opening fully cortical flake, which was additionally modified. This can suggest that there was a selection of blanks (primary products) for further modification. Tools distributed across the Early Neolithic features and fill layers demonstrate the presence of sickle blades, followed in number by end-scrapers made on

2 "Bipolar" knapping with the core set on an anvil where the direct striking by a hammerstone results in a simultaneous chipping from two different core sides, the top and the bottom which has contact with the anvil (see Crabtree 1972 for the original definition) should not be conflated here with bidirectional knapping, which represents removal of blanks from two different (opposed) platforms in a more controlled and organised manner.

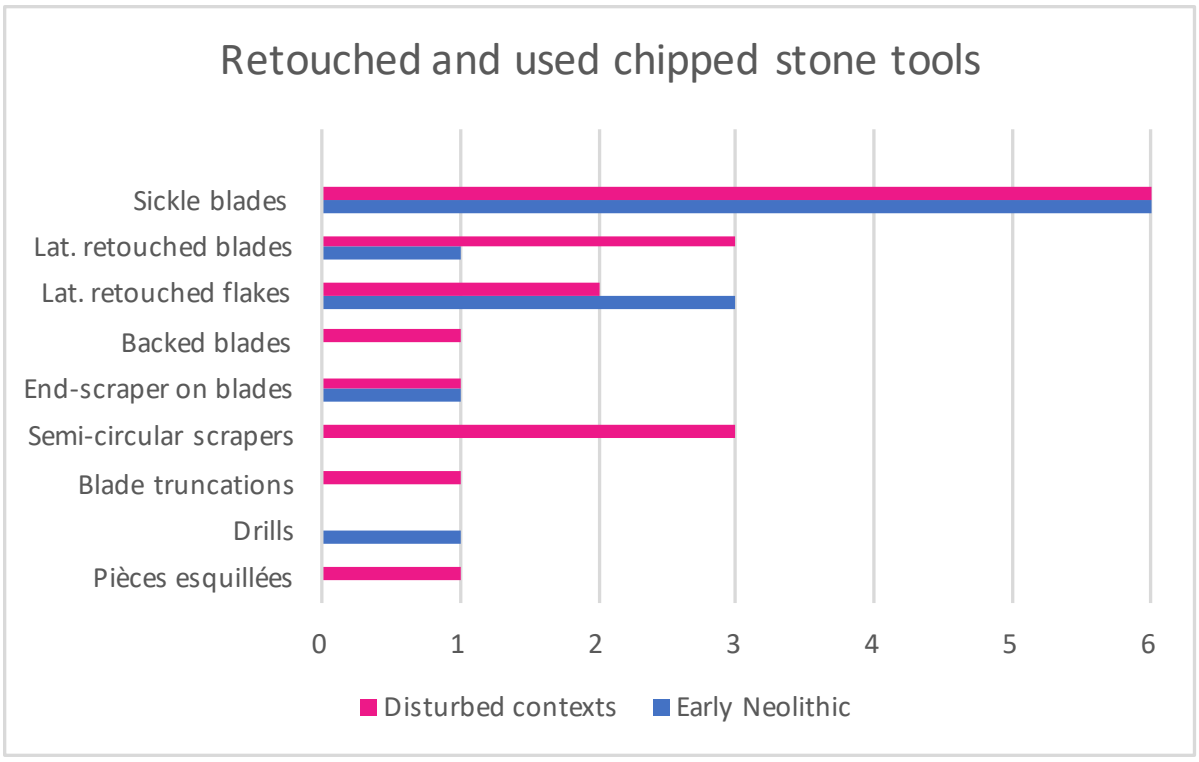


Fig. 1 Chipped stone typology (distribution of tool types in the Early Neolithic and disturbed contexts from the excavations 2013–2015).

blade blanks, and drills (Fig. 1; see Pl. 1 and 3 as well). The sickle elements are comprised of retouched or non-retouched blades (of which some have truncations), while specimens display the gloss which is both parallel and oblique to the edges of the blanks, possibly suggesting different hafting practices.

Tools recorded from disturbed layers evidence a similar typology, especially in the number of sickle elements which are based on retouched blades, followed in number by truncations and end-scrapers. However, there is a bigger variety of tool types in these contexts, which also include semi-circular scrapers made on flakes, a backed blade, and a pièce esquillée (a symmetrical splintered piece), which could technologically and typologically fit into the Early Neolithic group of finds (Fig. 1; see Pl. 2 and 4). Still, although a part of the retouched tools and tools with macroscopically observed scalar removals from disturbed contexts belongs to rather uncharacteristic blanks (flakes and blades), a couple of the tools clearly demonstrate non-Early Neolithic features in terms of tool typology, and should therefore be counted among the mixed material. As already mentioned in one of the sections above, there are three large blades with retouched edges and a truncation (BP-K-7, BP-P-19, BP-P-20), which could be attributed to somewhat later chronological spans in regard to production technique, size, and retouch type. Moreover, a circular obsidian scraper also does not occur as a typical Early Neolithic tool (BP-M-1). Finally, a bilaterally retouched sickle insert (BP-K-3) can most likely be associated with the Bronze Age.

Addendum: Material from early excavations in 2010 and 2012

In the course of first excavations of the German-Romanian team in different parts of the mound, two trenches (A and B)

context	RM	prov	nat. surface	core	debitage unmodified				debitage modified			hammerstone
					blade	flake	core prep. and rejuv.	debris	blade	flake	core prep. and rejuv.	
Bucova Pusta IV_Early Neolithic	„Balkan Flint“	NE Bulgaria or Romania	not preserved	1	1				5	1		
	chert	indet	not preserved						1	1		
	radiolarite	possibly Mecsek	not preserved						1			
	radiolarite	Transdanubia (Bakony Mts.)	not preserved						1			
	radiolarite	possibly Carpathian	not preserved		1							
	NLS	indet	residual / n.p.			1		1				
	obsidian	SE Slovakia (type C1)	not preserved		1					1		
	quartz	indet	gravel				1					1
	indet (burnt)	indet	not preserved							1		
Bucova Pusta IV_Disturbed contexts	"Balkan Flint"	NE Bulgaria or Romania	1 pc gravel		1	1	1		4			1
	"Central Banat Flint"	indet	not preserved							1		
	flint	Volhynia	not preserved						1			
	chert	indet	gravel				1				1	
	high quality grey chert	indet	not preserved						1			
	chert	indet	not preserved		1	1			2			
	chert	indet burnt	not preserved		1	1						
	chert/spiculite	indet	not preserved		1							
	radiolarite (burnt)	most likely Bakony Mts.	not preserved							1		
	radiolarite	possibly Mecsek	not preserved							1		
	NLS	indet	gravel + residual			1		1	1	2		
	obsidian	SE Slovakia (type C1)	not preserved	1			2			1		
	quartz	indet	not preserved	1								
	indet (burnt)	indet	not preserved			1						
Bucova Pusta IV_survey	"Balkan Flint"	NE Bulgaria or Romania	not preserved						1			
	"Central Banat Flint"	indet	not preserved			1						
	radiolarite	possibly Mecsek	not preserved						1	1		
CAL	"Balkan Flint"	NE Bulgaria or Romania	not preserved							1		
	radiolarite	possibly Mecsek, 1 pc burnt	not preserved	1					1			
	NLS	possibly Mátra perivolcanic silcrete	primary/residual						1			

Tab. 3 Raw materials according to technological elements (material from the excavations 2013–2015 and surveys).

yielded two and four chipped stone artefacts respectively. In Features 13 and 16 of Trench A (excavated in 2010), a laterally retouched fragmented blade-like-flake in chert and an obsidian thick flake were found, and can be attributed to the Early Neolithic layer (see more details and distribution of finds in the section with stratigraphy data). However, an Early Neolithic feature documented during the excavations in 2012 potentially affected

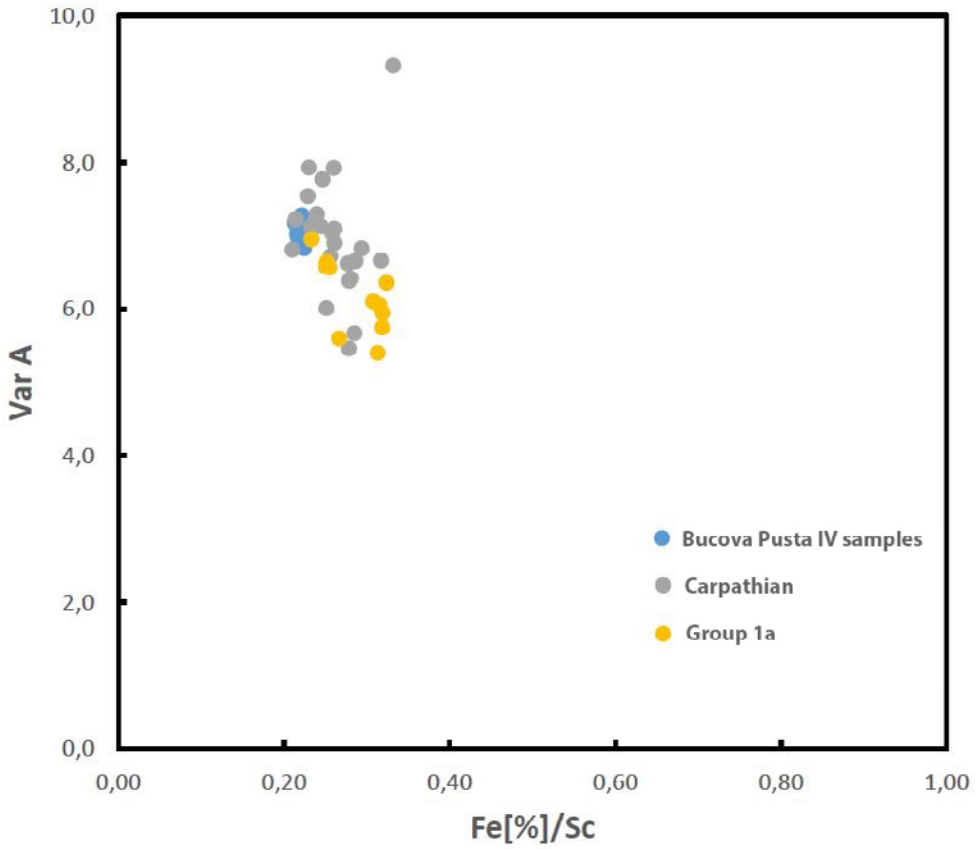


Fig. 2 Results of the Neutron Activation Analyses (NAA) made by E. Pernicka.

by recent agricultural activities must be taken with caution regarding the dating of finds. These comprise three chert artefacts (two elongated, regular flakes and a larger thick non-cortical flake), and one small obsidian flake (Pl. 6).

Material from the survey around Bucova Pusta IV and Kalcsov I

The surface survey in the vicinity of Bucova Pusta IV and the material gathered around Kalcsov I yielded eight prehistoric chipped stones. There are 4 blades, 3 flakes, and 1 anvil core in this collection, of which 6 pieces bear modification in the form of retouching. According to two pieces from the survey (Pl. 5), namely a denticulate, bifacial sickle element (BP-SURV-4), and a retouched "mini-adze" tool made of chert (BP-SURV-1), the existence of a Bronze Age occupation in the vicinity of the site cannot be doubted.

On the other hand, artefacts from Kalcsov I do not display particular characteristic features (with blades and a flake) permitting a more detailed chronological determination of the material (see Pl. 7). However, an out-of-shape anvil core could well be related to the Early Neolithic, which chronologically accords with early pottery sherds recorded in the course of work on the site, although a test trench exclusively uncovering Iron Age structures did not present stratified data for earlier periods (see Chapter 4).

Method of raw material analysis

Lithic raw materials in the chipped stone tool assemblage of Bucova Pusta IV were

stereomicroscopically analysed using a Zeiss SteREO Discovery.V20 microscope with 40–150 times magnification, and coupled with an Axiocam 305 colour digital camera for optimal microphotographic documentation. Stereomicroscopy aims at the identification of characteristics such as the microstructure, i.e. size, shape, and spatial arrangement of the constitutive components, and particular inclusions and bioclasts. In the case of silicites (i.e. organically formed SiO_2 modifications such as chert and flint), this investigation primarily focuses on the detection of microfossil remains; however, non-fossils may also be representative of specific source environments. This type of analysis allows the identification of raw material sources or source regions by reconstructing individual facies under which particular stone raw materials were formed.

To illustrate the raw materials with identified and unidentified provenance, we provide microphotographs under standardised 40 times magnification and water immersion at unpolished rock surfaces, which can be used as a reference catalogue for comparison with other assemblages from this area.

Comparisons with materials from the Vienna Lithothec (VLI) at the Department of Prehistoric and Historical Archaeology at the University of Vienna and the in-house rock collection at the ÖAW allowed the determination of the origin of a series of lithic raw materials at BP; however, this was not possible for the entire assemblage (especially some chert varieties). The question regarding their provenance will be addressed in the course of further in-depth studies involving cooperation with local lithic specialists and geo-archaeological surveys.

Raw materials

The distribution of raw materials according to all elements of the *chaîne opératoire* of chipped stone production at Bucova Pusta IV and Kalcsov I is provided in Tab. 3.

From an overall perspective, a characteristic yellow-honey-brown raw material of high quality oftentimes displaying white spots dominates the lithic (and specifically the Early Neolithic) assemblage from Bucova Pusta IV. This material is easily recognisable, and typically referred to as "Balkan Flint" (BF), although significant variability exists upon closer (and especially petrographic) examination. Sources of this kind of material(s) are known from the Moesian Platform and adjacent regions in Bulgaria and Romania from both Lower and Upper Cretaceous formations, with the best documented outcrops along the River Danube in the Pleven-Nikopol area (Biagi/Starnini 2013; Ciornei 2015; Crandell 2013; Gurova 2012a; id. 2016; Gurova et al. 2016; Gurova/Nachev 2008). Several authors have recognised the significance of BF as a marker of the Neolithisation in the Balkans and the Carpathian Basin, and its role in the subsequent maintenance of socio-economic contacts (e.g. Gurova 2012a; id. 2016; Gurova et al. 2016; Kaczanowska/Kozłowski 2008). The dominance of BF at Bucova Pusta IV indicates the strong involvement of its inhabitants in Neolithic networks active on a broader scale in the circum-Carpathian realm.

Two chipped stone tools (BP-K-3 and BP-SURV-2) are made from so-called „Central Banat Flint" (CBF). This is a silicite (chert; also described as "biogenic jasper" from the Metaliferi Mts., see Crandell 2011, 71) of lower quality on account of frequently occurring fissures and cracks. It is typically yellowish-brown, sometimes with a green hue. The most characteristic features are dark brown to black veins and spots. The exact source regions of this type of material are still not systematically investigated; outcrops are, however, known

from Timiș and Hunedoara Counties in western Romania (Comşa 1971, 15; Biagi/Starnini 2013, 50; Starnini et al. 2012, 109; Biró et al. 2000). Both artefacts are clearly related to a later stage of prehistory, best corresponding to the Bronze Age (a bifacial sickle implement and a bifacial "mini-adze").

Obsidian artefacts from Bucova Pusta IV microscopically match the Carpathian I type typically associated with sources in south-eastern Slovakia. This obsidian type is typically shiny black, and can appear almost completely translucent in the case of very thin pieces (e.g. bladelets). By means of contrast, Carpathian II obsidian from north-eastern Hungary mostly displays a slightly greyish hue, and is non-translucent, while Carpathian III obsidian, which only occurs in the western extreme of Ukraine at Rokosovo, is characterised by a porous structure and macroscopically visible grains (Rácz 2018). Chemical Neutron Activation Analyses (NAA), made by Ernst Pernicka at the Curt-Engelhorn-Zentrum Archäometrie (CEZA) laboratory in Mannheim, Germany, demonstrate that the sampled assemblage comprised of seven obsidian artefacts (from the Early Neolithic and disturbed or survey contexts – see pieces on photographs), corresponds to the Carpathian I source region, therefore confirming the first microscopic observations (Fig. 2). This study compares the data on chemical characterisations of the Carpathian source areas made by Oddone et al. (1999).

Together with BF, obsidian is one of the most significant exogenous materials for Neolithic chipped stone production in the Carpathian region (Bačo et al. 2017; Biagi 2011, 71–72; Culicov et al. 2009; Milić 2014; Rosania et al. 2008; Szepesi et al. 2018).

An end-scraper on a blade made of Volhynian flint (BP-K-8), which represents a long-distance import from the western Ukraine, is noteworthy. As suggested for sites in eastern Hungary (e.g. Maroslele-Pana, see Kaczanowska et al. 2011, 276–277, or Alsónyék-Bátaszék, see Szilágyi 2018), Volhynian flint is typically associated with the Late Neolithic/Chalcolithic and does not occur in Early or Middle Neolithic contexts.

Neogene lacustrine silicites (NLS; oftentimes termed "limnosilicites" or "limnoquartzites", which is problematic – see Brandl/Hauzenberger 2018, 57 for a discussion on the terminology) are represented by a total of eight chipped stone artefacts. NLS are by-products of volcanic activities and visually highly diverse. Sources can consequently be found at various locations between western Hungary and the Tokaj Mountains, and along the entire intra-Carpathian volcanic arch comprising Slovakia and parts of west-central Romania (Biró 1986; Biró et al. 2000). Furthermore, this type of raw material can be found throughout Serbia (Miladinović et al. 2016). Blade CAL-4 could correspond to one particular subtype of NLS, the so-called Mátra peri volcanic silcrete (Szurdokpüspöki opalite, see Biró 1986).

Radiolarites within the assemblages are derived from three different source regions. Petrographically, most of this group corresponds best to Mecsek-type radiolarite (see e.g. Szilágyi 2018, 132). Two artefacts are made from Transdanubian (Bakony) radiolarite; however, one is heavily burnt (BP-H-1), and cannot therefore be unambiguously assigned. The one securely determined specimen (BP-T-3) is of the so-called "Hárskút" type (for a discussion related to the relevance of this sub-division of Bakony radiolarites, see Szilasi 2017). Based on its petrographic composition, BP-P-11 is most likely of Carpathian origin, i.e. from the Pieniny Klippen Zone (Brandl et al. 2014; Cheben/Cheben 2010). Of the presumed Mecsek radiolarites, BP-SURV-4 again most

likely represents a Bronze Age denticulated sickle element.

The provenance of other silicite (chert/flint) raw materials cannot presently be securely identified. Some of those pieces may be uncharacteristic (i.e. very small or burnt) BF (e.g. BP-Q-1; BP-R-5; BP-OP-1), and some derive from (most likely "local") gravels, as indicated by natural surface remains (BP-P-1). One spiculitic chert, for which we cannot indicate potential geologic sources at present, was also recorded (BP-P-5).

The broad large blade BP-K-7 is a high-quality grey chert of unknown provenance, probably corresponding to the "grey/blue" flint described from Foeni (Kuijt 1994, 89).

Of three quartz artefacts in the assemblage, the two Early Neolithic pieces (one preparation flake and one hammer stone fragment) remain of a gravel surface, which indicates an origin of very likely close-by river sources. However, the exact provenance cannot be determined at present.

The material of the two pieces BP-R-3 and BP-P-9 was indeterminable due to the influence of intense fire

Chipped stone production and use in context – concluding remarks

The Early Neolithic chipped stone collection from Bucova Pusta IV represents a curious case in terms of the number of artefacts, considering that multiple excavation seasons were conducted on site. However, the paucity of chipped stones in the Early Neolithic context here is not unique, as similarly small assemblages (under 40 pieces) resulting from the scarcity in knappable raw materials were reported from comparable sites in the wider vicinity, such as Foeni-Salaş and Miercurea Sibiului-Petriş (Bácskay 1976; Kuijt 1994; Biagi 2011). This pattern in the western Banat in Romania also seems to follow a culturally different outline when compared against the other two geographical regions within the Banat – the mountanious area in the east and southeast, and the Danube Gorges respectively (Draşovean 2007, 67f.). On the other hand, the small assemblages from the Romanian Banat limit our understanding of the variety of evidence in terms of production techniques and the components of lithic toolkits, therefore leaving very little room for comparisons with other well-known assemblages from contemporaneous chronological sequences, for instance those in the Danube Gorges region or northern and central Serbia.

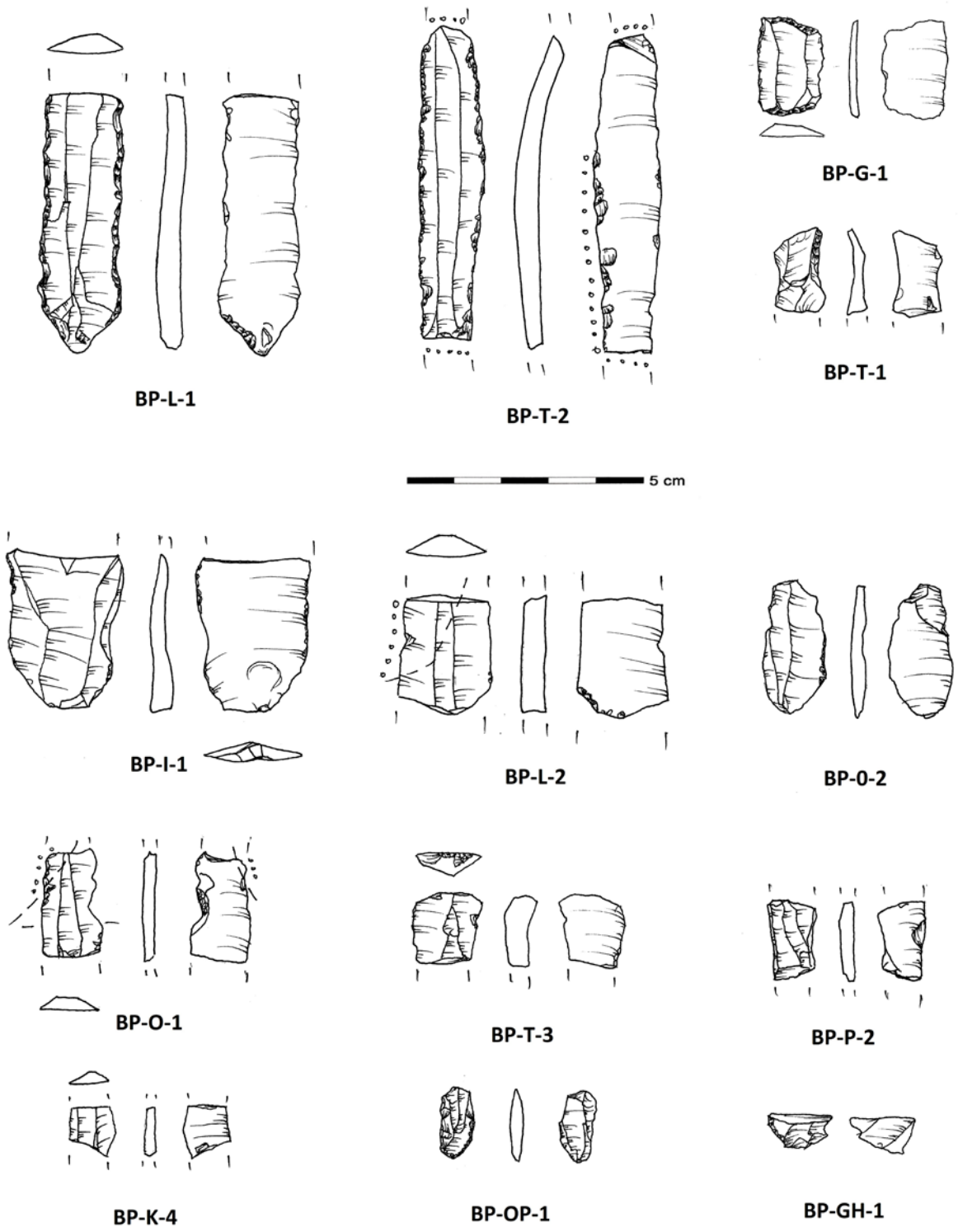
In a similar way, internal changes and developments of chipped stone production involving the questions of cultural continuity and discontinuity through time cannot be explicitly framed as has been done for other sites, which exhibit clearer trends in production and use of chipped stone tools (e.g. Kozłowski/Kozłowski 1984, Šarić 2014; Bogosavljević Petrović/Starović 2016). Sites with low numbers of artefacts (including Bucova Pusta IV) clearly demonstrate that chipped stones supported domestic activities performed in everyday life, likely on a household level. They are mostly expressed in tools used in harvesting domestic cereals, and other cutting, drilling, and scraping implements, with many retouched tools most likely being hafted, based on the retouch types. The absence of geometric microliths in the assemblages with a low number of artefacts from the Romanian Banat should be also interpreted with caution, considering the ongoing debate about the role of geometrics in Early Neolithic horizons, in which Donja Branjevina and other sites from the Starčevo-Körös-Criş in Romania and Hungary likely demonstrate different cultural traditions (Šarić 2014, 176).

Techno-typological and raw material studies of the small Early Neolithic assemblage from Bucova Pusta IV mark an important step in understanding the behaviour of this agricultural community with no direct access to knappable materials. Two different core reduction systems can be outlined based on the intended or final products, and other technical elements available in the assemblages. The first, which is unlikely to be related to a local production, concerns blades which were produced from single-platform cores by percussion and pressure technique, and arrived at the site via exchange, for which particular raw material selection suggests the involvement of long-distance networks. "Balkan Flint" makes up a significant portion of the chipped stone assemblage in the Early Neolithic assemblage. The obsidian from south-eastern Slovakia (Type Carpathian 1) is also present here, albeit in small quantities. The exchanged products include bladelets and long blades which were used on site, and were occasionally additionally modified and secondarily reduced in the final exploitation of blanks for obtaining small specimens. The second reduction strategy concerns local production, which is related to knapping of quartz, most likely accessible to the community, and the knapping of smaller blanks (used secondarily) related to cores set on an anvil. The production of bladelets and small flakes coming from anvil knapping does not necessarily indicate low knapping skills, but could be related to an opportunistic means of raw material use. There are still open questions concerning the recycling of the material in this assemblage, and occasional introduction of larger cores for blade and flake production, which are currently linked to the existence of some core preparation and rejuvenation elements, although these are especially related to the group of artefacts from disturbed contexts.

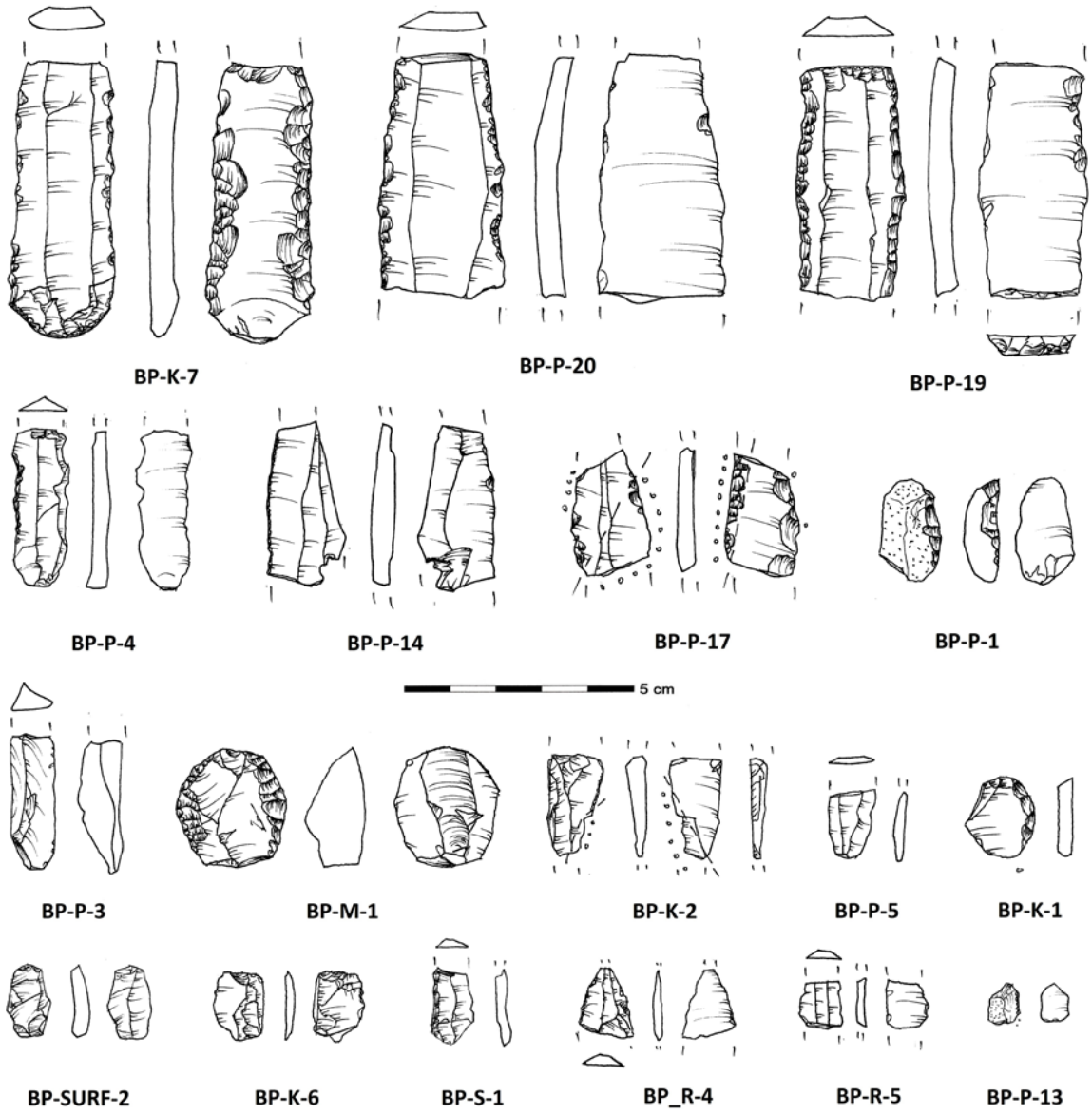
A larger diversity of lithic raw materials is present from these disturbed contexts. Although from a raw material and techno-typological perspective, a good part of these finds corresponds to cores, blanks, and tool types recognised in the secure Early Neolithic layers, later intrusions are doubtless present. There are some chipped stone tools indicating post-Neolithic activities at and around Bucova Pusta IV. These are Bronze Age sickle elements, retouched in a different (bifacial) fashion, and large blades demonstrating a skilled production which could be related to either the later Neolithic and/or Chalcolithic periods. Future investigations should focus on tracing the full scope of these, also including the later prehistoric periods at this unquestionably important site, so as to better understand the diachronic developments of early farming communities in the Banat region.

Acknowledgements

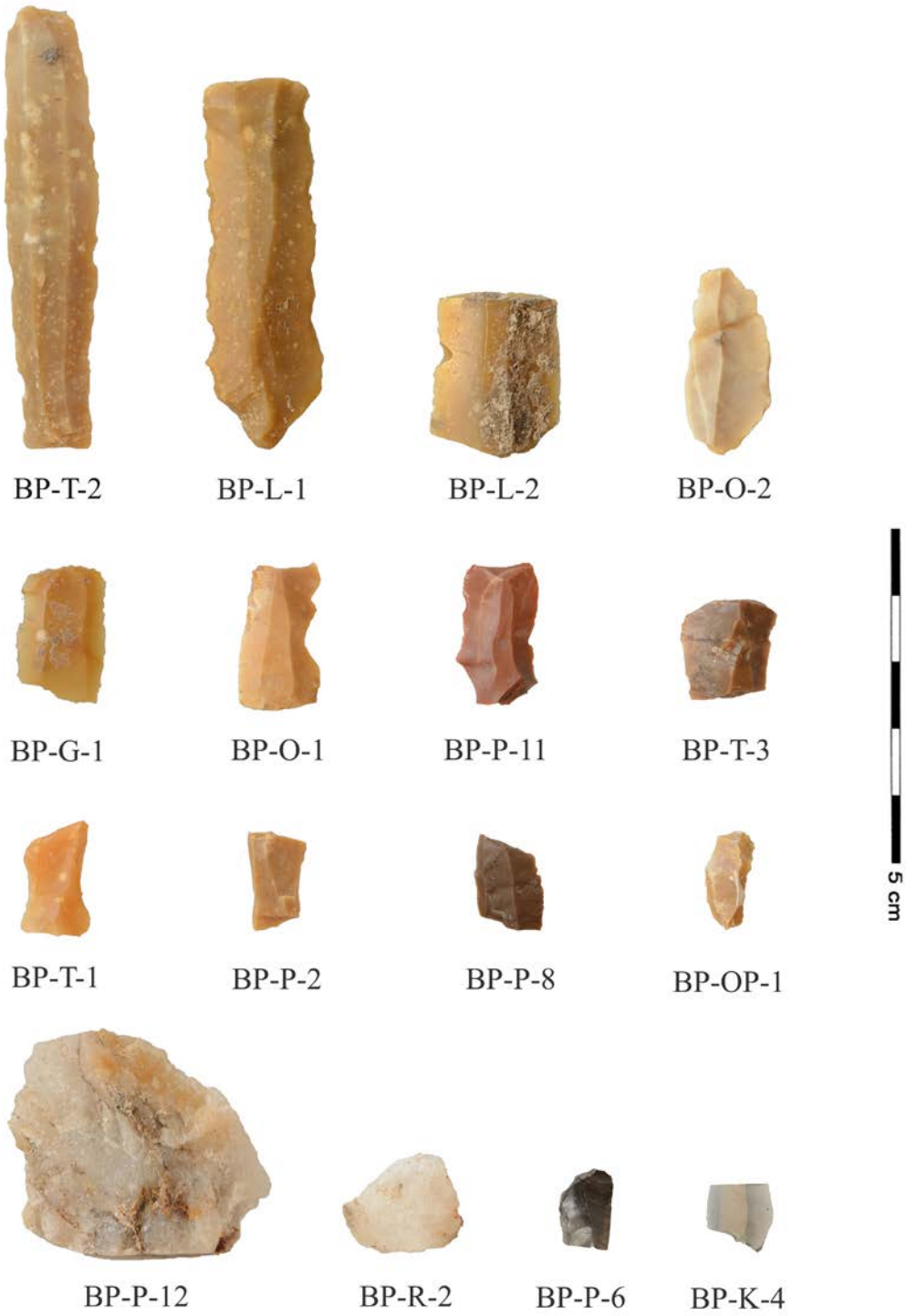
The study of chipped stone assemblage is the result of collaboration between the projects of Raiko Krauß (Tübingen) and Barbara Horejs (Vienna). Our analyses were carried out within the scope of the NEOTECH project – "Neolithic technological trajectories in the Balkans", financed by the Austrian Science Fund (FWF) (Project P32096), which we would like to acknowledge here. We are deeply grateful to Ernst Pernicka for sharing his results of the Neutron Activation Analyses made for the provenance of obsidian artefacts. We also wish to thank our colleagues Christoph Schwall and Mario Börner for their kind help with initial setting for the taking photos of finds.



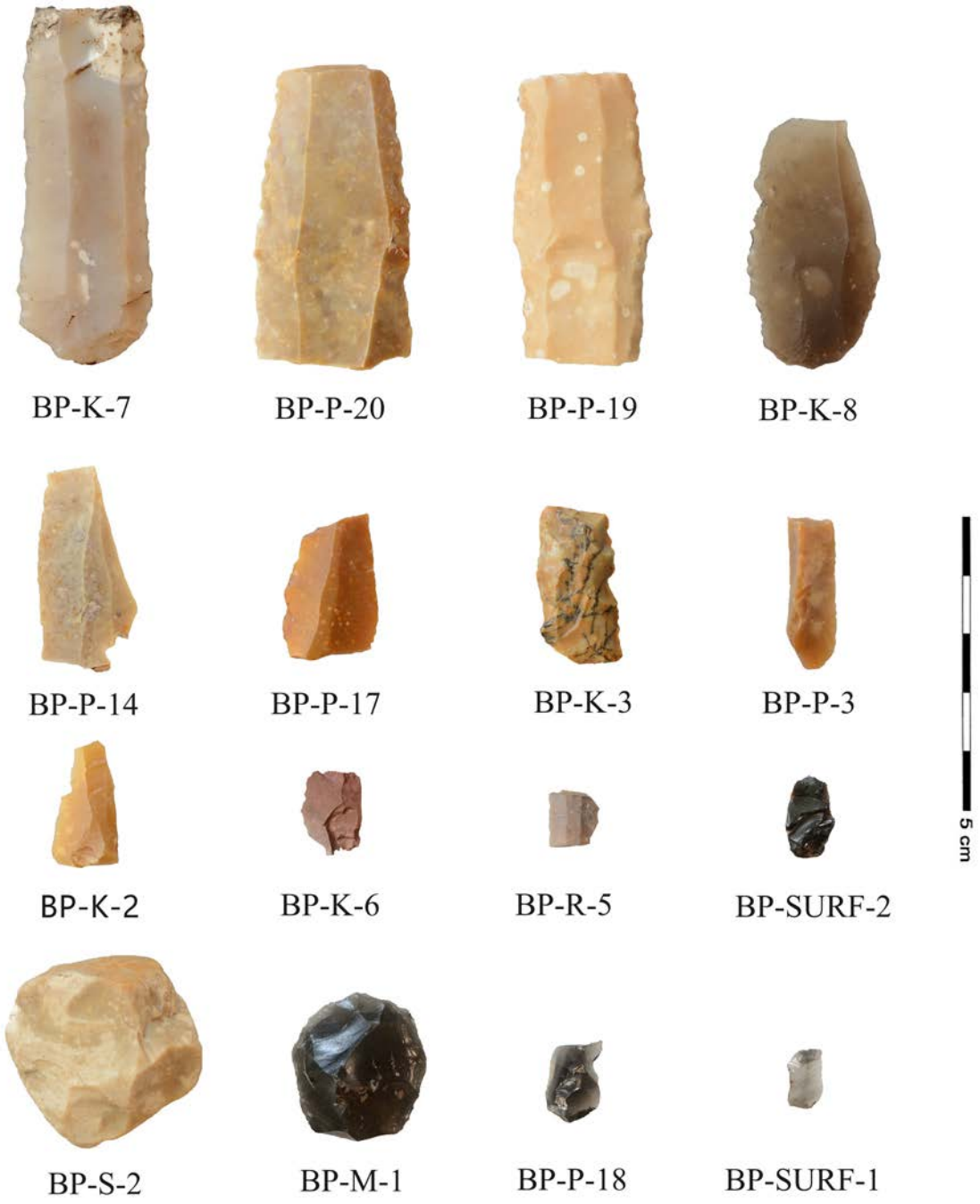
Pl. 1 Chipped stones from the Early Neolithic contexts at Bucova Pusta IV (drawings: B. Milić).



Pl. 2 Chipped stones from disturbed contexts at Bucova Pusta IV (drawings: B. Milić).



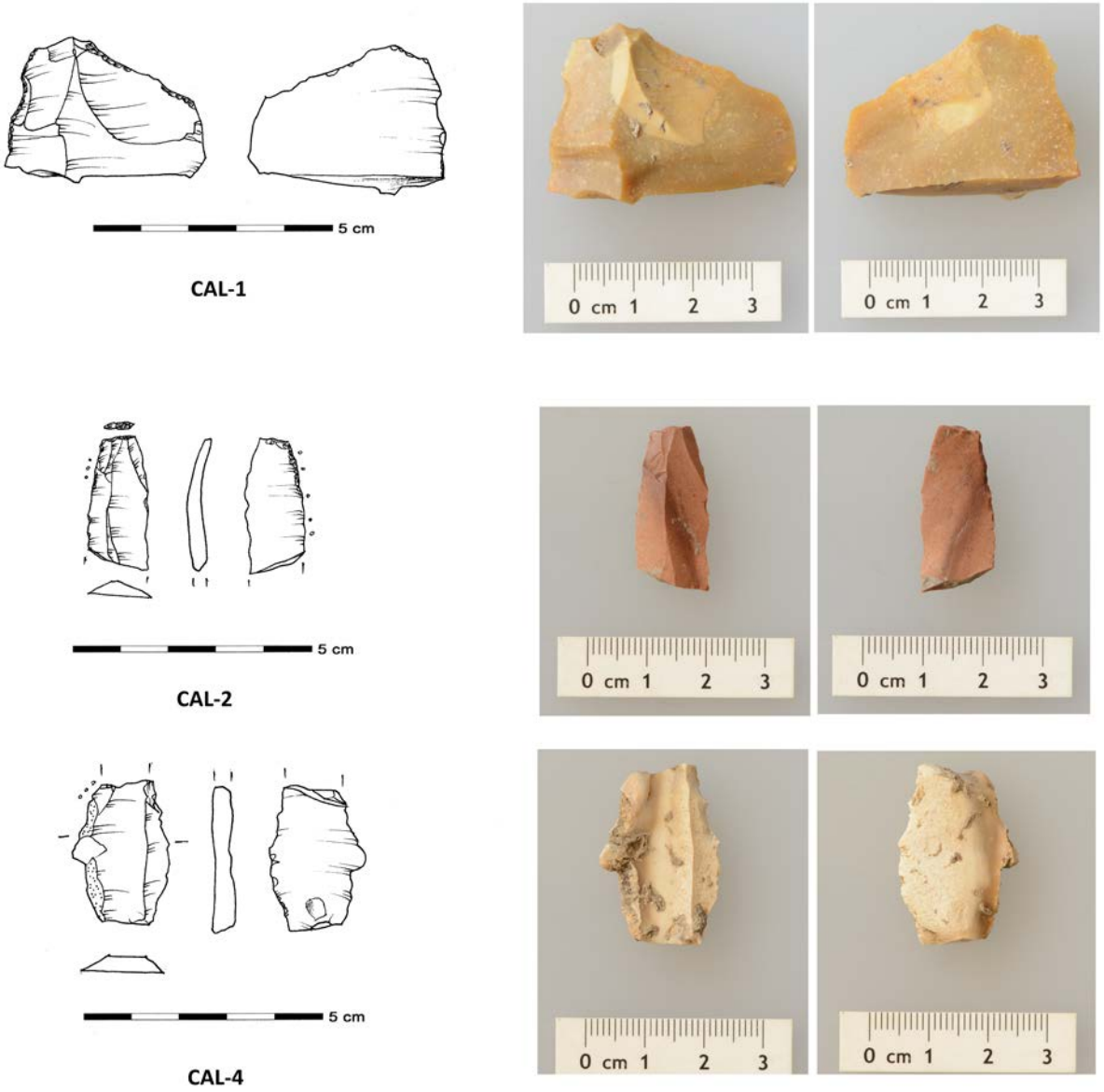
Pl. 3 *Chipped stones from the Early Neolithic levels of Bucova Pusta IV (photos: B. Milić).*



Pl. 4 Chipped stones from disturbed contexts of Bucova Pusta IV (photos: B. Milić).

Pl. 5 Chipped stones from the survey around Bucova Pusta IV (photos: B. Milić).

Pl. 6 Finds from Trench B of the site excavation in 2012 (photo: Bucova Pusta IV archive with modification).



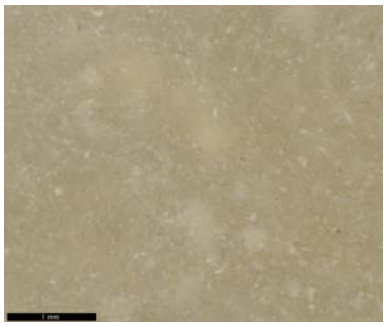
Pl. 7 The selection of chipped stone tools (retouched flake and two sickle blades) from the surface finds of the Kalcsov I survey (drawings&photos: B. Milić).

APPENDIX: Microphotographs of the chipped stone assemblage (Photos: M. Brandl)

Microphotographs were produced under standardised 40 times magnification and water immersion at unpolished rock surfaces using a Zeiss SteREO Discovery.V20 microscope coupled with an Axiocam 305 colour digital camera.

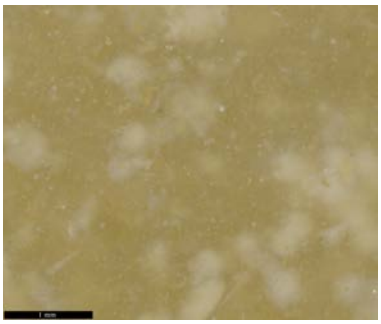
Bucova Pusta IV – Early Neolithic

"Balkan Flint"



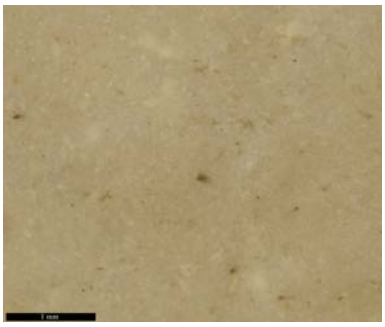
BP-I-1

"Balkan Flint"



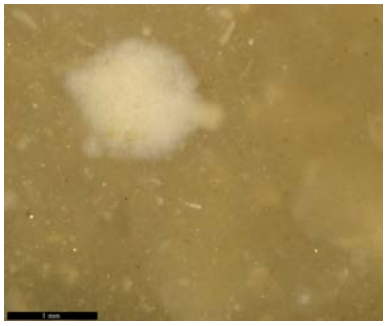
BP-L-2

"Balkan Flint"



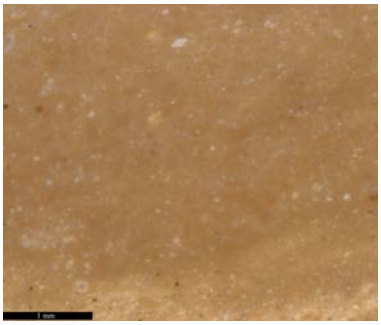
BP-O-1

"Balkan Flint"



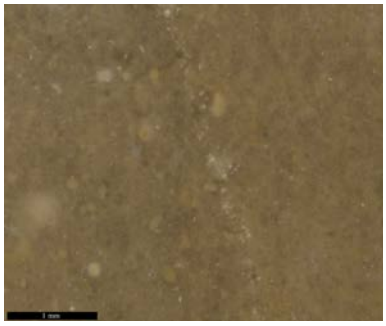
BP-T-1

Radiolarite (Carpathian)



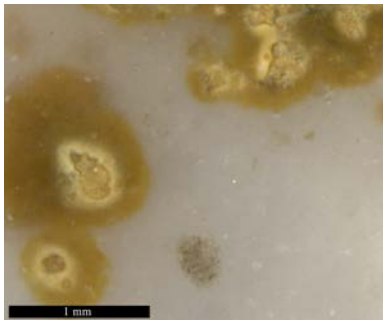
BP-O-1

Radiolarite (Transdanubian - Bakony)



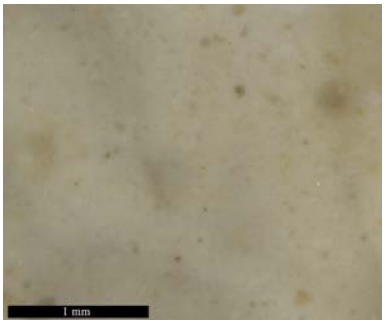
BP-T-1

Neogene Lacustrine Silicite (NLS)



BP-P-7

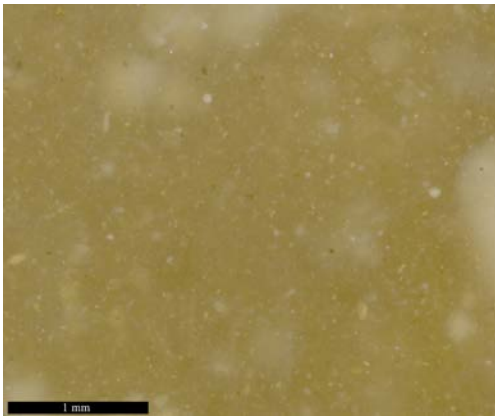
Chert, indeterminable



BP-O-2

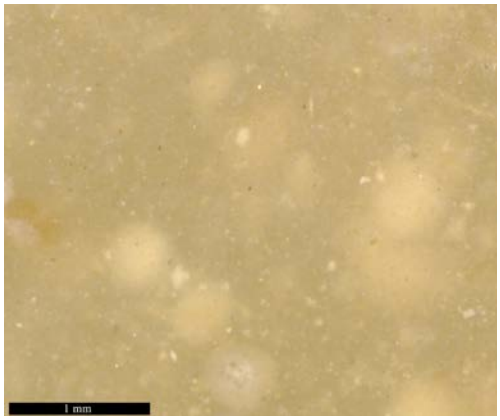
Bucova Pusta IV – Disturbed contexts

"Balkan Flint"



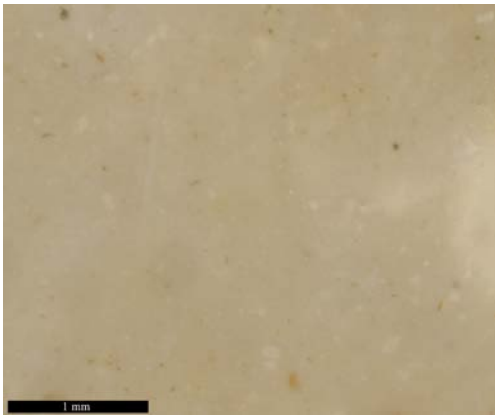
BP-K-2

"Balkan Flint"



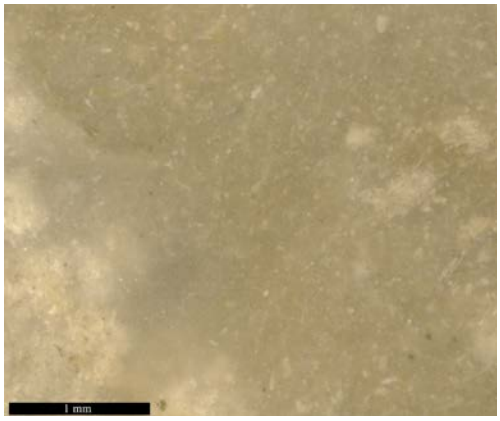
BP-P-17

"Balkan Flint"



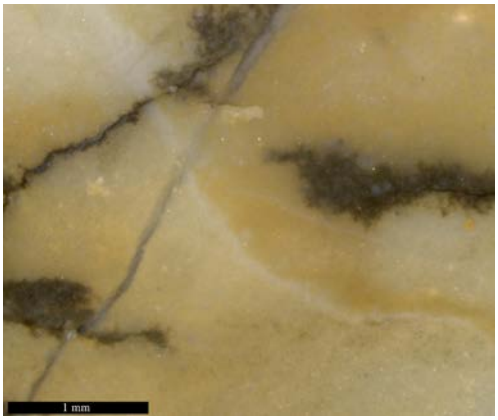
BP-P-19

"Balkan Flint"



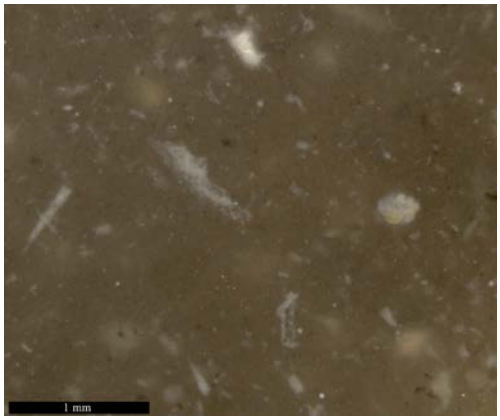
BP-S-2

"Central Banat Flint"



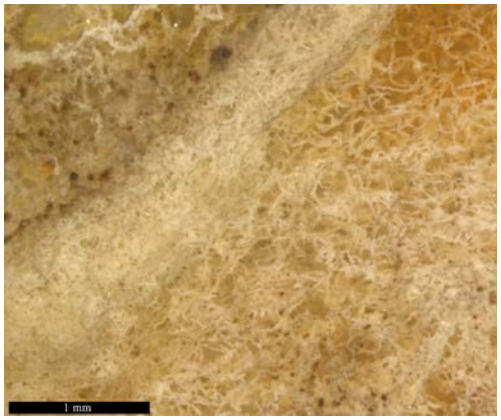
BP-K-3

Volhynian flint



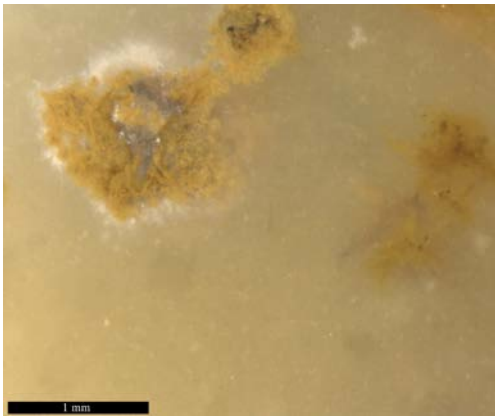
BP-K-8

Neogene Lacustrine Silicite (NLS)



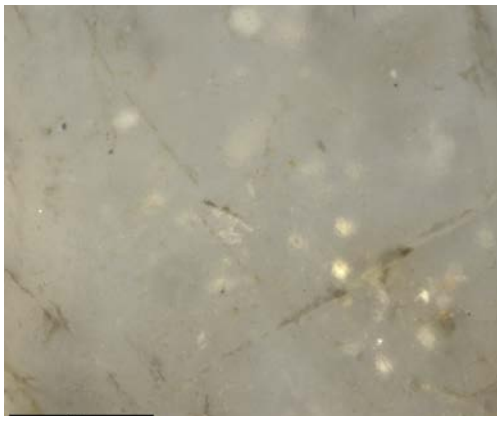
BP-K-1

Neogene Lacustrine Silicite (NLS)



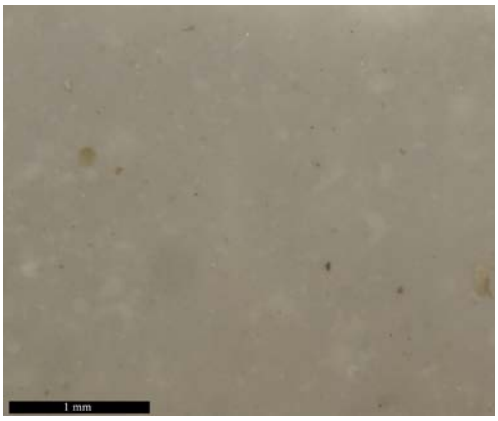
BP-R-1

Neogene Lacustrine Silicite (NLS)



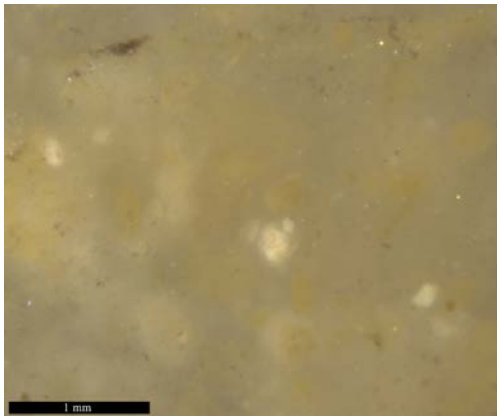
BP-P-15

High quality grey chert



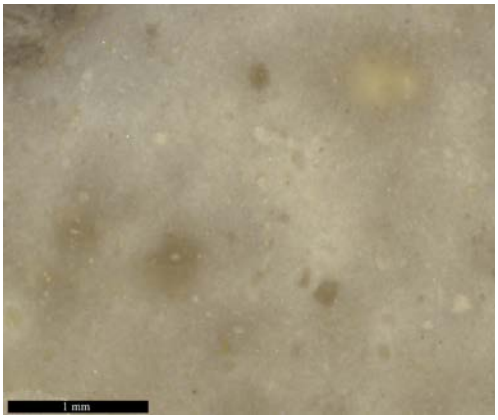
BP-K-7

Chert, indeterminable



BP-P-1

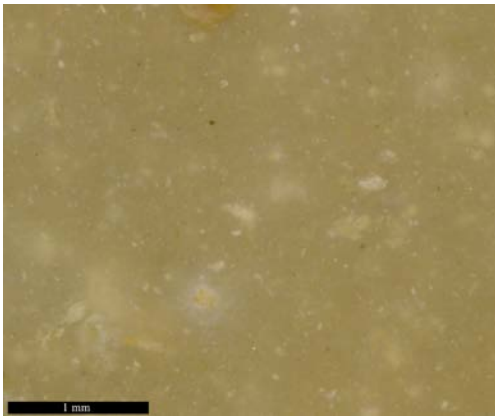
Chert, indeterminable



BP-P-4

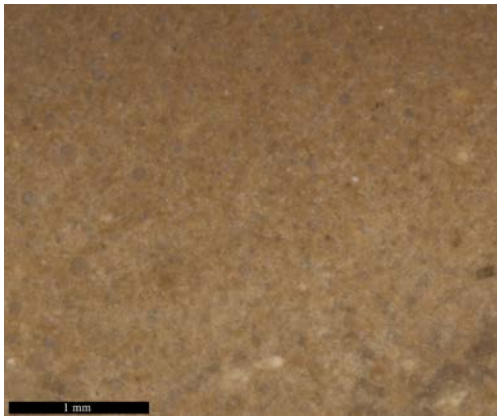
Kalcsov I

"Balkan Flint"



CAL-1

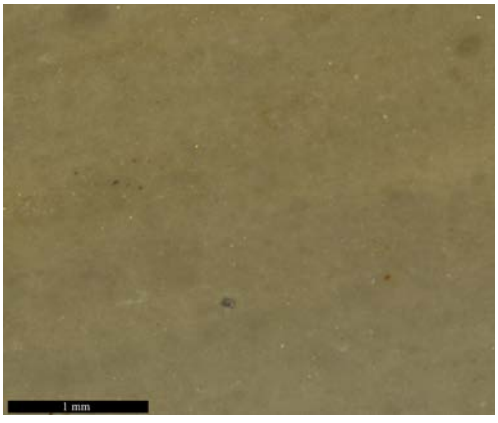
Radiolarite (possibly Mecsek)



CAL-2

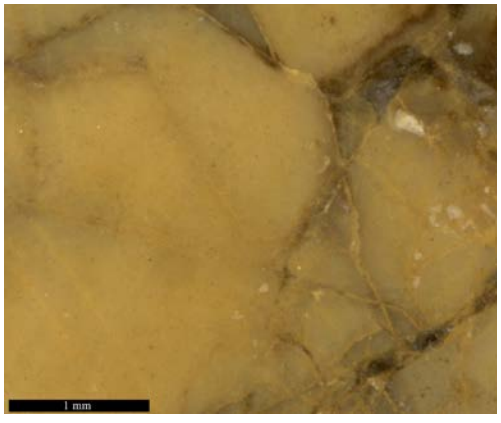
Survey material around Bucova Pusta IV

Radiolarite (possibly Mecsek)



BP-SURV-1

"Central Banat Flint"



BP-SURV-2

The ground stone tools from Bucova Pusta IV

Florian Klimscha

Introduction

The spread of the Neolithic way of life to Central Europe through the Linear Pottery Culture (LBK) is relatively well-researched. Especially in recent years, a number of projects have succeeded in harmonising the state of research on the emergence of the LBK (see, in particular, Jakucs et al. 2016; Krauß et al. 2020a; cf. older perspectives e.g. in: Bánffy 2000; Cladders/Stäuble 2003; Neugebauer-Maresch/Lenneis 2013; Stäuble 1995). Nonetheless, while the distribution of the LBK can casually be connected to that of Vinča A (cf. inter alia: Krauß et al. 2020b), even in recent work, it is difficult to connect the LBK to its possible origins in south-eastern Central Europe (Windler 2018), that has recently also been confirmed from the point of view of absolute dating (Weninger 2020). While the westward spread of the LBK now presents itself as a migration of human groups in the light of strontium isotopy and paleogenetic studies (Bentley et al. 2002; Bentley et al. 2003; Bramanti et al. 2009; Haak et al. 2005; Haak et al. 2010; Deguilloux et al. 2012)[1], clearly distinguishable neolithisation scenarios are reconstructed for the Eastern Linear Pottery Culture, also known as Alföld LBK (Kozłowski et al. 2003; Kozłowski/Raczky 2010; Kalicz/Koós 2002). Stone artefacts provide an opportunity to discuss the relationship between these two groups (Tillmann 1993)[2], particularly as the potential of polished stone axes has not yet been fully exhausted (cf. in detail the explanations in Ramminger 2007). The axe blades of early Neolithic groups in south-eastern Europe, in any case, can only be cited as exemplary to a limited extent (Klimscha 2014). In particular, the D-shaped cross-section of these axe blades is remarkable (Kalicz/Makkay 1977, 56–57). This can only be identified in isolated cases in older Neolithic groups, and is also known from Mesolithic contexts, albeit only in northern regions yet (Salomonsson 1958, 38 Fig. 6)[3].

1 However, there are still considerable uncertainties, especially about the mode and consequences. Cf. Hofmann 2015; Hofmann 2016. Cf. also Stäuble/Wolfram 2013, who discuss the coexistence of both groups.

2 Significant work has been done by Gronenborn 1997 and Mateiciucová 2008.

3 Although the dating and typology of these so-called round axes remains a major desideratum of research, there are indications that render such a derivation possible. On the one hand, the association with a pre-Bandkeramik radiocarbon date has been postulated for an asymmetrical axe blade with a D-shaped cross-section from the Schletau site (Breest 1988; Breest/Veil 2001); on the other hand, an even older axe blade with a flat, asymmetrical cross-section is available from Hermitage Island (Little et al. 2017).

Address	N=
Axe blade fragment	12
Possible axe blade- or pestle fragment	9
Undetermined	4
Crushing stone	2
Smoothing stone	1
Pestle	2
Axe blade	2

Tab. 1 Overview of the classification of the ground stone artefacts from Bucova Pusta IV (n=32).

Colour	N=
White	4
Grey-light grey	2
Grey	4
Light grey-white	5
Light grey-brown	1
Greenish	1
Light grey	2

Tab. 2 Overview of the colours of the ground stone artefacts from Bucova Pusta IV (n=19).

Longest dimension	N=
<9 cm	2
<8 cm	3
<7 cm	3
<6 cm	4
<5 cm	6
<4 cm	5
<3 cm	7

Tab. 3 Overview of the longest dimensions of Bucova Pusta IV cut stone devices (n=30).

Thus, interdisciplinary research at this prehistoric site not only provides an important basis, but will also provide new data for supra-regional questions in the long term.

The finds: type specimens

A total of 34 finds from the excavations were available for processing. One of these could be identified as unworked, while assignment remains uncertain for another example; two fragments of a pestle could also be matched together. Thus, a total of 32 objects were included in the find processing. With two complete pieces and 12 fragments (as well as some new possible fragments), axe blades make up the largest share of the finds. Additionally, there are a few crushing and polishing stones, two pestles, and four indeterminate fragments, which, however, evidence traces of processing (Tab. 1). The small number of fragments means that detailed statistical studies are not very useful, and the very small proportion of complete artefacts does not permit any typological or typometric classification attempts.

The raw material was determined on site; most of the objects defy any more precise classification. The rocks determined were basalt, andesite, quartz, granite or pegmatite, gabbro, amphibolite or feldspar, and "silicoid". The quartz displayed no traces of processing. The finds range in a very uniform colour spectrum, varying between white, light grey to grey, and light brown to grey. One greenish piece, the butt of an axe blade, was determined as gabbro, which falls outside of the spectrum (Tab. 2). There is an elongated small block of a fine crystalline white rock that has already been cut but not polished, which possibly shows the form in which the raw material arrived at the settlement (Fig. 2,1). Apart from that, however, there are no signs of the axes being made on site.

The many fragments in the find material are striking. 18 pieces have a longest edge of 3.1–5.0 cm, only ten pieces have a longest edge of 5.1–8.0 cm. Only two objects are longer than 8.0 cm (Tab. 3).

Determination stone axe fragment	N=
Fragment, undetermined	2
Narrow side fragment	1
Medial fragment	1
Broadside fragment	6
Cutting edge fragment	2
Butt fragment	7
Complete	2

Tab. 4 Overview of the classification of the stone axe fragments from Bucova Pusta IV (n=21).

Discussion of typologically significant pieces

There are several pieces in the find material which return us to the question posed at the beginning of this chapter. These are the two complete axe blades (no. 31, 32), as well as five further fragments with D-shaped cross-sections. Comparable pieces are frequently documented from sites in the Balkan region of a similar age[4].

Find no. 31 can be identified as a reworked cutting edge fragment because both the asymmetrical, sloping cutting edge shape (See Klimscha 2016, 83, Fig. 80 with examples) in plan view and a 2–3 mm wide bar on one narrow side indicate that this piece was fashioned from a fragment of a larger axe blade. The ridge is the result of a modification of an irregular break edge, while the other narrow side remains from the creation of the original axe. Find no. 32 is also heavily modified; it may well originate from a butt or cutting edge fragment. The cross-section is relatively flat. The axe could no longer be used because the cutting edge had become dull.

4 E.g.: Klimscha 2014, 187 Figs. 120, 188 („small chisel-like axes with oval cross-section"); Klimscha 2016, 109 („Form F3. Ground small axes with D-shaped cross-section) with further references from the Chalcolithic.

Hatchet fragment no. 5 (Fig. 1,4) was originally part of a cutting edge; it now has a flat D-shaped cross-section; the cross-section of another fragment (no. 7) cannot be clearly determined, but must originally have been oval or D-shaped. The piece is a broadside fragment. A butt fragment with an undamaged butt (no. 8) also has a flat D-shaped cross-section (Fig. 1,3). Another butt fragment (no. 26) cannot be clearly determined either, and the cross-section may have originally been both oval and D-shaped. A last piece cannot be unequivocally interpreted as an axe, but does possess a suggestive D-shaped cross-section. All of these pieces are shorter than 5 cm, and it may be at these dimensions prehistoric tool users stopped recycling their axe blades.

Most of the finds (n=21) of the ensemble are objects that can be addressed as parts of axes, or where at least an attribution to an axe blade would be a probable reconstruction (Tab. 4). What is striking is not only the high proportion of fragments which can still be identified as stone axes, but also the clear predominance of broadside and butt fragments. The large amount of butt fragments fits well into the reduction schemes of known sites in the region, where a regular recycling of axe blade fragments into smaller axes very often took place. Although every larger axe blade fragment could be reworked into a new axe blade in principle (Klimscha 2016, 79–91), and this factor can explain the very diverse morphology of the pieces very well, butt fragments were particularly well suited for this because these often permitted use of the previous hafting, necessitating only the creation of a new cutting edge (Klimscha 2016, 80f., 81 Fig. 76–77). In general, the large amount of work required for grinding seems to have been decisive in not disposing of these pieces, but rather continuing to use them as tools through small repairs. Butt fragments were therefore provided with a new cutting

edge as often as possible, and only disposed of when they became too small for hafting (Klimscha 2016, 81 Fig. 77), at which point they entered the archaeological record. It should be noted, of course, that these may also be butt fragments of axe blades originally fashioned from other axe fragments.

Nonetheless, why there are almost as many broadside fragments in Bucova Pusta IV cannot be immediately clarified by these explanations. The fact that broadside fragments can be easily identified on the basis of the cut on one side, and thus also recognised as parts of axe blades during excavation, is probably also illustrative here. If one adds the one narrow side fragment and the medial fragment in question, then this group of finds could have emerged from its constituents' relative ease of recognition. However, the two complete axe blades demonstrate that modifications from other axe blade fragments also occurred at Bucova Pusta IV, and thus that the inventory fits well into known Neolithic and Chalcolithic spectra (Klimscha 2016, 67f.).

Grinding stones

Another category of worked stones are the grinders (Fig. 3). They are necessary to make stone axes, but were very probably mainly used to mill the cereal grain in the settlement (see Chapter 16). Similar to the stone axes, there are not very many of them and the few pieces are also heavily fragmented. Here, too, the general lack of stones in the region is reflected. Apparently, the grinding stones were used until they were completely worn out and later reused secondarily, for example as hammer stones, beating pads or numerous other activities. The characteristic rubbing surfaces were found on a total of 53 stones. The raw material used seems to be very different. Apparently, all kinds of materials that were available in the wider surroundings of the settlement were used indiscriminately.

Conclusions

Unfortunately, the small amount of finds from excavations as of yet only permits the drawing of limited conclusions. It should be noted, however, that the cross-sections of the axe blades, which have already been identified for other sites, could certainly be cited as models for the LBK stone axes (cf. Klimscha 2014 with further literature). To be mentioned in this regard is the LBK settlement at Glăvănești Vechi, from which a similar piece hails (Comșa 1959, Taf. I,8).

These findings are constrained by the small sample, and the fact that the axes in Bucova Pusta IV were subject to intensive reduction, in which fragments were repeatedly reworked into smaller axes. In particular, the fact that the two "complete" axe blades can be identified as former cutting edge fragments is problematic, inasmuch as the most frequently reworked part of the axe blades served as the basic form. Regular reworking of the cutting edge leads to asymmetry longitudinally and in its cross-section (Klimscha 2016, 67f.), which, in turn, results in a flat, D-shaped cross-section.

Possible influences on the design of LBK stone axes can, therefore, only be suggested to a very limited extent at the present state of knowledge.

	Find number / Illustraition	Context	Description	Length (cm)	Width (cm)	Thickness (cm)
1	BP2013/01/516	Feature D1	Stone axe fragment, trapezoidal outline. Reground at the fracture edges. White basalt.	2.2	6.3	2.4
2	BP2014	Feature K17; Measurement No. 5949	Stone chipping. Narrow side fragment of a stone axe blade. Slightly curved and without hammer marks, therefore probably not a former butt. Former cross-section probably sub-rectangular. Rock, indeterminate. Grey-light grey.	3.6	2.4	1.0
3	BP2013/ G-H1/51 Fig. 1,6	Feature G-H1; Measurement No. 10193; DNr 428	Fragment of a stone object with chipped surface. Fracture edges partly smoothed. Surface ground. It could be the medial fragment of an axe blade with oval cross-section. Rock, indeterminate. Grey.	6.3	6.0	2.4
4	BP2012/09/56 Fig. 1,2	Feature B9	Stone chipping with a ground dorsal side. Broadside fragment of a ground axe blade. Rock, indeterminate. Light grey-white.	3.7	2.1	0.5
5	BP2015 Fig. 1,4	Feature O3; Measurement No. 77; DNr 347	Fragment of a stone axe blade. Blade fragment with undamaged, circular in outline, asymmetrical in longitudinal section. Flat D-shaped cross-section. Surface very cleanly and smoothly ground; scratch marks along the track. Fracture edge unworked; the axe is broken across the track. Rock, indeterminate. White.	2.4	1.3	0.1
6		Feature P3; Measurement No. 1478	Stone chip with polished dorsal side. On the dorsal side there is a shallow furrow. Rock, indeterminate. Light grey-brown.	2.3	1.4	0.2
7		Feature R15; Measurement No. 2538	Stone cutting with one ground side. Broadside fragment of a ground stone axe blade. Cross-section must originally have been oval or D-shaped.	4.8	2.1	1.1
8	BP2012/B9/58 Fig. 1,3	Feature B9; DNr 49	Fragment of a stone axe blade. Butt fragment with undamaged butt. Butt sawn and straight. Surface ground, in one place where there is a small depression, clearly less clean. Cross-section flat D-shaped. Scratch marks on the lower and upper broadside diagonally. Fracture across the track.	3.9	4.4	1.8
9		Surface find	Quartz rubble without machining marks.	-	-	-
10	BP2013/C/518	Trench C	Heavily damaged fragment of a formerly spherical stone with a polished surface. Possibly used as a crushing stone. Rock, determined as andesite.	8.2	6.8	3.8
11	BP2013/ G-H1/54	Feature H1; Measurement No. 9911	Stone chipping. Surface fragment of a stone axe blade; trapezoidal in outline, and therefore probably to be assigned to the butt. Scratch marks parallel to the track.	2.1	1.9	0.9

	Find number / Illustraition	Context	Description	Length (cm)	Width (cm)	Thickness (cm)
12	BP2015	Feature S19; Measurement No. 5466	Quartz pebble with ground surface. Pebble with a high D-shaped cross-section used as a smoothing stone.	5.6	2.7	2.8
13	BP2014/L3/310 Fig. 1,5	Feature L3; DNr 427	Axe blade fragment. Butt fragment of a ground stone axe. Surface pecked, then smoothed, ground over on one narrow side, diagonal scratch marks there.	5.8	4.1	2.1
14	BP2015	Feature P3; Measurement No. 2865	Stone chipping.	-	-	-
15	BP2015	Feature Q7; Measurement No. 212	Fragment of a stone implement, smoothed on the surfaces. Originally probably angular cross-section.	6.5	6.9	5.2
16	BP2015	Feature T4¸ FPL 2; Measurement No. 6093	Fragment of a stone with smoothed surface. Artefact character. Unclear.	4.9	4.7	3.5
17	BP2013/H9/5-13	Feature G-H9; from the Profile; Measurement No. 9399	Crushing stone, damaged. One narrow side, chipped on about a quarter-third of the object. Surface polished. Outline oval. Cross section oval. Rock, determined as granite or pegmatite.	5.3	5.0	3.9
18	BP2015	Feature P3; Measurement No. 458	Flat damaged stone which could possibly be the rolled fragment of an axe edge or a pestle. Rock, unknown.	2.1	2.0	0.4
19	BP2013/G7/511	Feature G7; Measurement No. 10376	In outline semicircular, in cross-section D-shaped fragment of a stone artefact.	2.6	5.1	1.8
20	BP2014	Feature I2; Measurement No. 122	Fragment of a stone axe. Butt fragment; surface not preserved on one broad side, broken off across the track. Butt rounded in outline, thin in longitudinal section. The cross-section of the piece is flat pointed oval (approximately "lenticular"). Greenish rock, probably gabbro.	3.1	2.7	1.0
21	BP2015	Surface find	Stone fragment, one broadside ground. Unclear whether it is the broadside splinter of an axe blade or a pestle. Rock, indeterminate. Light grey.	4.8	3.0	0.7
22	BP2014	Feature K6	Stone chipping with a ground broadside. It could be the broadside fragment of an axe blade or a pestle. Rock, indeterminate. Light grey.	2.4	1.7	0.4
23	BP2013	Feature H8; Measurement No. 8473	Small fragment with a ground (?) side. Possibly a fragment of an axe blade. Rock, indeterminate. Grey, slightly reddish in fracture.	2.2	1.8	0.7
24	BP2015	Feature S13¸ P.PI. 1; Measurement No. 5747	Stone chipping with a ground ventral side. Broadside fragment of a ground axe blade or pestle. Rock, light grey-white.	2.6	2.7	0.4

	Find number / Illustraition	Context	Description	Length (cm)	Width (cm)	Thickness (cm)
25	BP2015	Feature P3	Stone chipping with a ground ventral side. Broadside fragment of a ground axe blade or pestle. Rock, light grey-white.	3.1	1.2	0.2
26	BP2013/49/53	Feature H9	Fragment of an axe blade. Butt fragment. Surface heavily sintered, ground underneath. Butt straight. Cross-section originally probably oval or D-shaped. Rock, indeterminate. Grey.	4.7	2.8	2.3
27	BP2013/E1/59 Fig. 1,7	Feature E1; Measurement No. 204; DNr 50	Fragment of an axe blade. Butt fragment. Surface very smoothly polished, diagonal scratch marks on the lower broadside. Butt damaged by two conchoidal fractures, originally probably pointed. Rock, indeterminate. Light grey.	3.9	2.2	1.5
28	BP2013/ G10/516 Fig. 2,2	Feature G10; Level 1; Measurement No. 9594; DNr 426	Pestle/smoothing stone. Elongated basic form, rounded on both sides. Square cross-section. Surface damaged on one side, otherwise very cleanly ground. One side of the head shows two larger (approx. 1 cm in length) hollows, which should have been created by hammering. Two of the sides are absolutely flat and could have been used as smoothing tools. Rock, unknown, whitish-light grey.	7.3	3.3	3.7
29	BP2013	Features S4 and 13; FPL-1; Measurement No. 5889 and 8432	Two fragments of a stone tool (pestle?). The smaller fragment comes from Feature 13, the larger from Feature 4. Surface smoothed, not preserved in large parts. One rounded edge, and one relatively flat broadside. Rock, unknown. Whitish.	8.1	4.3	4.2
30	BP2014/K12 Fig. 1,1	Feature K12; Measurement No. 8233; DNr 425	Axe blade. Slightly trapezoidal in outline. Straight, slightly convex butt, thicker in longitudinal section. Surface sintered, ground underneath, scratch marks on the lower broadside diagonally, on the cutting edge across, on the narrow sides and the butt parallel. One narrow side damaged towards the butt. Cutting edge asymmetrical, semicircular, damaged at one corner, and therefore ending more steeply. Rock, determined as amphibolite or feldspar. Grey.	6.7	2.7	1.3

	Find number / Illustraition	Context	Description	Length (cm)	Width (cm)	Thickness (cm)
31	BP2013/E1/39	Feature G6; Sq A4; Measurement No. 5999	Axe blade. Slightly trapezoidal I n outline, the butt broken off. Surface damaged in some places by previous cracks, otherwise cleanly polished over. Flat D-shaped cross-section. Cutting edge oblique. One narrow side consists only of a 2-3 mm wide ridge. Based on this narrow side and the shape of the cutting edge, it is probably a cutting splinter that was reworked into a smaller axe. Rock, unknown, described as silicoid. Whitish-very light grey.	4.3	2.2	1.2
32	BP2015	Feature R8; Measurement No. 1594	Fragment of a stone implement, probably an axe blade. Surface damaged in various places, in one place completely straight broken (possibly sawn). Cross-section originally probably flat D-shaped. Probably either a cutting edge fragment with a heavily worn, now blunt edge or a butt fragment. Rock, indeterminate. White.	7.8	3.3	2.6

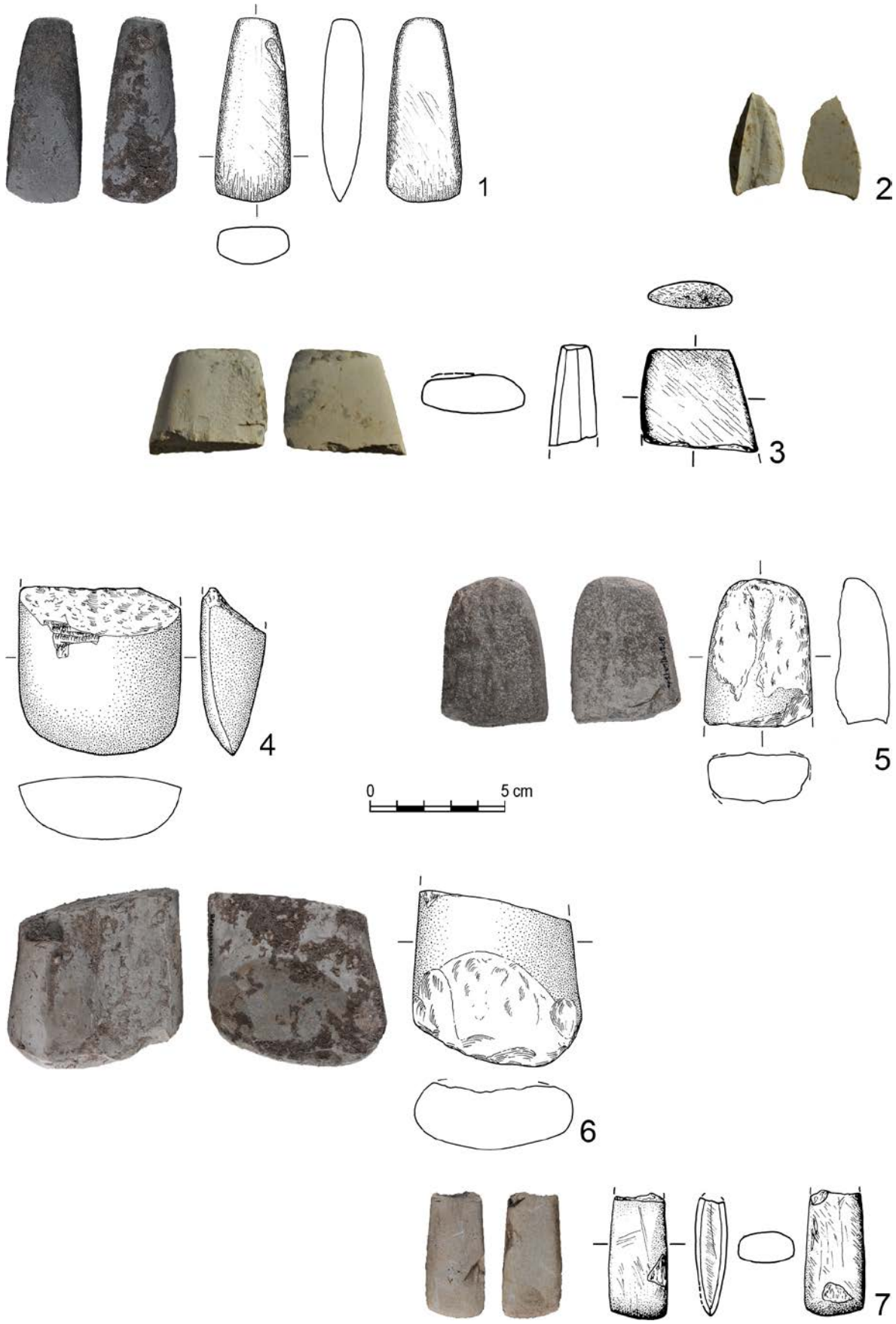


Fig. 1 Early Neolithic stone axes and fragments of such from Bucova Pusta IV.

Fig. 2 Portioned stone, possibly a blank for a stone axe (1) and a stone pestil (2) from Bucova Pusta IV.

Fig. 3 Grinding stone fragments from Bucova Pusta IV.

Chapter 14

Between two worlds: Early Neolithic bone and antler artefacts from Bucova Pusta IV

Petar Zidarov

Fifty-four objects made of modified animal bone, antler, or teeth were recovered during the excavations at Bucova Pusta IV between 2010–2015. These originate from various locations at the site roughly dating to the Early Neolithic (ca. 5750-5650 calBC) occupation levels at the site (see Chapter 7). Thus, they may reflect different occupation episodes and unrelated activities, but by necessity will be treated as a homogenous assemblage, and as representative for the place and the period. As expected, one could recognise various types of bone awls, spoons, spatulas, and bevel-edged tools, but also ornamental pieces such as pins, discoid beads, rings, and off-cuts from their production. Among them, a single projectile and a massive shaft-hole object made of red deer antler stand out as rarities, and are possibly even reminiscent of local Mesolithic traditions.

The main recovery method during the excavations was the hand-picking of bones and finds, complemented by targeted flotation of special features of interest. The fact that objects smaller than 10 x 2 mm and weighing less than a gram (awl tips and pin segments) were systematically recovered, while all animal remains were also meticulously checked by the archaeozoologist Bea de Cupere attests for the representative character of the collection.

1. Raw material selection

The amount of modified skeletal remains (n=54) is just a tiny fraction (4 %) of the total number of mammal skeletal parts identified at the site (n=1201) (Krauss et al. 2018a, 164 tab. 9.2).[1] Yet, the taxonomic distribution of the identified species is at odds with the consumption units, demonstrating patterns of deliberate selection of certain species and their body parts. For example, the skeletal remains of sheep and goat among the studied faunal remains are twice as numerous (66 %) as those of the cattle (28 %), whereas cattle bones were preferred almost three times (59 %) more often for the manufacture of objects than those of the small ruminants (22 %). The wild animals are likewise considerably better represented among the worked bones, with cervid (red and roe deer) remains making up to 15 % of all worked bones compared to their insignificant 3 % share among the consumption units, and the wild boar being on the average twice as often sourced for its bones and teeth (4 %) than would be expected from its average contribution to the menu.

1 This figure excludes identified intrusive rodent bones, as well as remains from birds, reptiles, amphibians, fish, and invertebrates. Cf. also Chapter 15 in this volume.

In both cases, the deer antlers which could be collected when shed in the forest during springtime regardless of individuals' actual hunting prowess, or the boar tusks which may be exchanged separately from the meat, make a rather limited contribution, and do not impact upon the general picture.

2. Technological sophistication

Most of the objects are finished products, quite often evidencing signs of extended exploitation and curation, leading not only to the obliteration of most manufacturing traces, but also to considerable modification of the original size and shape of the objects, as best illustrated by the remains of spoons, pins, and rings. This specific exploitation pattern often hinders the reconstruction of the chaîne opératoire from direct observation, necessitating interpolation by analogy of ethnographic and experimental observations. There are, however, a few fortunate findings of unfinished blanks and off-cuts from the production of spoons and possibly rings which deserve greater attention not only as an indication of the local production of these objects, but also to serve as a frame of reference for following studies.

In general, some of the characteristic elements of the so-called Anatolian Neolithic package such as metapodial awls produced by extensive grinding, the beveled spatulas made of sheep tibiae, the decorative bone hooks, and the pronged finger-rings (Sidéra 2010; Russell 2016), as well as the sickle handles made of antler popular across Bulgaria (Zidarov 2014; Gurova 2016b) are lacking at Bucova Pusta IV. Only the bone spoons remind of the typical hallmarks of the Anatolian bone-working tradition, yet these are so extensively re-worked that were it not for the identification of possibly unfinished examples, one could assume that they were imported from elsewhere, or represent transgenerational heirlooms brought by the first settlers, and passed down in families (Choyke 2006). This does not mean that the local craftsmen of the Neolithic Banat were helpless or lacked skill and know-how. On the contrary, the flat disc (Pl. 5.1) interpreted as a by-product from a perforation with a tubular drill/reed stalk (for production of beads or rings?), as well as the off-cuts from the production of rings or tubes by transversal segmentation of cattle long bones by friction with a wet sandy string (Pl. 4.1–2,4) demonstrate ingenuous adaptation to the local ecological conditions, and the general dearth of suitable lithic resources for the production of the typical toolkits.

3. Typological and functional diversity

Awls – three main types of bone awls could be identified:

Small metapodial points – three pointed tools (Pl. 1.6,9,12) are made of small ruminant metapodials split lengthwise in two, and retaining half of their epiphyses as anatomical grips. The first example retained the proximal epiphysis, while the other two retained their distal epiphyses. The epiphyses of the latter are not yet fused, meaning that they were sourced from very young animals (less than 2 years old), providing a good match for the profile observed for typical age at death among the faunal remains from the site (Krauss et al. 2018a and Chapter 15), the latter being consistent with primary interest in sheep and goat as providers of meat.

Splinter points – a few more pointed tools are similarly made of split metapodials of small ruminants, but they lack their epiphyses. Typically, the basal parts were minimally tapered and rounded to provide a better

grip for the fingers (Pl. 1.1,11), but, in some cases, they are obliquely broken, and their edges are left sharp (Pl. 1.3,13), leaving some doubt as to the deliberate acquisition of this design.

Flat rib points – a few flat points were made of split and ground cattle ribs (Pl. 1.2, 4, 8, 14, 2.24). Some are wide and symmetrical (1.2), others are narrow and curved (1.4, 1.8), while there are also just sharp and narrow tips from shouldered rib awls (1.4).

Regardless of their typological traits, the various types of bone awls could have similar or different uses. The definitive factor determining their function is the shape and the size of the working ends.

Robust points – one could easily distinguish some wide and robust asymmetric tips such as those of Pl. 1.3,6 or Pl. 1.15 which are reminiscent of the most robust example (Pl. 1.7) considered a likely projectile head. Their tips are wide and curved, and, if forced as perforators through any membrane like a leather or hide, would leave a broad slit which would not easily close; one could thus use these tools to pass a string while sewing, in basketry and wickerwork, or in untying rope and nots.

Fine points – on the contrary, the smaller metapodial points with distal epiphyses, as well as the finer splinter points have such delicate and sharp tips that they could rarely survive intact. Their tips are less than 1 mm wide when measured at 5 mm away from the distal end, and have a round cross-section, thus efficiently corresponding to the size of a medium-sized syringe at the tip. These parameters would render them practically inefficient against any contact material more resistant than linen cloth, very fine leather, or skin. Moreover, when such thin round tips perforate a membrane, the hole closes upon their withdrawal without leaving a trace. That is why the needles used for sewing garments or wounds have a comparable size and cross-section. Furthermore, these fine tips are characterised by (a) black discoloration running 5–10 mm from the tip, (b) handling polish over the entire surface, and (c) repetitive resharpening until they could no longer be held efficiently between the tips of the fingers. Such use-wear patterns, in my opinion, correspond rather well with their possible use as tattooing needles. It would be interesting to find out whether the black discoloration of the tips is actually due to deliberate exposure to a burning flame for hardening and disinfection or is a residue of sooth (and accidentally sweat) which was typically used as the chief traditional tattooing pigment in the Western Balkans (Croatia) well into 20th century (Krutak 2017), and which could have permeated the porous structure of the bone.

The flat and narrow rib points are comparably thinner and more fragile than the former, but somewhat broader than the latter, effectively occupying an intermediate size, and thus presenting arbitrary choices for use in differing contexts, most likely for weaving baskets and finishing bark containers.

Spatula

Among the highlights of the collection from Bucova Pusta IV is a large spatula made of cattle rib, painstakingly reconstructed from minute fragments (Pl. 3.1). The rib retained much of its volume throughout most of its length, and it served as a comfortable grip. Only the distal end is split, retaining only one of the compact plates, its edge modified into a broad oval. The edge is flattish and sharp, polished on both surfaces from intense contact with soft and yielding material. Thus, it was most likely used to burnish leather or hide, or even in pottery production.

Bevel-edged tools

A broken working edge of a bevel-edged tool (Pl. 2.6) was recovered. It ends in a straight and sharp perpendicular edge. Both surfaces are ground almost flat, and its entire volume is characterised by a pale brown hue, possibly a result of controlled heating at lower temperatures or permeation of tannins in a moist humic (?) environment (either taphonomic or while in use). Its frontal edge displays signs of chipping damages which were curated until the lateral edge broke, leaving it dysfunctional beyond repair. This demonstrates a repetitive use against a comparably resistant contact surface, the carving of wood or deer antler being among the best fitting candidates.

Projectile

The most massive, pointed object (Pl. 1.7) has a large, sharp, and slightly asymmetrical tip, a roughly square cross-section of the central part, and a flat slightly converging base reminding of a short tang. Its intentionally acquired robusticity in combination with a base adapted for hafting makes it a proper candidate for a projectile tip. Comparable tips were documented embedded into the facial part of a skull and between the vertebrae of human skeletons from Lepenski Vir and Schela Cladovei in Serbia and Romania respectively (Roksandic et al. 2006; Boroneanţ 2012). With a length of 68 mm and a weight of 6 g, it takes the contested marginal position between the typical size range of the heavy arrowheads and the light darts which could be either thrown from hand or atlatl. In practice, it is well suited for hunting wild game in the wetlands where a boat could provide the critical advantage for catching up on prey, necessarily reducing its speed while swimming. Hence, it may be responsible for the occasional acquisition of red and roe deer, as well as for spearing some of the biggest fish specimens in the assemblage reaching 1 metre or more (see Chapter 15).

Similar projectile tips were part and parcel of the Mesolithic hunting and fishing kits known from few sites at the Danube Gorges (Boroneanţ 2012). Interestingly, they remain in use in some Early Neolithic sites along the Danubian shores, often developed on top of former Mesolithic camps (Vitezović 2018), leaving the question open as to whether the know-how for their manufacture and use was transmitted and established during the contact period (reverse acculturation), or that the infrequent finds were simply residual. I am more inclined to consider the possibility for reversed acculturation or occasional prolonged contact with communities which possibly retained a parallel hunter-gathering economy (a) because of the repetitive recycling of broken spoon handles (shared Neolithic Anatolian-Balkan tool type) into such projectiles, and (b) because I had the chance to observe similar projectile points at Early Neolithic sites in Northeastern Bulgaria (i.e. Ovcharovo-Gorata and Varbitsa-Kenevira) where there were no traces of earlier Mesolithic habitation (Zidarov 2014).[2]

Antler mace head or sleeve

Among the collection from Bucova Pusta IV, there is a curious object of contested functional interpretation. Being made of red deer antler base, it is both massive and shock-resistant. The round perforation running laterally across the growth axis of the antler

2 Personal observations on a worked bone collection from Early Neolithic Varbitsa-Kenevira in Bulgaria courtesy of Dr. Svetlana Venelinova from the Regional Historical Museum in Shumen.

is convincingly understood as a shafting hole for a wooden handle as in well-preserved antler axes found in later waterlogged contexts. The removal of the lowermost two tines (the brow and bez tines) as well as the short preserved dimensions of the beam leave an altogether awkward stumpy appearance without any real beginning or an end. There is a diffuse polished zone on one of the rounded edges, and a rectangular break pattern on the opposite side which looks like the damaged negative of a sleeve for hafting polished stone axes. So, there is a chance that this object could have been used as a sleeve of composite tool and/or a soft hammer for knocking soft organic matter at some point in its biography. In the hands of a skilled person, and with its weight of little over 200 g, however, it could have performed various non-specialized tasks such as killing fish by hitting their heads after being caught, hunting hares by throwing it at them (similarly to the athletic exercises with lagobolon of the ancient Athenian gymnasts), or even as an added weight to a digging stick – one of the universal foraging tools of hunter-gatherers until today. Time and again, similar objects have been considered as mace heads, and thus symbols of power (fr. bâton de commandement). Other functions include shaft-straighteners, fishing rods, and tent accessories (Barge-Mahieu et al. 1992; Riout 2015), but this particular find lacks the characteristic handle warranting against direct comparisons. Beyond later interpolations, the abovementioned hypothetical functions do embody the power to give and take life in a very immediate way. Yet, there is no certain clue about its use and significance for the inhabitants of Bucova Pusta IV beyond its connotations of traditional hunter-gathering activities documented by comparable Mesolithic finds from several sites along the Danube Gorges (Boroneanţ 2012).

Spoons (Pl. 2. 2–3)

There are various hypotheses concerning the use of the Early Neolithic bone spoons ranging from collection of flour from the grinding stones to application of pigment to human body, and even for feeding babies (Георгиев 1958; Тодорова/Вайсов 1993; Beldiman 1999; Stefanović et al. 2019). On another occasion, I noted the heavy asymmetric unilateral wear and continuous reduction of their sizes through continuous use being at the same time (a) unaffected by the changing shapes and sizes, and (b) responsible for the development of intensive polish and occasional residues resembling ochre or other iron oxide-containing clays; this is how I reached the conclusion that all of these conditions would be met if one considers the possible use of the spoons as shaping and burnishing tools in ceramic production of the typical spheroid Early Neolithic pots which required controlled removal of volume from the inner side of the fine-walled vessels, as well as extensive polish on their outer surfaces after the application of the red slip/engobe (Zidarov 2014). For a different reconstruction of Neolithic ceramic technology, cf. Thissen 2017). The distribution maps of the red-slipped Early Neolithic pottery and the bone spoons in Anatolia and across the Balkans – also attested at Bucova Pusta IV – provide an indirect confirmation of this hypothesis.

Pins or labrets? (Pl. 2.7, 8, 9, 10, 12, 14, 18)

There are no intact pins from Bucova Pusta IV, and their presence is inferred from several slender cylindrical rod segments truncated on both ends with roughly round cross-sections ranging between 4–8 mm (the wider examples could have been parts of projectiles). The Neolithic pins in Anatolia and the Balkans are comparable to later

decorative examples. Occasionally they reach considerable size, and could be distinguished by rich plastic decoration (notable examples are known from Lepenski Vir, Varbitsa, and Sarnevo, among others) (Srejović 1973; Зидаров 2017). The preserved segments from Bucova Pusta IV, however, have plain surfaces, and could have been used both for fastening hair and cloth. It cannot be entirely excluded that they represent the shaft segments of nail-shaped decorative labrets, and yet the latter are typically not as slender, and only rarely made of bone (Boroneanţ/ Mirea 2020).

Discs and rings

A flattish discoid ring (Pl. 5.2) is actually made of mineralized matter, possibly a fossilized mollusk. Its overall shape, round edges, polished surface and proportionally small dimensions of the central hole hint at its likely use as ornamental ring bead. The matching size of the bone disc (discoid off-cut (Pl. 2.1 referred to as discoid off-cut, cf. below), in turn, clearly attests for the local production and consumption of similar bone rings at the site even if they are not found yet. The ring fragment illustrated in plate 4.5 was made from a raw material that is difficult to determine and breaks in plates. It is either petrified wood (lignite) or also a mollusc shell. It is also possible that it is charred bone or antler material.

Off-cuts (Pl. 4.1–4)

Cylindrical shaft segments

There are several long bone shafts – mostly the femur and humerus of large-sized ruminants like cattle and red deer – sawn across the shafts. These segments occupy the transitional area between shaft and epiphysis, but the outlines of the latter are severely damaged. Judging by their sizes, they did not belong to fully mature individuals. Thus, they may not have been fused in the first place, but were nevertheless additionally cracked open. The most remarkable thing about them is that the sawing traces detaching the epiphyses from shafts have smooth edges and characteristic U-shaped profiles. These features disclose the use of sanded string utilized much like a modern hand-held chain saw (Poplin 1974). The only unfinished groove on Pl. 4.1 demonstrates that it was started with a flint blade, and possibly only finished with the string in order to maximise the output but spare the flint edges. There are no unmistakably corresponding objects made of cylindrical shafts at the site which could directly reveal what was likely produced from the detached cylindrical shafts. The groove from an unfinished sawing-mark on Pl. 4.1, however, hints at the possible serial production of irregular bone cylinders ca. 30 mm in diameter (29x35 mm) and 10–15 mm high, and Pl. 2.25 may be a piece of such. The possible use of such bone rings/cylinders is uncertain. Bone cylinders are known to have been mounted on wooden shafts of tools and weapons as a means to decorate and reinforce them, but the inner diameter of the only shaft-hole antler implement is considerably smaller (d=20.5 mm).

The edges of the shorter and thicker regular sections could have been rounded and smoothed to be turned into elegant rings like Pl. 4.5. It has been suggested earlier that the elaborate finger rings known from Anatolia were mostly fashioned from the diaphysis wall of massive long bones allowing greater freedom in the choice of diameters and the execution of plastic decoration, the limitations being set only by the thickness of the cortical volume, whereas the Danubian Neolithic sets preferences to the slicing of rings by sawing long bone shafts, whereby they will have limited diameters, being

directly dependent on the circumference of the bone (Sidéra 2005). The above-described shaft segments from Bucova Pusta IV are a good illustration of this trend.

Finally, tubular segments from long bones could have been used as hollow drills to perforate through various materials like bone and antler (Osipowicz 2006) either for producing rings and discs such as those described in this assemblage or for making shaft holes like that of the antler object described above. However, neither the cylinders at hand have the characteristic use-wear, nor the finds from bone and antler have the corresponding diameter, effectively preventing for now the direct link between all these categories.

Discoid off-cut

Another kind of off-cut is represented by a small white disc (Pl. 5.1) with the shape of a low truncated cone. Its origin may be understood through comparison to unfinished shaft-hole axes demonstrating the process of perforation with a hollow drill – most likely, a bone tube or a reed stalk filled with wet sand. When it is set in rotative motion, the abrasive forces progressively wear down the material, leaving cores like tapering cylinders. The truncated discoid cone Pl. 5.1 is therefore likely the core produced by drilling flat bone splinters with a similar cylindrical device. The flat disc on Pl. 5.2 has a roughly matching inner diameter which could have been produced this way. Similarly, such discs would probably remain from the production of finger rings.

4. Conclusions

The collection from Bucova Pusta IV is characterised, on one hand, by the reduction of the number of elements constituting the typical "Neolithic package" introduced from Anatolia to the Balkans (consistent with Özdoğan 2010, 895, Tab. 2 indicating a steep decline in the variety of characteristic bone types of near Eastern origin between the Neolithic Balkans and the LBK zone), while, on the other, it preserves several specific tool types such as projectile head(s) and the massive shaft-hole antler tools better known from the Mesolithic assemblages along the central reaches of the Danube (Beldiman 2007; Boroneanț 2012; Mărgărit et al. 2017). The few Neolithic sites with such mixed inventories are more often than not located directly above older Mesolithic settlements on the coast of Danube (Vitezović 2018), hinting at a possible continuous development of hunter-gathering practices, or even the survival of residual pieces connected with past or modern stratigraphic disturbances.

It seems that a similar reduction of imported domesticates – such as founding crops (legumes) and domestic animals (pig) – and adaptive inclusion of new species of plants, fish, and shells in the menu is characteristic for a full spectrum of economic activities. Ultimately, this led to the development of some kind of hybrid economy relying heavily on Near Eastern farming practices while adopting some local hunter-gathering strategies for exploiting the local aquatic resources and the wild plants as a nutritional buffer during the long process of the adaptation of the farming regime to the continental climate before crossing the so-called climatic barrier (Krauß et al. 2017). Such hybrid strategies have also been noted at other places in the region (Kreuz et al. 2005; Ivanova et al. 2018). In such a perspective, one should appreciate the adoption of abrasive technologies based on perforation with reed stalks or bone cylinders and wet sanded strings as a demonstration of the adaptive capacity of the inhabitants of Bucova Pusta IV. Therefore, its frontier location makes it an excellent candidate for

studying such patterns of adaptation and acculturation during the transition from a hunter-gathering to farming economy in Central Europe.

There are some obvious differences when the abovementioned observations are compared to the collection of bone artefacts from the site Movila lui Deciov (falsely attributed to Humka Mare, see Chapter 3) excavated by Gyula Kisléghi Nagy in 1911, and revisited by Cornelius Beldiman more recently (Beldiman 1999). It is characterised by identical types of bone awls made of split metapodials from small ruminants partly retaining their proximal or distal epiphyses, ribs and sharpened splinters of long bones both from cattle and small caprines, as well as elaborate spoon-spatulas made of bovine metapodials. Similar to the collection from Bucova Pusta IV, the one from Movila lui Deciov is likewise characterised by overrepresentation of cattle bones followed by small caprines, whereas the metapodials of both size groups were likewise the favourite choice among the skeleton parts. Bone ornaments from the same site published earlier by Gheorghe Lazarovici include also ornamental pieces like pins and a boar tusk pendant. Admittedly, the collection studied by Beldiman is a tiny fraction of the pieces from the same excavations published previously by different authors, and it is not impossible that the sampling strategy at the time of the excavations was biased towards bigger and more distinguished specimens. Yet, there are no antler tools or projectiles, and no indications of onsite production in the form of blanks and off-cuts. It is tempting to assume that these differences could indicate differential access to certain resources and technologies by the inhabitants of the two neighbouring communities, which, in turn, may reveal differing origins for their respective technological traditions and/or social asymmetry between the community living on the Movila lui Deciov and that from Bucova Pusta IV. These questions should be addressed properly, however, after analysing a more representative sample from the renewed excavations at the Movila lui Deciov.

5. Catalogue

1 DNr 130; Feature H9; awl; long bone splinter, medium mammal; length 4.8 cm, width 0.6 cm, thickness 0.2 cm; very small and fine awl, expediently made on long bone sliver with curvy irregular outlines. The manufacture is restricted to minimal sharpening of the very tip; almost complete.

2 DNr 528; Feature G10; awl; rib, large mammal; length 4.1 cm, width 1.1 cm, thickness 0.3 cm; sharp, but broad and flat point with oval cross-section. Dark staining on the tip (3 mm from the end) and on left edge (ventral view). Carefully shaped and finished, but the surface is not polished; distal, old break.

3 DNr 418; Feature I4; 58; awl; long bone splinter; large mammal; length 6.8 cm, width 0.9 cm, thickness 0.3 cm; a long bone sliver ending in an asymmetric point, with working traces and use-wear polish confined to the distal part down to 20 mm from the tip; distal part; new break.

4 DNr 419; Feature H9; awl; rib; large mammal; length 7.1 cm, width 1.2 cm, thickness 0.3 cm; totally modified rib splinter, ground flat and smooth all over, ending in a sharp symmetric point on one end and flat bevelled base at the other. Ca. 10 mm down from the top, the dorsal side seems darkened by contact material. Some oblique grinding traces on both surfaces; complete.

5 Feature S13. awl; rib; large mammal; length 8.1 cm, width 0.7 cm, thickness 0.32 cm; very fine rib point with sharp symmetrical tip (missing), quite similar to the Pietrele tattoo needles (cf. Zidarov 2009; id. 2017) and the bone needle bundle published by Haak et al. 2015. Preserved in two pieces; almost complete, old break.

6 DNr 282; Feature I17; awl; metapodial, medium mammal; length 6.1 cm, width 1.8 cm, thickness 0.6 cm; complete finished awl, made on split proximal end of a metapodial tibia of a medium mammal with a broad asymmetric point, and signs of burning on the distal end; complete.

7 DNr 421; Feature K6; projectile; long bone splinter; large mammal; length 6.8 cm, width 1.1 cm, thickness 0.7 cm; relatively short but very massive and robust pointed object, with 5 mm broad symmetric point with oval to trapezoid cross-section. The blank was carelessly snapped off, but then the tip, the base, and one lateral edge were heavily ground to shape. The grinding traces are left easily visible, leaving doubt as to whether it was finished at all. The base is modified as a simple bevelled base, suitable for hafting, thus reminding of similar projectiles from the Mesolithic of the Danube Gorges (Schela Cladovei – bone projectile embedded in a human spine); complete.

8 DNr 420; Feature L11; awl; rib; large mammal; length 7.1 cm, width 1.2 cm, thickness 0.4 cm; class 1, formal rib point, carefully shaped and finished. The surface displays a reddish tone with dark spots and evenly distributed polish – probably heated and impregnated with oils (Spangenberg et al. 2014). Grinding traces on the side edges. Both ends are missing. displaying hinge-shaped trampling breaks; middle section, old break.

9 DNr 468; Feature S19; awl; metapodial, medium mammal; length 4.0 cm, width 0.6 cm, thickness 0.3 cm; very fine and small awl with oval cross-section, black burning at the break; proximal end, distal epiphysis, not fused, old break.

10 Feature T3; awl; metapodial, medium mammal; length 5.45 cm, width 0.72 cm, thickness 0.43 cm; class 1, carefully shaped small metapodial point with very sharp symmetrical tip, almost oval in cross section. Made on longitudinally halved metapodial with extensive grinding and polishing resulting in obliteration of manufacture traces, except for oblique grinding traces running UL–LD on the ventral side down to ca. 15 mm from the tip. The surface is discoloured and stained, possibly related to heat exposure; distal part, old break.

11 DNr 530; Feature H/I–G/H; awl; long bone splinter; medium mammal; length 4.6 cm, width 0.8 cm, thickness 0.3 cm; very fine and small awl with oval cross-section. Black burning at the break. Transversal grinding traces mask the flint shaving marks. Use-wear polish down to 10 mm from the preserved distal end, and superficial handling polish all over the remainder of the dorsal surface; almost complete, old break.

12 DNr 469; Feature T4; awl; metapodial, medium mammal; length 3.05 cm, width 1.1 cm, thickness 0.3 cm; very fine and small awl with oval cross-section, black burning at the break; proximal end, distal epiphysis, not fused, old break.

13 DNr 133; Feature H8; awl; long bone splinter; medium mammal; length 3.7 cm, width 0.7 cm, thickness 0.2 cm; distal. sharp point with triangular cross-section at the tip; distal part with signs of burning.

14 DNr 525; Feature L11; awl; rib; large mammal; length 0.6 cm, width 0.2 cm, thickness 0.2 cm; pin with sharp point and round cross-section; distal part; burned black.

15 DNr 531; Feature P3; awl; metapodial, medium mammal; length 0.7 cm, width 0.7 cm, thickness 0.25 cm; very fine and small awl with symmetric point and oval cross-section. Both ends are broken. Greyish-white colour indicates considerable exposure to heat. The pervasive polish could be due to handling; distal, old break.

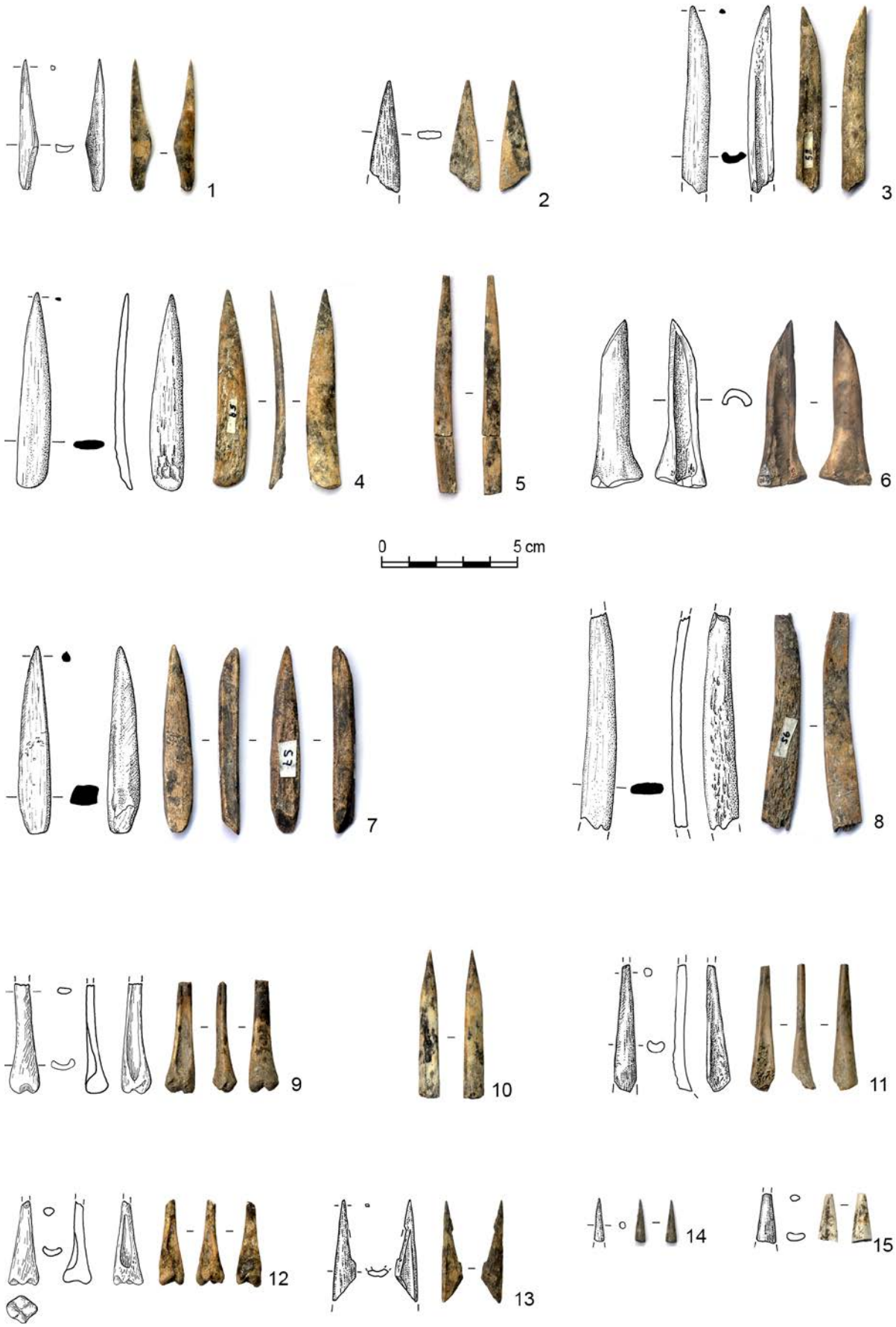


Plate I

1 Feature L–K4; hook blank; long bone splinter; large mammal; length 2.55 cm, width 1.0 cm, thickness 0.2 cm; flattish piece of long bone (?) splinter, extensively ground and polished. One oval convex edge, the other seems cut-out like the inner curve of a hook, but a peculiar break pattern of a oval spatula could not be ruled out completely; middle section, old break.

2 DNr 78; Feature H1; spoon; long bone splinter, large mammal; length 3.4 cm; width 1.4 cm; thickness 0.6 cm; V-shaped spoon, very worn. The receptacle is reduced to a mini-spatula, and even its distal edge is damaged. After its abandonment, both surfaces became covered by a network of root marks; distal part, old break.

3 DNr 280; Feature L11; spoon; long bone splinter; large mammal; length 4.8 cm, width 1.6 cm, thickness 0.6 cm; V-shaped spoon. The handle is snapped and missing, but the receptacle is complete. This is a very carefully crafted piece with delicate finish, obliterating most manufacture marks. Shining polish covers regularly the entire surface, but there is a differentiated staining – whitish on the left hand ventral part and greyish-brown along the right edge and the distal end. If the latter is developed from contact with greasy materials, then the user must have been left-handed. The white colour looks like heat treatment induced discoloration; distal part.

4 DNr 529; Feature I4; spatula; rib; large mammal; length 2.5 cm, width 1.6 cm, thickness 0.5 cm; sharp edge with oval shape, mostly undamaged. The remainder of the surface is encrusted. Possibly leather folder; distal part, new break.

5 DNr 543; Feature H8; unclear; length 4.0 cm; width 3.0 cm, thickness 0.2 cm; flat piece of bone from the compacta of a long bone.

6 DNr 545; Feature P3; bevel-edged; femur; medium-large mammal; length 2.0 cm, width 1.6 cm, thickness 0.4 cm; bevel-edged tool, shaped on long bone splinter knapping and through diligent grinding limited to the ventral surface. The working edge and the left hand lateral part are severely damaged (use-wear retouch), indicating heavy-duty use (e.g. chisel in woodworking). The remainder of the ventral surface has a shiny polish, whereas the dorsal part is left completely unworked. The entire piece has regular pale brown colour, revealing moderate heat exposure; distal, old break.

7 Feature S13; rod; antler, Cervus; length 4.7 cm, diameter 1.0 cm; curious cylindrical piece, reminiscent of both a massive spoon handle and a projectile, but curiously there is a "hole" (ca. 5 mm diameter) drilled not through, but removing the half of the shank at one of its ends. The other one has a hinge-like break pattern; middle section, old break.

8 DNr 557; Feature S19; pin; long bone splinter; large mammal; length 1.5 cm, diameter 0.55 cm; measured from drawing; middle section.

9 DNr 638; Feature L11; pin; long bone splinter; large mammal; length 1.65 cm, diameter 0.7 cm; measured from drawing; middle section.

10 DNr 556; Feature H8; pin; long bone splinter; large mammal; length 0.7 cm, diameter 0.35 cm; measured from drawing; middle section.

11 DNr 532; Feature C1; uncertain; long bone splinter; large mammal; length 3.0 cm, width 1.4 cm, thickness 0.7 cm; formless, burned and heavily weathered piece of thick (but light) long bone wall fragment. Two of its surfaces seem flat and worked, but the miserable state of preservation hinders positive identification; distal, old break.

12 DNr 558; Feature L11; pin; long bone splinter; large mammal; length 2.8 cm, diameter 0.7 cm; measured from drawing; middle section.

13 DNr 544; Feature P3; awl; long bone splinter; large mammal; length 1.2 cm, width 0.4 cm, thickness 0.3 cm; distal end of a very well planned and executed fine awl (tattoo needle), almost rectangular in cross-section, extensive polish, black colour; middle section, old break.

14 DNr 559; Feature S13; pin; long bone splinter; large mammal; length 1.55 cm, diameter 0.65 cm; Measured from drawing; middle section.

15 DNr 541; Feature D17; ring waste; femur; medium mammal; length 2.8 cm, width 1.5 cm; sawing traces from flint blade are visible on the distal end. The piece was sawn partially and snapped, resulting in a step-like break pattern, and the possible waste of the ring. Most of the surface is eroded except for the sawn part, where some superficial polish is formed as a result of the friction during string sawing; middle section, old break.

16 Feature G2; plaque; tusk, Sus; length 1.85 cm, width 0.9 cm, thickness 0.25 cm; Flattish rectangular piece with plan-convex shape, sharp, short and rounded long edge – possibly a piece of flattish plaque or inlay. It is very carefully shaped with heavily polished finish, obliterating all working traces. It has regular grey colour all over and throughout, possibly resulting from controlled heating at certain temperature (400°C). X-ray diffraction analysis revealed xydroxylapatite and calcium phosphate composition, i.e. bone/tooth; distal, old break.

17 DNr 637; Feature K6; pin; long bone splinter; large mammal; length 1.4 cm, diameter 0.7 cm; measured from drawing; middle section.

18 DNr 618; Feature L11; length 2.0 cm; diameter 0.5 cm; measured from drawing; unclear; possibly small bone remain or a natural formation of the soil; nevertheless, the piece could have been used in the Early Neolithic.

19 DNr 555; Feature B7; bracelet; long bone splinter; large mammal; length 2.1 cm, diameter 0.9 cm; measured from drawing; middle section.

20 DNr 524; Feature C19; awl; rib; large mammal; length 2.3 cm, width 0.7 cm, thickness 0.25 cm; carefully extracted splinter of cattle rib (?), the ventral surface displays no traces of spongiosa, the lateral edges are ground flat, this identified through clearly visible parallel oblique grinding striations; middle section, old break.

21 DNr 526; Feature H3; polisher; tusk, Sus; length 4.3 cm, width 0.7 cm, thickness 0.3 cm; a boar tusk splinter initially reduced through percussion. The distal end has a flattish facete (7 x 3 mm), possibly the natural wear of the tusk. It is, however, covered by grinding traces and use-wear polish, indicating possible use as a micro-polisher (?); complete.

22 DNr 132; Feature H2; uncertain; long bone splinter; medium mammal; length 1.6 cm, width 1.3 cm, thickness 0.3 cm; measured from drawing; middle section.

23 DNr 523; Feature G6; awl; rib; large mammal; length 2.6 cm, width 0.55 cm, thickness 0.2 cm; very carefully executed rib point, with sharp symmetric tip, oval in cross-section. Both ends are missing, displaying differential break pattern, i.e. tongue-like trampling break at the proximal end, and flat break at the distal end. Careful finish obliterated all manufacture traces, but hardly more than superficial handling polish was developed. Light brown tone and dark gray-black stains, possibly indicate greasy contact materials; middle section, old break.

24 DNr 467; Feature T3; ring; ivory?; large mammal; diameter >3.0 cm, width 0.8 x 1.4 cm, thickness 0.45 cm; Broken cylinder ring, extensively ground and polished. Old breaks at both ends. The surface is not cleaned, but some spots are very much reminiscent of enamel (with this thickness and size, possibly ivory); middle section, old break.

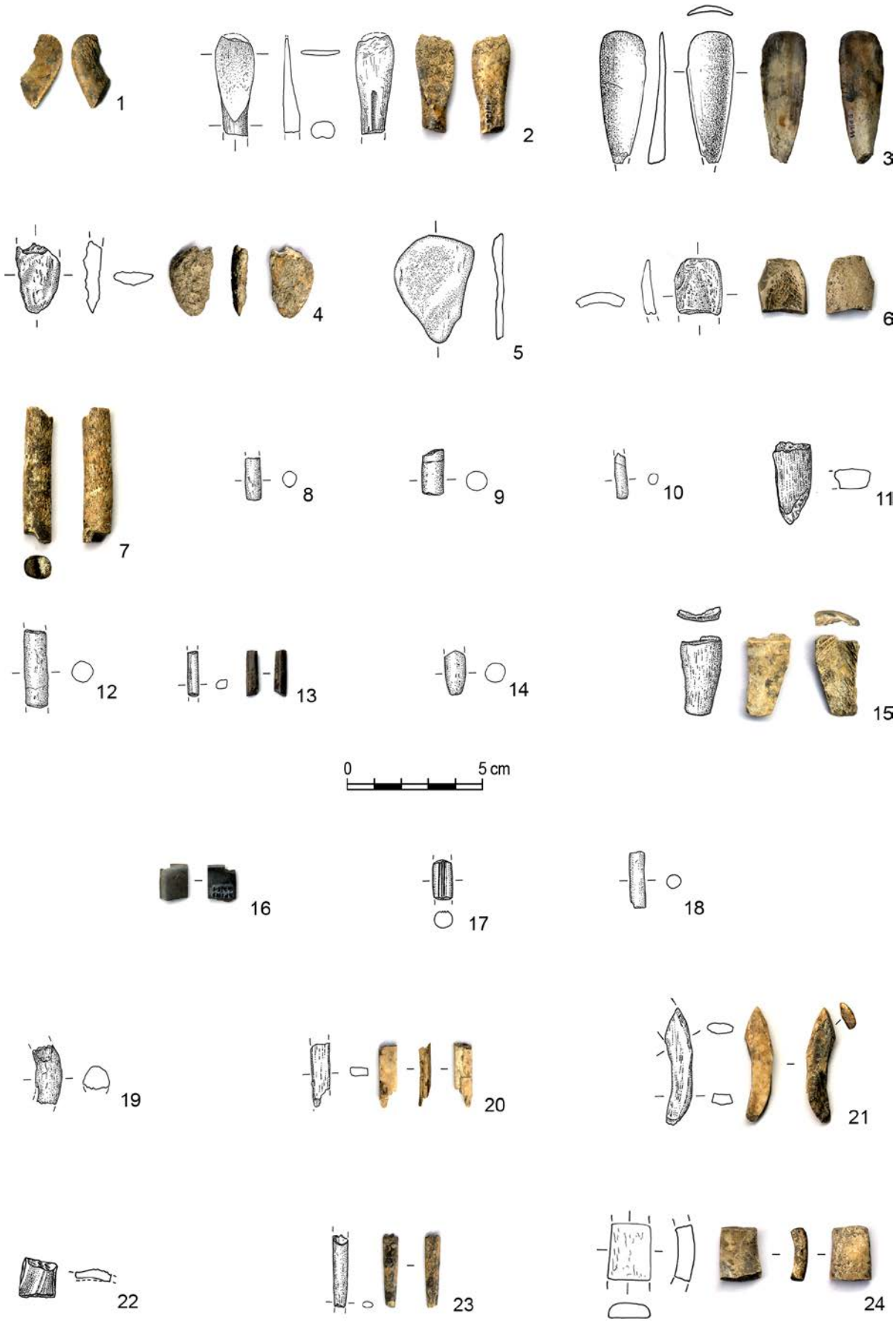


Plate 2

1 DNr 478; Feature S16; spatula; rib; Bos; length 28.0 cm, width 4.4 cm, thickness 0.7 cm; complete cattle rib spatula made by percussion and grinding. The working edge has an oval asymmetric shape and a curious polished notch from 30–47 mm from the tip on the left ventral side. Only the distal end is split to utilise a single lamella; the remainder of the tool has the whole circumference of the rib preserved. Preservation – split in multiple fragments glued together; complete.

2 Feature H/I–G/H spoon blank; metapodial, red deer; length 17.3 cm, width 2.4 cm, thickness 1.0 cm; carefully halved metapodial of a small red deer, likely prepared as a blank for sculpting a bone spoon. The lateral edges are very carefully regularised and smoothed. The part closer to the distal epiphysis is thinner, and seemingly prepared for the spoon handle. Both ends bear light brown staining, as if from contact with ochre or fire; complete.

3 Feature L–K4; spoon blank; ilium, medium-large mammal; length 9.7 cm, width 2.6 cm, thickness 1.55 cm; a very good candidate for imitative technology for spoon making from iliac bone of large mammal, hastily reduced through percussion and oblique grinding confined to the lateral sides. Handling polish, root-marks, dirt; middle section, old break.

4 Feature S12; spatula blank; rib; large mammal; length 9.56 cm, width 3.55 cm, thickness 1.45 cm; basal part of massive bone spatula. The end was shaped through percussion and grinding. Extensive handling polish on the ventral surface. The distal part is broken and missing. Colouration indicates moderate exposure to heating; proximal end, old break.

5 Feature H9; spatula blank; rib; large mammal; length 12.1 cm, width 2.9 cm, thickness 1.6 cm; basal part of massive bone spatula. The end was shaped through percussion and grinding. Extensive handling polish on both ventral and dorsal surfaces. The distal part is broken and missing. Coloration indicates moderate exposure to heating; proximal.

6 Feature P7; waste; unidentified; large mammal; length 3.7 cm, width 2.85 cm, thickness 2.05 cm; bulky piece with irregular shape – possibly a manufacture waste from cylinder production from red deer femur, through string sawing. The outer surface is flat cortical tissue, unworked except for a smooth steep cut, whereas the inner side is defined by bulky spongy tissue; distal, old break.

7 Feature S3; ring waste; femur, red deer; length 5.4 cm, width 5.75 cm, thickness 4.3 cm; manufacture waste from cylinder production, made on proximal part of red deer femur string sawn and snapped. The epiphysis was chopped away, whereas the shaft was circumsawn to an extent, then sawn through on the ventral side and snapped, leaving a characteristic U-shaped break, with a very smooth and even polished surface. The negative has an oval, not circular shape, and dimensions ca. 58 x 43 mm. The remainder of the surface is untreated, and covered with a network of root-marks; almost complete, old break.

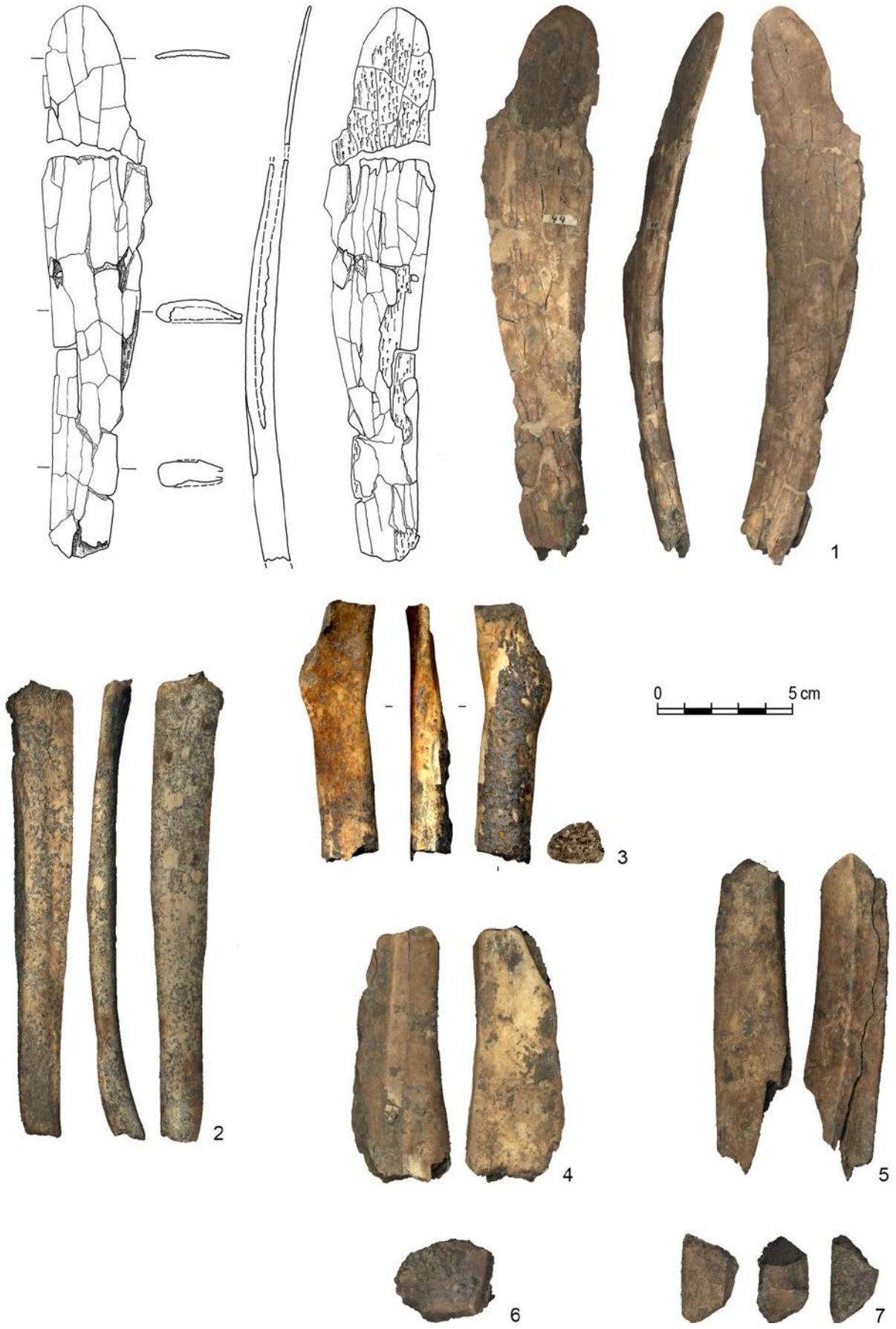


Plate 3

1 DNr 533; Feature T4; cylinder waste; femur, red deer; length 9.5 cm, width 3.2 cm, diameter 2.9x3.5 cm; manufacturing waste abandoned in unfinished state, helping to reconstruct the chaîne opératoire. The epiphysis is snapped away, and the remainder of the surface or the volume of the bone are minimally modified. The detachment of the ring is started by grooving with a flint tool, well documented at the unfinished groove and around the circumference of the finished one. On the contrary, the sawn edge has a very fine and polished surface, indicating that another ring was already detached by rope sawing. The planned ring would have cylindrical shape with a diameter of ca. 30 mm, and a height between 10–15 mm. The bone has a light brown tone, indicating moderate heat treatment; unfinished, old break.

2 DNr 542; Feature A16; cylinder waste; femur, red deer; length 6.8 cm, width 3.7 cm; manufacture waste from ring production. The sharp edge of the left-over from the inner perimeter of the ring displays a very regular and thin cut. The transversal cut, on the other hand, does not display criss-crossing sawing traces, but rather a smooth and polished surface, implying the use of very fine string for sawing. The remainder of the dorsal surface is badly weathered, almost lacking a natural surface, destroyed by the dense network of root traces. The overall tone of the object is light brown, revealing likely moderate heat treatment or the impact of the soil chemistry; complete.

3 Feature S3; cylindrical ring waste; femur, large mammal; length 5.0 cm; width 8.0 cm; manufacture waste from ring production; laterally broken.

4 DNr 540; Feature D17; ring waste; humerus; large mammal; length 7.1 cm, diameter 2.5x2.0 cm; proximal part of juvenile cattle/red deer humerus. The epiphysis is snapped away. To judge by the smooth cut, the shaft was sectioned by rope-sawing. The remainder of the surface is badly weathered through a dense network of root marks; complete.

5 DNr 644; Feature S13; curved point or fragment of a bracelet; antler of a roe deer or petrified wood (cf. Chapter 10, Pl. 66,3); length 4.75 cm, width 1.05 cm, thickness 9; Slightly curved hook-shaped pointy object, possibly made from severed roe deer antler tine (indicated as stone bracelet on the label). The basal part is very well preserved, with a round cross-section. The distal part is lengthwise split, and has a partially unfinished look. The remainder of the object is carefully shaped and ground. It has a regularly distributed grey colour (all over and throughout), indicating intentional and controlled heat-treatment at 400°C over an extended period of time in oxygen-poor conditions; almost complete, old break.

Plate 4

1 DNr 522; feature M29; disc waste; long bone splinter; large mammal; diameter 1.4–1.52 cm, thickness 0.4–0.6 cm; plug-like cylindrical discoid bead/ring waste from drilling the central perforation. Its thickness is irregular, ranging from 4–6 mm, and the upper diameter is smaller than the lower: 14x15.2 mm. Looks like dentine or severely heated cortical bone. The entire surface is polished, and the only manufacturing trace is a rather obliterated drilling negative. Chalky white colour; complete.

2 DNr 521; feature O3; disc; mollusc (?); diameter >3.0 cm, width 1.32 cm, thickness 0.8 cm; section of a very massive discoid bead (ring) with estimated outer diameter 30+ mm and 6–8 mm thickness. It is carefully made of thick white mineralised matter, possibly a fossilised mollusc. It is covered with shining polish which has obliterated all traces of manufacture. However, it is also covered with some curious weathering pits. The inner perimeter, but not the thickness, correspond to the outer diameter of the bone plug z522; middle section, old break.

3 Feature P6; hammer; antler, red deer; length 10.3 cm, width 11.06 cm, thickness 4.5 cm, diameter of shaft hole 2.05 cm; perforated heavy-duty tool, made from the basal part of a trophy antler. A few chop-marks on the basal part reveal that stone axes were used to detach the antler from the skull. However, the pedicle was later carefully rounded and heavily used to crush relatively soft organic materials, indicated by the pervasive use-wear polish on the most protruding part. The beam and the bez tine were similarly chopped away with an axe, and their surfaces ground flat and covered with some polish. The thickest part of the base is transversally perforated, opening a round 25–30 mm shafting hole. This tool type is absent from the typical Neolithic package, and should be considered to have been inspired by Mesolithic examples; complete, old break.

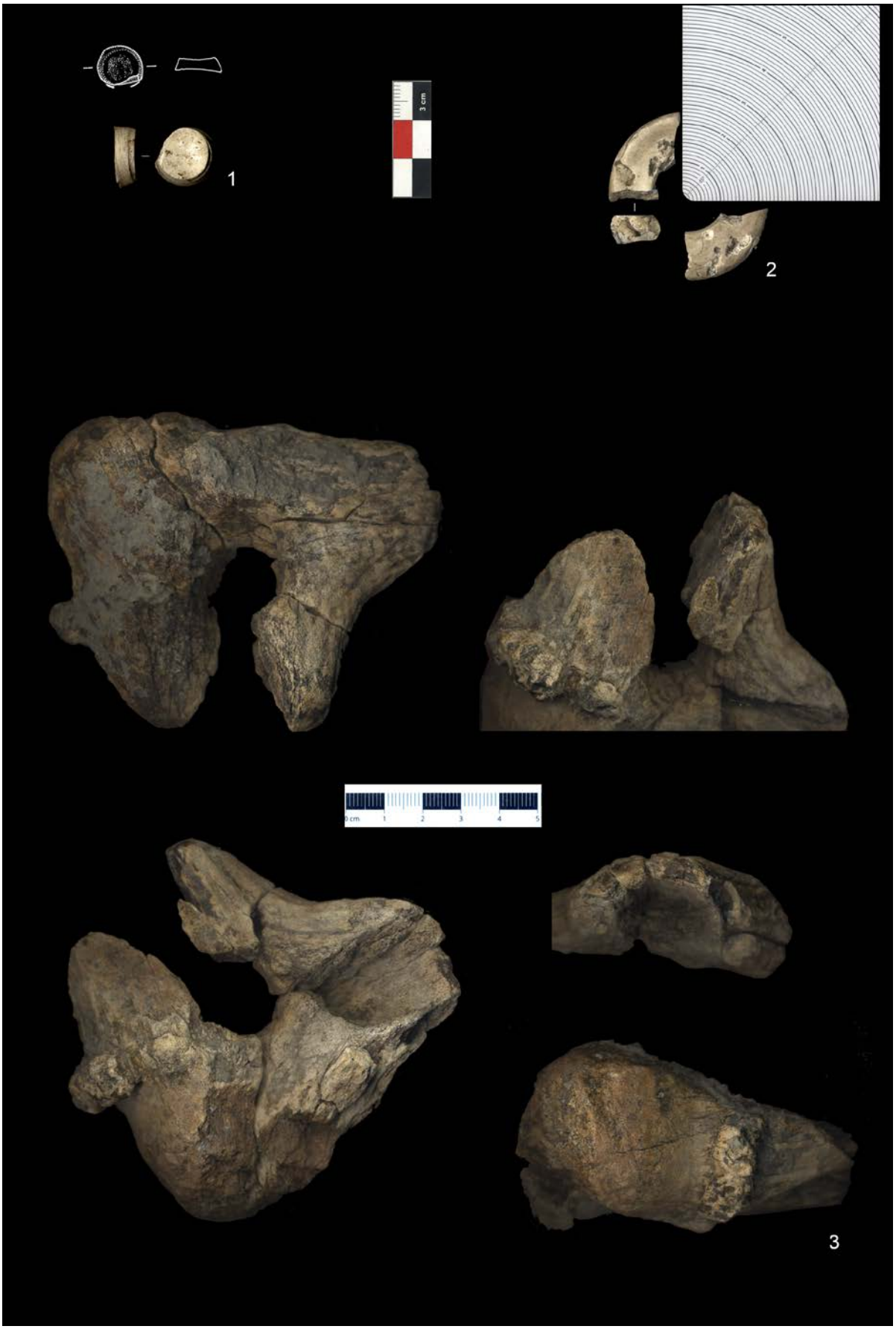


Plate 5

The faunal remains of Bucova Pusta IV

Bea De Cupere, Wim Wouters

1. Introduction

Animal remains were unearthed during the various excavation seasons at Bucova Pusta IV. Part of this faunal material was collected by hand in the excavation trench; in turn, sediment samples were taken from features of special interest and submitted for flotation, in order to retrieve botanical remains (see Chapter 16). Thereafter, the residues of the floated soil samples were sieved on a 2 mm mesh and used to retrieve the animal remains. The first results of the hand-collected material from the Early Neolithic period were already published in Krauss et al. (2018a). In this contribution, both hand-collected and sieved faunal remains will be discussed.

The excavations carried out at Bucova Pusta IV attest to a human presence at the site from the Early Neolithic up to the Medieval period (Chapter 19). However, the main structures and artefacts are related to the Early Neolithic (ENL) occupation. Table 1 indicates the number of available faunal remains in the hand-collected assemblages, and clearly demonstrates that the analysis of diachronic changes will not be possible. Faunal remains from securely dated contexts are almost exclusively restricted to the Early Neolithic period; only a few finds date to the Early Iron Age (EIA) and Medieval period. Several features are most likely dated to the Early Neolithic, and therefore listed separately; other features remained undated due to their mixed origin. In addition, not all trenches yielded a similar number of faunal remains; some trenches, especially G, H, K, L, S, and T, were much richer than others in remains (Tab. 1).

The sieved samples are from Trenches C, G, H, J, K, L, P, and S, and almost exclusively from ENL features (Tab. 2). The sediment volumes floated per feature vary considerably in size, ranging between 2.5 litres and more than 150 litres. These very large volumes are related to the ENL oven in Trench G (Features G7, G10), the ENL pit in Trench G/H (Feature G6/H9), and the ENL child burial in Trench S (Feature S13, S14).

All hand-collected faunal remains were analysed during fieldwork in 2014 and 2015; problematic pieces were compared to the reference collection housed at the Royal Belgian Institute of Natural Sciences (RBINS), Brussels. All the remains from the sieved residues were studied at the RBINS. The faunal specimens were identified and counted in order to establish the representation of the animal species and their

	A	B	B/D	C	D	E	F	G	G/H	H	K	L
ENL	8	365	70	-	8	-	-	969	171	605	464	789
(ENL)	5	34	2	-	18	-	9	-	-	18	211	16
EIA	-	-	-	-	2	-	-	-	-	-	-	-
Medieval	-	-	-	-	-	-	-	-	-	-	-	1
no date	118	11	-	150	51	5	38	48	-	73	50	12
all periods	131	410	72	150	79	5	47	1017	171	696	725	818

	L/K	M	N	N/O	O	O/P	P	Q	R	S	T	all trenches
ENL	174	6	2	22	146	50	158	-	-	1484	817	6308
(ENL)	-	57	9	-	6	2	41	1	2	15	16	462
EIA	-	-	-	-	-	-	-	-	-	-	-	2
Medieval	-	-	-	-	-	-	-	-	-	-	-	1
no date	6	106	-	-	-	-	242	20	75	489	-	1494
all periods	180	169	11	22	152	52	441	21	77	1988	833	8267

Tab. 1 Number of hand-collected faunal remains available for study arranged by trench and by period.

trench	**C**	**G**	**G**	**G**	**G**	**G/H**	**H**	**H**	**J**	**J**	**K**	**L**	**L/K**
feature	**18**	**6**	**7**	**10**	**7/10**	**G6/ H9**	**8**	**9**	**3**	**8**	**12**	**11**	**7**
ENL	-	6	5	10	>150	>150	11	6	?	1	63	2.5	8
-	5	-	-	-	-	-	-	-	-	-	-	-	-

trench	**P**	**P**	**P**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
feature	**3**	**4**	**3/4**	**3**	**6**	**7**	**11**	**13**	**14**	**14(/13)**	**16**	**22**	**24**
ENL	-	75	-	-	19	29	12	>123	54	20	26	42	43
-	70	-	60	38	-	-	-	-	-	-	-	-	-

Tab. 2 Sediment volumes floated and subsequently sieved for the retrieval of faunal remains, arranged by trench and feature.

abundancy. All identified bone and tooth fragments were counted and represented as Number of Identified Specimens (NISP). In the case of the bivalves, the number of umbo's was counted. Unidentifiable bones and teeth were also inventoried; shell fragments were not counted. The skeletal measurements are taken following the standards of von den Driesch (1976). For the fish, the standard length (SL), i.e. the length from the tip of the snout to the base of the caudal fin, was established through direct comparison with reference skeletons. Data on ageing for the main domesticates were collected using the method of Grant (1982) based on the eruption and wear of teeth, and on the fusion states of long bones.

The aim of this contribution is to investigate the taphonomical processes which were responsible for the accumulation of the animal remains, to document the food procurement strategies, and to reconstruct the natural environment of Bucova Pusta IV during the Early Neolithic period.

Fig. 1 Example of the state of preservation of the faunal material.

2. Description of the material

In general, the bones and teeth were quite dark in colour, and very fragmented. Many of the specimens were encrusted with sediment, and some demonstrated traces of burning. The colour of the burnt bones ranged from brown/black to grey or white. As this state of preservation (fragmentation and encrustation) for the bones were often hard to identify to species level (Fig. 1). The identifications of the hand-collected material and the material from the sieved residues are listed by period in Table 3 and Table 4. A more detailed inventory, i.e. by trench and feature, is given in Appendix 1 (hand-collected material) and Appendix 2 (material from sieved residues). All measurements taken on the bird and mammals remains, are listed in Appendix 3.

Molluscs

The molluscan fauna from Bucova Pusta IV comprises both local terrestrial and aquatic species. Nowadays, 61 freshwater mollusc species are present in the Banat region (Sîrbu et al. 2010). The archaeological assemblage only accounts for 10 taxa. The larger species are mainly found in the hand-collected material, and the smaller species in the floated samples. Among the common molluscs found at Bucova Pusta IV are the bivalve shells of the genus *Unio*. These freshwater bivalves are represented by the painter's mussel (*Unio pictorum*) and the swollen river mussel (*Unio tumidus*). There is no evidence for the common river mussel (*Unio crassus*), the third *Unio*-species which occurs in the Banat region. In the hand-collected material shells of the river snail (*Viviparus acerosus*) are by far the most

	ENL	(ENL)	EIA	Medieval	-	Total
Freshwater bivalves						
Unio pictorum - painter's mussel	445	4	-	-	21	470
Unio tumidus - swollen river mussel	309	10	-	-	43	362
Unio sp.	31	2	-	-	8	41
Freshwater gastropods						
Viviparus acerosus - river snail	1015	16	-	-	121	1152
Lymnaea stagnalis - great pondsnail	156	2	-	-	3	161
Planorbarius corneus - great ramshorn	101	4	-	-	2	107
Terrestrial gastropods						
Cepaea sp.	248	32	-	-	46	326
Helix lutescens	92	3	-	-	83	178
Bradybaenidae (cf. Fruticicola)	4	1	-	-	-	5
Fishes						
Acipenser sp. - sturgeon	2	-	-	-	-	2
Cyprinus carpio - wild carp	16	-	-	-	-	16
Cyprinidae - carps	80	-	-	-	1	81
Esox lucius - pike	74	2	-	-	-	76
Silurus glanis - Wels catfish	68	1	-	-	3	72
Amphibians & Reptiles						
Anura - frogs and toads	1	-	-	-	-	1
Ophidia - snakes	-	1	-	-	-	1
Emys orbicularis - European pond turtle	11	-	-	-	1	12
Birds						
Cygnus sp. - swan	1	-	-	-	-	1
Anser anser - greylag goose	-	-	-	-	1	1
Anas platyrhynchos - mallard	2	-	-	-	-	2
Anatinae (cf. Anas platyrhynchos) - cf. mallard	1	-	-	-	-	1
Anatinae (cf. Aythya ferina) - cf. common pochard	2	-	-	-	-	2
Anatinae - ducks	1	-	-	-	-	1
Lyrurus tetrix - black grouse	2	-	-	-	-	2
Tetrax tetrax - little bustard	1	-	-	-	-	1
Ciconia sp. - stork	-	-	-	-	1	1
Ardeidae (cf. Ardea cinerea) - cf. grey heron	-	1	-	-	-	1
Mammals						
Lepus europaeus - brown hare	9	-	-	-	1	10
Cricetus cricetus - European hamster	6	-	-	-	3	9
Spalax/Nannospalax - mole rat	5	-	-	-	1	6
Microtus sp. - vole	-	1	-	-	-	1
Rodentia - rodents	8	1	-	-	2	11
Vulpes vulpes - red fox	-	-	-	-	1	1

Tab. 3 Inventory of the hand-collected animal remains at Bucova Pusta IV, arranged by period.

	ENL	(ENL)	EIA	Medieval	-	Total
Capreolus capreolus - roe deer	12	4	-	-	5	21
Cervus elaphus - red deer	19	4	-	-	6	29
Cervidae - deer	3	-	-	-	-	3
Sus scrofa - wild boar	15	3	-	-	6	24
Sus - wild boar/domestic pig	8	1	-	-	5	14
Bos primigenius - aurochs	3	-	-	-	2	5
Canis lupus f. familiaris - dog	3	-	-	-	5	8
Equidae - equid	-	1	-	-	2	3
Equus ferus f. caballus - horse	-	-	-	-	1	1
Capra aegagrus f. hircus - goat	13	1	-	-	-	14
Ovis ammon f. aries - sheep	96	4	-	-	16	116
goat/sheep	683	58	-	-	110	851
Bos primigenius f. taurus - cattle	341	52	1	1	138	533
aurochs/domestic cattle	-	-	-	-	2	2
unidentified fish remains	58	-	-	-	1	59
unidentified bird remains	11	-	-	-	2	13
unidentified mammal remains	2284	249	1	-	830	3364
unidentified mammal bone, with trace of working	3	-	-	-	3	6

Tab. 3 Inventory of the hand-collected animal remains at Bucova Pusta IV, arranged by period.

numerous. Other frequently counted species are the great pond snail (*Lymnaea stagnalis*) and the great ramshorn (*Planorbarius corneus*). Shell concentrations or large numbers of these large to medium-sized gastropods were found in several instances, including an ENL feature related to the oven in Trench G (Feature G7/10), an ENL pit in Trench S (Feature S22), in and around the ENL child burial (Feature S13/14), an ENL pit in Trench L (Feature L11), and an ENL dwelling in Trench T (Feature T4). The smaller-sized species were all represented in small numbers only, and include the faucet snail (*Bithynia tentaculata*), *Gyraulus* sp., the large-mouthed valve snail (*Valvata piscinalis*), the flat valve snail (*Valvata cristata*), and the river nerite (*Theodoxus fluviatilis*). Remarkably, the shells of these small gastropods only seem to be present in the sediment of Trench S (Features S11, 13, 14, 16, 22). The four specimens of the nerite *Theodoxus* sp. were found in Trench G (Feature G7/10).

The terrestrial gastropods are mainly represented by shells of the small-sized garden snail (*Cepaea* sp.), and the large-sized edible escargot (*Helix*). In archaeozoological literature, the large edible snail is often referred to as *Helix pomatia* (e.g. Greenfield/Jongsma 2008). This is a *Helix* species with an enormously large distribution area, including Central and large parts of Eastern Europe. *Helix lutescens* inhabits the eastern part of the distribution area of *H. pomatia*, including modern Romania. *Helix lutescens* can be separated from *Helix pomatia* because of its smaller size and non-granulated shell (Neubert 2014). Based on these criteria, *Helix* shells found at Bucova Pusta IV have

Fig. 2 Concentration of shells of Helix lutescens, found in Trench M (feature M13) and related to a Chalcolithic burial.

Fig. 3 Example of fish remains (Esox Lucius) from sieved residue.

been identified as *Helix lutescens*. Many of the *Cepaea* shells are still (brightly) coloured, whereas most Helix shells no longer display colour bands. Both species occur throughout the various trenches. A concentration of *Helix* shells was found in Trench M (Feature M13) (Fig. 2), and is related to a Chalcolithic burial (Krauß et al. 2016, 298–302). The shells of other small-sized species, i.e. *Vitrea* sp., *Vallonia* sp., *Cochlicopa lubrica*, and *Oxychilus* sp., are restricted to Trench S; shells of Bradybaenidae (cf. *Fruticicola*) were found in Trenches H, K, and L, while the shell of a snail belonging to the family of the Enidae was collected in Trench G (Feature G7/10). A large amount of *Vallonia* shells, the so-called grass snail, were found around the ENL child burial in Trench S (Feature S14), and in the sediment around the ENL oven (Feature S6).

Fish

Fish are quite poorly represented in the hand-collected material, as expected from experiments proving the inefficiency of this method (Payne 1972; Meadow 1980). The residues of the floated sediments, however, yielded a much higher number of fish remains (Fig. 3). Altogether, eleven taxa have been recognised (Tab. 3 and Tab. 4); their skeletal element distribution is summarised in Table 5. Most of the fish remains identified belong to the carp family (Cyprinidae). These carp-like fishes are represented by numerous species. Due to the large number of Cyprinidae species and the great similarities of their skeletons, precise bone identifications are limited to only a few diagnostic elements. Among the cyprinid material from Bucova Pusta IV, the following species could be identified: bream (*Abramis brama*), wild carp (*Cyprinus carpio*), roach (*Rutilus* sp.), and tench (*Tinca tinca*). Bream is represented by a pharyngeal plate of an individual of 10–20 cm standard length (SL) in the ENL kidney shaped pit (Feature H9). Roach is represented by a pharyngeal plate of an individual of 10–15 cm SL in the same feature; a second pharyngeal plate of an individual of 10–20 cm SL was found in an ENL pit (Feature S16). Another pharyngeal plate is from a tench with a SL of 20–30 cm, and was found in the sediment related to the ENL child burial (Feature S14). The wild carp remains are from individuals ranging in size between 10 and 70 cm SL, with most individuals measuring 20–30 cm SL. In the case of the unidentified cyprinids, their size ranges between 5 and 70 cm SL, with most individuals measuring 10–20 cm SL (Tab. 6). The remains of wild carp and the unidentified

	ENL	-	Total
Freshwater bivalves			
Unio pictorum - painter's mussel	13		13
Unio tumidus - swollen river mussel	6		6
Unio sp.	12		12
Freshwater gastropods			
Bithynia tentaculata - faucet snail	4		4
Gyraulus sp.	2		2
Planorbarius corneus - great ramshorn	78	1	79
Valvata piscinalis - large-mouthed valve snail	3		3
Valvata cristata - flat valve snail	3		3
Theodoxus fluviatilis - river nerite	2		2
Theodoxus sp.	4		4
Lymnaea stagnalis - great pondsnail	529	28	557
Terrestrial gastropods			
Bradybaenidae (cf. Fruticicola)	12		12
Cepaea sp.	4		4
Helix lutescens	1		1
Helicidae	57	1	58
Vitrea sp.	11		11
Vallonia sp.	117	18	135
Cochlicopa lubrica - slippery moss snail	6		6
Enidae (cf. Chondrula tridens)	1		1
Chondrinidae	1		1
cf. Succinea oblonga		1	1
Oxychilus sp.	5		5
Fishes			
Abramis brama - bream	1		1
Cyprinus carpio - wild carp	144	6	150
Rutilus sp. - roach	2		2
Tinca tinca - tench	1		1
Cyprinidae - carps	1696	84	1780
Misgurnus fossilis - weatherfish	30	2	32
Cobitidae - loaches	1		1
Esox lucius - pike	701	34	735
Sander lucioperca - pikeperch	14		14
Percidae - perches	229	15	244
Silurus glanis - catfish	145	4	149
Amphibians & reptiles			
Bufo sp. - toad	6		6
Rana sp. - frog	4		4
Anura - frogs and toads	21	1	22
Ophidia - snakes	166	18	184
Birds			
Strix aluco - tawny owl		1	1
Mammals			
Talpa europaea - mole	1		1
Soricidae - shrews	1		1
Lepus europaeus - brown hare	1		1
Arvicola terrestris - water vole	2	4	6
Mus musculus - house mouse		1	1
Cricetus cricetus - European hamster	2		2
Microtus sp. - vole	16	8	24
Rodentia - rodents	4		4
Insectivora/Rodentia	50	7	57
Vulpes vulpes - red fox	4		4
wild boar/domestic pig	1		1
Ovis ammon f. aries - sheep	1	1	2
Capra aegagrus f. hircus - goat	1		1
goat/sheep	31	2	33
Bos primigenius f. taurus - cattle	1	1	2
unidentified fish remains	729	20	749
unidentified bird remains	1	1	2
unidentified mammal remains	417	15	432

Tab. 4 Inventory of the animal remains from the sieved residues at Bucova Pusta IV, arranged by period.

cyprinid remains are found throughout the various trenches.

Sturgeon (*Acipenser* sp.) is represented by two pectoral spines, one in an ENL pit (Feature L11) of a quite small individual, and another in an ENL feature (M24); no standard length could be established. A precaudal vertebra is from a species of the family of the loaches (Cobitidae), from an individual with a SL of 10–15 cm. The vertebra was found in the ENL kidney-shaped pit (Feature G6/H9). Weatherfish (*Misgurnus fossilis*), a species of true loach, is only represented by vertebrae in Trench S. Most of these finds are related to the ENL child burial (Features S13

and S14); two ENL pits (Features S16 and S22) yielded a single find, as well as the ENL oven (Feature S6). The vertebrae are almost exclusively from individuals of 10–20 cm SL.

Remains of pike (*Esox lucius*) were frequently identified in most trenches. They are from individuals ranging in size from 20 to 80 cm SL; the majority, however, are from fish measuring 20–30 cm SL and 30–40 cm SL. Given the fact that pike can attain a maximal length of 1 m (males) to 1.5 m for females (Nijssen/de Groot 1987), the remains of Bucova Pusta IV represent small-sized individuals. The pike remains were found throughout the various trenches.

Bones of pikeperch (*Sander lucioperca*) are limited in numbers, and found in contexts related to an ENL oven (Feature G7/10) and the ENL kidney-shaped pit (Feature G6/H9), and in two ENL pits (Features S16, S22). The finds are also from small-sized individuals, i.e. 20–30 cm SL. Many other remains from perches (Percidae) could not be identified to species and are almost exclusively from individuals of 10–20 cm SL. They were collected from an ENL oven (Feature G7/10), in the ENL kidney-shaped pit (Feature G6/H9), in an ENL feature with EIA intrusions (Feature P3/4), next to an ENL oven, (Feature S6), the ENL child burial (Feature S13/14) and in an ENL pit (Feature S22). The sieved material of Trench S (Features 3, 6, 13/14 and 22) yielded bones of Wels catfish (*Silurus glanis*) of a small size, i.e. up to 60 cm SL, but with most individuals measuring 20–30 and 30–40 cm SL. The hand-collected assemblage, by means of contrast, also produced finds from large to very large individuals, up to 170 cm SL; these were found in most trenches.

Amphibians and reptiles

A few remains from either frog (*Rana* sp.) or toad (*Bufo* sp.) were found. Within the sieved residue, vertebrae and ribs from snakes (Ophidia) were collected; no further identification was undertaken. The excavations at Bucova Pusta IV also yielded several carapace fragments of the pond turtle (*Emys orbicularis*); they were found in various trenches.

Birds

The faunal assemblage of Bucova Pusta IV included only a few bird bones. These include a phalanx from the wing of a swan (*Cygnus* sp.) found in an ENL pit (Feature G6). The distal end of a metacarpus from a greylag goose (*Anser anser*) was also found; it was recovered in an ENL feature with EIA intrusions (Feature C13). Mallard (*Anas platyrhynchos*) is represented by a carpometacarpus in the upper part of an ENL pit (Feature S19), and by a complete coracoid in an ENL find concentration (Feature S25); most probably, the sternum found in an ENL pit (Feature K6) is also from a mallard. A tibiotarsus and an ulna found in an ENL pit (Features H9 and L11 respectively) are most likely from the common pochard (cf. *Aythya ferina*). A tarsometarsus and a carpometacarpus of black grouse (*Lyrurus tetrix*) were found in, respectively, an ENL pit (Feature S16) and an ENL dwelling (Feature T4). The distal end of a humerus of little bustard (*Tetrax tetrax*) was found in an ENL pit (Feature S19). Stork (*Ciconia* sp.) is represented by a carpometacarpus in an undated feature (L10). A cervical vertebra is most likely from grey heron (cf. *Ardea cinerea*); it was recovered from a possible ENL feature (K11). Finally, the sieved residue from Trench S (Feature S3, undated) yielded the distal end of a tibiotarsus from a tawny owl (*Strix aluco*).

Mammals

The list of mammals from which remains were found at Bucova Pusta IV first includes

	Acipenser sp.	*Abramis brama*	*Cyprinus carpio*	*Rutilus* sp.	*Tinca tinca*	Cyprinidae	Cobitidae	*Misgurnus fossilis*	*Esox lucius*	*Sander lucioperca*	Percidae	*Silurus glanis*
suborbitale			3			1						
frontale			1			1						
parietale									7			
basioccipitale			2			4			5	1		10
parasphenoideum			2						6			1
neurocranium fragments			1			13						
articulare			6			13			7			2
dentale			10			10			33			1
ectopterygoideum									5		1	
entopterygoideum									1			
maxillare			8						7		2	
palatinum			2			1			27			
praemaxillare										1		
quadratum						2			7		2	3
loose tooth									21			
branchiostegalia						3						
ceratohyale			8			12			1			
epihyale			5			1						
hyomandibulare			2			7			8			
hypohyale						4						
interoperculare			3									
operculare			4			6						
praeoperculare			1			4			1		1	
suboperculare									1			
symplecticum									2			
urohyale						13						
pharyngeal plate		1	53	2	1	22						
pharyngeal tooth			31			2						
branchial element												1
cleithrum			3						37			13
postcleithrale			2									
scapula						3						
supracleithrale			1						1			
pectoral spine	2											15
PELVIC GIRDLE												
basipterygium						3						
tripus						1						
Weber app.												6
praecaudal vertebra						663	1	30	426	7	147	71
caudal vertebra						875		2	205	5	86	88
processus vertebra						70			1			
urofoor						2						
urostyl						5						

	Acipenser sp.	*Abramis brama*	*Cyprinus carpio*	*Rutilus* sp.	*Tinca tinca*	Cyprinidae	Cobitidae	*Misgurnus fossilis*	*Esox lucius*	*Sander lucioperca*	Percidae	*Silurus glanis*
vertebra						7			1			2
costa						70			1			8
dorsal lepidotrichia			13			7						
lepidotrichia			1			5					4	
pterygiophore			4			23					1	
radialia						8						

Tab. 5 Skeletal element distribution of the fish species at Bucova Pusta IV, based on both hand-collected and sieved material.

small insectivores and rodents. These are mole (*Talpa europaea*), shrews (Soricidae), water vole (*Arvicola amphibius*), vole (*Microtus* sp.), house mouse (*Mus musculus*), European hamster (*Cricetus cricetus*), and mole rat (*Spalax/Nannospalax*). They were found almost exclusively in the sieving residues of Trench S. Remains of brown hare (*Lepus europaeus*) were found in several trenches (Features B3, H2, H9, K4, L11, S13, S16, T4) and all seem to be from adult individuals. The skeletal element distribution is summarised in Table 7. Red fox (*Vulpes vulpes*) is represented by a mandible fragment in an ENL feature with EIA intrusions (Feature C18), two phalanges in the sediment of the ENL child burial (Feature S13), and a femur and a phalanx in an ENL pit (Feature S22).

Cervid remains include specimens from both roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*); they are about equally represented, and found in most trenches. The roe deer remains are from adult individuals; two cranial fragments with pedicle and part of the antler are from males with unshed antlers. The red deer finds are also all from adult individuals. Related to the ENL child burial (Feature S13), several elements (os centrotarsale, metatarsus, phalanx 1, phalanx 2) of a right hind leg were found; they were counted as one in Table 3. In the upper part of an ENL dwelling (Feature T4), Trench T yielded the distal end of a femur from which the shaft was cut through (see also Chapter 14). Four antler fragments in an ENL feature (Feature P6) were also counted as one in Table 3. They are from an unshed antler; one of these fragments includes the pedicle which has been rounded. Three antler fragments could not be identified to the level of species, and are listed as Cervidae in Table 3 and Table 7. However, these are most likely from red deer.

Eight remains are from dog (*Canis lupus* f. familiaris). A mandible fragment and a molar (M2) were found in an ENL feature with EIA intrusions (Feature C18); they are most probably from the same individual. A mandible and pelvis fragment were found in a mixed context (Feature M3); their state of preservation is very different from the general preservation of the ENL material. A complete metacarpal V was found in the lower part of the ploughing horizon (Feature S3). A mandible fragment and the proximal end of a metatarsal II were collected in the upper part of an ENL pit (Feature S19). A tooth fragment was recovered from another ENL pit (Feature K6).

cm SL	*Abramis brama*	*Cyprinus carpio*	*Rutilus* sp.	*Tinca tinca*	Cyprinidae	Cobitidae	*Misgurnus fossilis*	*Esox lucius*	*Sander lucioperca*	Percidae	*Silurus glanis*
5-10	-	-	-	-	3	-	-	-	-	-	-
10-20	1	27	2	-	1235	1	29	38	3	219	20
20-30	-	66	-	1	462	-	3	439	8	16	74
10-30	-	1	-	-	1	-	-	-	-	-	-
20-40	-	-	-	-	15	-	-	8	-	-	1
30-40	-	10	-	-	81	-	-	241	3	-	47
30-50	-	-	-	-	3	-	-	-	-	-	-
40-50	-	1	-	-	10	-	-	14	-	-	14
40-60	-	1	-	-	3	-	-	-	-	-	-
>40	-	1	-	-	3	-	-	-	-	-	-
50-60	-	6	-	-	8	-	-	5	-	-	4
50-70	-	-	-	-	1	-	-	-	-	-	-
>50	-	-	-	-	1	-	-	-	-	-	-
60-70	-	4	-	-	5	-	-	7	-	-	1
>60	-	-	-	-	3	-	-	-	-	-	-
70-80	-	-	-	-	-	-	-	4	-	-	6
80-90	-	-	-	-	-	-	-	-	-	-	8
>80	-	-	-	-	-	-	-	-	-	-	1
90-100	-	-	-	-	-	-	-	-	-	-	5
90-110	-	-	-	-	-	-	-	-	-	-	1
100-110	-	-	-	-	-	-	-	-	-	-	1
100-120	-	-	-	-	-	-	-	-	-	-	1
>100	-	-	-	-	-	-	-	-	-	-	2
110-120	-	-	-	-	-	-	-	-	-	-	7
120-130	-	-	-	-	-	-	-	-	-	-	2
120-140	-	-	-	-	-	-	-	-	-	-	1
120-150	-	-	-	-	-	-	-	-	-	-	1
>120	-	-	-	-	-	-	-	-	-	-	1
130-140	-	-	-	-	-	-	-	-	-	-	6
140-150	-	-	-	-	-	-	-	-	-	-	4
150-160	-	-	-	-	-	-	-	-	-	-	4
>150	-	-	-	-	-	-	-	-	-	-	1
160-170	-	-	-	-	-	-	-	-	-	-	3

Tab. 6 Distribution of the standard lengths of the various fish species in the hand-collected and sieved material.

There are a few equid remains in the faunal assemblage of Bucova Pusta IV. A more or less complete but fragmented metacarpal and a second/fourth metapodal were found in an EIA feature (Feature F2), but with a mixed character in date. One tooth fragment was found in the ploughing horizon (Feature L1), while fragments of a left and right mandible with some preserved tooth (I1–3, P2–4) were found within the same trench (Feature L10; undated). The dental pattern points towards an identification of a hybrid (crossbreeding of horse and donkey).

A small part of the faunal assemblage has been identified as pig (*Sus*). Based upon their size, two thirds of these specimens have been attributed with certainty to wild boar (*Sus scrofa*). For the other specimens, it is unclear whether they are from wild or domestic pigs. Considering the lack of clear evidence for the presence of domestic pig and the low number of *Sus* remains in general, it can be assumed that all of the uncertain specimens are also from wild boar. The sex of the animal could be established in three instances. A left and right mandible fragment found in an ENL pit (Feature G6) are from a male wild boar. A canine fragment of another male was found in an undated feature in Trench S (Feature S3). The area between the Medieval graves (Feature A12) yielded a maxilla fragment from a female (wild or domestic) pig. All remains which were securely identified as wild boar are from adult individuals. Among the specimens identified as wild or domestic pig, three finds are from young animals. Measurements could only be taken in few instances (Appendix 3).

Remains of sheep (*Ovis ammon f. aries*) and goat (*Capra aegagrus* f. hircus) are the most abundant in the faunal assemblage of Bucova Pusta IV (Tab. 3). Given the difficulty to discriminate between the postcranial skeletal elements of sheep and goats (Zeder/Lapham 2010) and the preservation state of the material, many finds could not be identified more precisely than to the level of sheep/goat. Among those which were identified with certainty, sheep are more common than goat, in a ratio of about 8:1. The tooth wear stages (TWS), recorded following Grant (1982), were converted into Payne's (1973) age classes, as given in Hambleton (2001). For incomplete mandibles, the tables with mandible wear stages in Grant (1982) were used to predict the age class (see Appendix 4 for detailed information). Based on these dental data, the slaughter ages of the sheep and goats were estimated. Considering the low number of observations for each species individually, all data (n=36) have been considered together (Fig. 4). These indicate that part of the herd was slaughtered quite young, mainly at the ages of 6–12 months and 1–2 years. Some animals were slaughtered in adulthood. Such a mortality profile corresponds to the production of tender meat, entailing the culling of most young animals for their meat, while a few individuals are preserved for breeding (Payne 1973). The data on epiphyseal closure in sheep/goat demonstrates slightly different results. They rather display an emphasis on young animals, i.e. between 1–2 years and 2.5–3.5 years, but again with a minority surviving into maturity (Tab. 8). In the area surrounding the ENL child burial (Feature S13), several bones of a foetal/neonatal lamb or kid have been found; it is not clear if they are from the same individual.

In the case of cattle (*Bos*), five specimens have been identified as aurochs (*Bos primigenius*) based on their exceptional size. These finds include a horncore fragment and a phalanx 1 in an ENL pit (Feature G/H1), two phalanx 2, of which one was found in a context related to an ENL oven (Feature G10), and the other in an undated context (Feature K15), and a carpal in the lower part of the ploughing horizon in Trench S (Feature S3). The latter feature also yielded a scapula and a vertebral fragment which are quite heavily built, and it is unsure if these finds also belong to aurochs. The other specimens have been labelled as domestic cattle. Measurements of both aurochs and domestic cattle remains were considered and the Logarithmic Size Index (LSI) calculated (see Meadow 1999) with the formula log(measurement X) – log(standard S), using the female aurochs of Ullerslev as standard (Degerbøl 1970). The histogram of the LSI-data shows the large

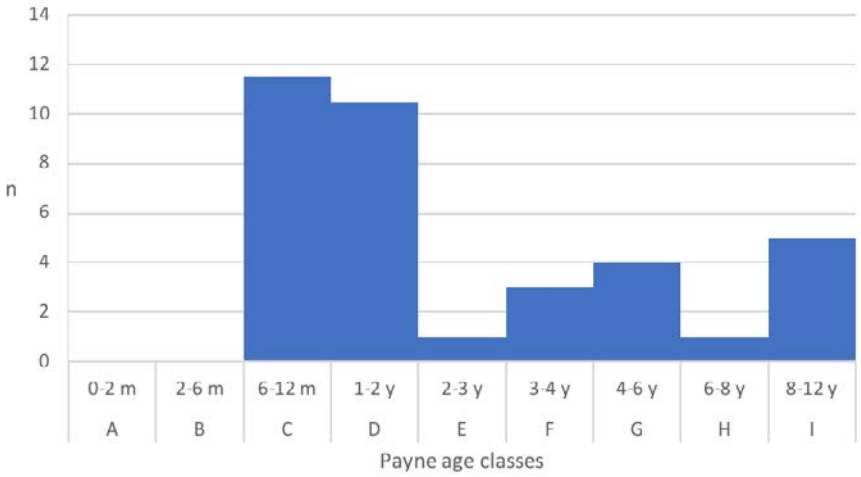


Fig. 4 Slaughter age of sheep and goat, following Payne's age classes (1973); based on the complete faunal assemblage (see Appendix 4 for raw data).

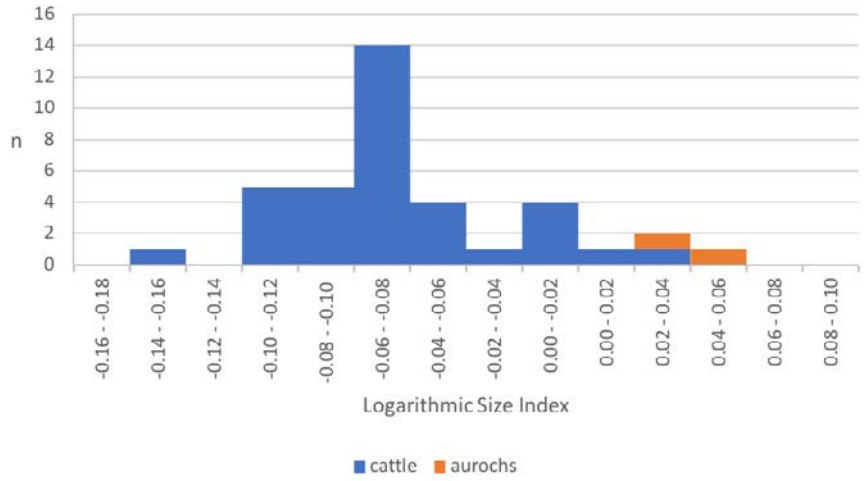


Fig. 5 Combined measurements of different bones using the Logarithmic Size Index for cattle and aurochs.

size of the specimens identified as aurochs (Fig. 5). It is, however, possible that some of the largest specimens recorded as 'cattle' are in fact from aurochs. The two smallest finds shown in Figure 5 (LSI of respectively -0.154 and -0.118) were found in an ENL context with EIA intrusions (Feature C22), and displayed another preservation colour (more yellowish) than the majority of the faunal material. Most probably, these specimens indeed represent such EIA intrusions. There are very few recordable mandibles which are suitable to establish slaughter age in cattle (n=5) (Fig. 6). These include four young individuals (with M1 erupting or slightly worn) and one adult animal (M3 worn). Some other specimens are clearly from young and adult animals, but no age class could be attributed (Appendix 4). Post-cranial data, which consider the fusion stage of epiphyses, are more numerous (Tab. 9), and illustrate the preference for slaughtering calves and young animals; however, some individuals also reached maturity. Three rib fragments of cattle have a smoothened or polished end at one side; they were uncovered in the kidney shaped ENL pit (Feature H9/G6), another small (ENL) pit (Feature T10), and in an ENL feature (S12) (see Chapter 14). Several bone fragments which could not be identified to the level of species demonstrated traces of cutting or working, and are considered as bone artefacts. These specimens are discussed in Chapter 14.

	Lepus europaeus	Vulpes vulpes	Capreolus capreolus	Cervus elaphus	Cervidae	Canis lupus f. familiaris	Equidae	Sus scrofa	Sus	Capra aegagrus f. hircus	Ovis ammon f. aries	sheep/goat	Bos primigenius	Bos primigenius f. taurus	aurochs/ domestic cattle
cranium + antler			2												
cranium + horn core											1			1	
antler				2	3										
horn core													1	1	
cranium												21		15	
maxilla								3	1			9		3	
mandible	1	1	1	1		3		4	1	1	8	70		48	
tooth			1	1		2	2	4	2	1	4	126		71	
rib									3			53		28	
vertebra			1					2	1			66		71	1
sternum												1		1	
scapula			2					2	1	1	2	45		14	1
humerus			2	2					1	2	7	39		22	
radius			1	2				1			18	66		8	
ulna	2		2									15		7	
carpal												9	1	6	
metacarpus						1	1				13	15		12	
pelvis	2			1		1		1	1			51		24	
femur	3	1		1					1		3	72		18	
patella												1		3	
tibia	3		1	2					2	1	3	69		23	
calcaneus				5					1	1	6	8		7	
talus				3						2	9	8		13	
malleolare														1	
os centrotarsale												3		5	
cuneiform														1	
metatarsus			1	4		1					15	18		21	
metopodal			1				1	2		3	2	9		17	
phalanx 1			3	2				3			20	19	1	32	
phalanx 2		1	2	1						3	4	2	2	17	
phalanx 3		2	1	2				1			2	2		5	
podal														1	
sesam								1				3		3	

Tab. 7 Skeletal element distribution of the mammal species at Bucova Pusta IV, based on both hand-collected and sieved material.

3. Taphonomy

Considering the general nature of the site of Bucova Pusta IV, the faunal remains most likely represent a mixture of various human activities. Artefacts such as the chipped stones indicate everyday activities on a household level (see Chapter 12). However, naturally deposited remains are also present. The latter group are the remains of the so-

Age			NF		fusing		F	
			n	%	n	%	n	%
< 1 year	scapula	distal	0		0		22	
	humerus	distal	-/2*		2		14	
	radius	proximal	3		0		12	
total			**5**	**9.1 %**	**2**	**3.6 %**	**48**	**87.3 %**
1-2 year	phalanx 1	proximal	9		2		21	
	phalanx 2	proximal	1		0		8	
	metacarpus	distal	6		1		3	
	metatarsus	distal	4/2*		0		4	
	tibia	distal	7		0		9	
total			**29**	**37.7 %**	**3**	**3.9 %**	**45**	**58.4 %**
2.5-3.5 year	humerus	proximal	3		0		2	
	radius	distal	14		0		3	
	femur	proximal	6		0		10	
	femur	distal	11/1*		0		9	
	tibia	proximal	10		0		3	
	calcaneus	proximal	7		0		4	
total			**52**	**62.7 %**	**0**	**0 %**	**31**	**37.3 %**

Tab. 8 Data on epiphyseal closure in sheep/goat, based on the entire faunal assemblage Bucova Pusta IV (: juvenile individual).*

called intrusive animals (cf. Gautier 1987). These animals or their remains arrive upon the site without the intervention of people. In the case of this faunal assemblage, they include taxa such as the small terrestrial and freshwater gastropods, frogs and toads, and small rodents (hamster, mole rat, vole). The rodents may represent commensal animals that lived contemporaneously with the human occupation, as well as, for example, *Vallonia* sp., a small gastropod species that lives in moist soil, and is attracted to decaying material. Other species may have arrived at the site after the human abandonment of the site. This is most probably the case for burrowing animal species, such as hamster, mole rat, vole, and the small terrestrial gastropods of the genus *Cepaea*. The well-preserved *Cepaea* shells with colour suggests that these shells are indeed of intrusive animals.

The dog and equid finds are most likely the remains of carcasses, i.e. animals that were not eaten after they died, or from which only the hide was taken. It cannot be excluded that the fox bones also represent the remains of a carcass, being an animal hunted for its fur. Furthermore, the tawny owl can be considered as a hunted bird, but might also represent an intrusive animal. A small amount of bone and antler had been used as a tool, or served as raw material for the production of artefacts. For a discussion of this material, see Chapter 14.

Yet, most of the faunal remains represent food refuse from the site's inhabitants. Without doubt, these include the freshwater bivalves (*Unio* spp.) at the first instance. The consumption of freshwater mussels have, indeed, frequently been reported at prehistoric sites in Eastern Europe (see e.g. Pickard et

Fig. 6 Slaughter age of cattle, following Halstead's age classes (1985); based on the complete faunal assemblage (see Appendix 4 for raw data).

Fig. 7 Concentration of shells of the river snail (Viviparus acerosus), found in the upper part of an ENL dwelling (Feature T4).

al. 2017). In addition, the large freshwater gastropods, *Lymnea stagnalis*, *Planorbarius corneus,* and *Viviparus acerosus*, are all three edible species, and the concentrations of their shells in several ENL features suggests that these snails were collected and exploited as a food resource (Fig. 7). Consumption of freshwater gastropods in the past is, however, rarely or not documented in the literature (see Lubell 2004; Thomas 2015). It is not very clear how to interpret the shells of the large terrestrial gastropod *Helix lutescens*. They may represent food remains; snails of the genus *Helix* were collected for consumption at many prehistoric sites (Lubell 2004, with references therein). At the same time, they are burrowing species and will burrow into loose soil (Germain 1921), looking for a suitable microenvironment to aestivate during hot dry summers or hibernate during winter (Thomas 2015). It is possible that the concentration of *Helix* shells in the Late Chalcolithic burial (Feature M13), near the chest of the human body, should be interpreted as a natural assemblage rather than an anthropic one.

All fish remains can be interpreted as consumption refuse as well as the finds of the pond turtle. With the exception of the tawny owl, all bird remains can also be put into this

Age			NF		fusing		F	
			n	%	n	%	n	%
< 1 year	scapula	distal	-/1*				3	
total			**1**	**25.0 %**	**0**	**0 %**	**3**	**75.%**
1-2.5 year	humerus	distal	1/1*				8	
	phalanx 1	proximal	6/4*				14	
	phalanx 2	proximal	-/3*				7	
total			**15**	**34.1 %**	**0**	**0 %**	**29**	**65.9 %**
2-2.5 (3) year	tibia	distal	1/1*				5	
	metacarpus	distal	3				2	
	metatarsus	distal	5/2*					
total			**12**	**63.2 %**	**0**	**0 %**	**7**	**36.8 %**
3.5-4 year	humerus	proximal	1					
	radius	distal	2/1*				1	
	femur	proximal	1		1			
	femur	distal	1/1*				5	
	tibia	proximal	1				3	
	calcaneus	proximal	1/1*				1	
total			**10**	**47.6 %**	**1**	**4.8 %**	**10**	**47.6 %**

Tab. 9 Data on epiphyseal closure in cattle, based on the entire faunal assemblage Bucova Pusta IV (: juvenile individual).*

category. Finally, most of the mammal finds, i.e. from hare, fallow deer, red deer, wild boar (or pig), aurochs, cattle, sheep, and goat can be considered as food remains.

4. Early Neolithic subsistence

The consumption refuse is used to make inferences about subsistence in the past. The material dated to the Early Neolithic period is treated and discussed as a single assemblage. Despite the quite small size of the vertebrate assemblage, its nature and characteristics are, together with the shells, indicative for the exploitation of domestic livestock and natural resources in the settlement vicinity.

When considering the different animal groups of the hand-collected material, Figure 8 clearly indicates that food provisioning of the inhabitants of Bucova Pusta IV during the Early Neolithic was based on the consumption of domestic mammals, i.e. the breeding of sheep/goat (with a preponderance of sheep), and to a lesser extent of cattle (Tab. 3). It is believed that little to no domestic pig is present at the site. A predominance of sheep (and goat) and a rare occurrence of suid remains (domestic and/or wild) in Neolithic assemblages have already been reported for several Körös-Culture settlements in the Pannonian Plain (Kovács et al. 2010), e.g. Ecsegfalva (Bartosiewicz 2007), Endröd (Bökönyi 1992), Ludas Budžak (Bökönyi 1974), Röszke (Bökönyi 1974), Szajol (Vörös 1980), and Szolnok-Szanda (Bartosiewicz 2012). While there is no clear indication for the presence of domestic pig at Bucova Pusta IV,

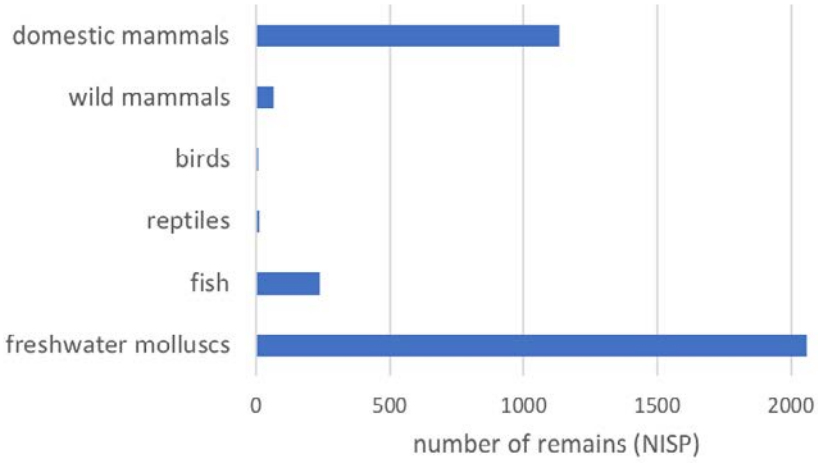


Fig. 8 Number of remains for each animal category in the hand-collected material.

the domestic status of pig is also questioned at the site of Dzhulyunitsa-Smardesh (Bulgaria) (de Groene et al. 2018). Indeed, a general absence or near-absence of domestic pig has been demonstrated for sites in the lowlands of the Pannonian Plain (Ivanova et al. 2018, Fig. 4).

The lack of cattle mandibles suitable to establish age at death posed a problem in determining kill-off strategies used in the cattle herds. The remains clearly demonstrate, however, the culling of calves and young animals, as well as mature animals which may have been slaughtered towards the end of their productive live. In the case of the sheep and goats, their mortality profile indicates the slaughtering of quite young animals (i.e. Classes C & D, 6–12 months and 1–2 years respectively according to Payne 1973). As already mentioned, such a profile corresponds most likely to the breeding of animals for their meat. At Chalcolithic sites (5th millennium BC) in eastern Romania, sheep were almost exclusively slaughtered at the age of 6–12 months (Bréhard et al. 2014).

Hunting played a minor role at Bucova Pusta IV, and included the hunt of small game (hare), large game (roe deer, red deer, wild boar and aurochs), and wild birds. Their numbers constitute around 2 % of the total hand-collected assemblage (Fig. 8). When only the vertebrate remains are considered (thus without the shells), this number increases to 5 %.

People also made use of aquatic resources to a large extent, i.e. molluscs (both gastropods and bivalves), pond turtle, and fish, as a contribution to the diet. It remains, however, difficult to estimate the importance of fish due to the sampling bias (small fish bones being missed in the trench). The sieved material (Tab. 4) clearly demonstrates that the consumption of fish was more key than assumed from the hand-collected material. The most abundant fish species are cyprinids, and especially wild carp, pike, perches, and catfish. These are ubiquitous species, and, indeed, fish remains in prehistoric sites of Hungary and Romania generally include these species (Bălăşescu et al. 2003; Bartosiewicz/Bonsall 2004). Remains of pike and cyprinids formed the majority of the fish remains from the sieved samples at the Körös-Culture site of Ibrány-Nagyerdő (Hungary) along the Tisza river; perch and catfish are not mentioned for this site, however (Kovács et al. 2010).

The high proportion of small fishes in the faunal assemblage of Bucova Pusta IV can be explained by the fishing methods used at the site. Indeed, small fishes can easily be

collected using static fishing gear like fish traps and fishing nets close to the margins of the water or shallow water bodies (Van Neer et al. 2013). Generally, larger fishes live more in open waters, and are less easily captured using hooks. Furthermore, the low frequency of large fish remains suggests that the spawning season was not primarily employed to catch big amounts of fishes. Indeed, carp and pike are known to spawn in flooded meadows, while catfishes and perches stay close to their nests to defend the eggs against predators (Kottelat/Freyhof 2007). The underrepresentation in the faunal assemblage of (very) large fish such as sturgeon, large pike, and large catfish, might also indicate that deeper waters were only occasionally exploited.

Marine molluscs, freshwater bivalves, and large terrestrial gastropods from the genus *Helix* are often mentioned in the literature as being a food resource (Lubell 2004; Thomas 2015). However, the opposite is true for freshwater gastropods. Nevertheless, the concentrations of shells of the latter category demonstrate that freshwater gastropods must have formed part of the ENL diet. Also in later periods, the consumption of the pond snail (*Viviparus*) is documented, for example for the Chalcolithic site of Taraschina in the delta of the Danube (Bălăşescu/Radu 2011). The freshwater gastropods in the assemblage of Bucova Pusta IV must have been harvested in the nearby waters, where ducks and swans were also hunted.

5. Ecology

Several taxa, the remains of which have been identified in the faunal assemblage of Bucova Pusta IV, can be used to reconstruct the natural environment of the site. A first group includes the mollusc shells. The presence of freshwater molluscs is often linked to environmental factors which are species dependent. Determining factors include water flow, temperature, and vegetation. In the case of the terrestrial gastropods, they usually do not travel far during their lifetime; the presence of their shells can therefore be used to sketch the local environment (Davies 2008). The biotope of the best represented species in the species list is described below.

The painter's mussel (*Unio pictorum*) is a species of medium-sized freshwater mussel, and more often occurs in standing water, while the swollen river mussel (*Unio tumidus*) lives in calmly flowing rivers, ponds, and lakes (Gittenberger 2004). The river snail (*Viviparus acerosus*) is a large freshwater gastropod, and its native habitat includes the river basin of the Danube; there, it occurs in slow flowing rivers and muddy channels. The great pond snail (*Lymnaea stagnalis*) is a species of large air-breathing freshwater snails; it is found in most larger water bodies, particularly in slow-flowing rivers (Davies 2008). The great ramshorn (*Planorbarius corneus*) is a large planorbid found in standing or slowly moving water, where there is a good growth of many different kinds of pond weeds, with high levels of calcium dissolved in the water. Among the terrestrial gastropods, the most common species, *Vallonia* sp., is a small gastropod species which lives in moist soil, and is attracted to decaying material. They are mainly found in open, grassy areas (Kerney/Cameron 1980).

A second group which can be used to make inferences about the palaeoecology includes the fishes (Kottelat/Freyhof 2007). Although nowadays introduced into all types of bodies of water, the wild carp (*Cyprinus carpio*) prefers deep, slow-flowing or standing waters with good vegetation. Similarly, the common bream (*Abramis brama*) is most abundant in slow-flowing rivers, brackish estuaries, and shallow lakes with dense vegetation for spawning. Roach (*Rutilus* sp.) can mainly be found in lowland areas, in nutrient-rich

waters of lakes and rivers; it may occur in fast-flowing rivers. The habitats preferred by the tench (*Tinca tinca*) are characteristically shallow lakes and backwaters with abundant vegetation. Adult weatherfish (*Misgurnus fossilis*) live in dense patches of aquatic vegetation; they are not found in open areas without vegetation. The Wels catfish (*Silurus glanis*) is the largest European freshwater fish, and abundant in the river basin of the Danube; it inhabits the lower reaches of large rivers and muddy lakes with good vegetation. Pike (*Esox lucius*) occurs in a variety of habitats, albeit all with aquatic or periodically flooded vegetation. Pikeperch (*Sander lucioperca*) inhabits both lakes and slow flowing rivers. In sum, both molluscs and fish are indicative for slow-flowing rivers which are rich in vegetation.

The remaining groups (i.e. the birds and mammals) hint at open landscapes alternating with forest. The natural habitat of the little bustard (*Tetrax tetrax*) is open grassland, while the black grouse (*Lyrurus tetrix*) can be found in and at the edges of forests with a dense vegetation cover for roosting and nesting. The cervids identified at the site of Bucova Pusta IV, red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*), are generally found in open, parkland forest, whereas aurochs (*Bos primigenius*) are supposed to have lived in open grassland and gallery forest. At Bucova Pusta IV, the low frequency of suids – the (near) absence of domestic pig and the low frequency of wild boar – might suggest that this was, indeed, an open environment, best suited for herding sheep.

The species represented at Bucova Pusta IV correspond well with the location of the site in a steppe-like and flat landscape, bisected by lesser tributaries of the Tisza River and undergoing periodic flooding (Krauss et al. 2018a).

Appendix I

Trench	Feature	**Freshwater bivalves**	*Unio pictorum* - painter's mussel	*Unio tumidus* - swollen river mussel	*Unio* sp.	**Freshwater gastropods**	*Viviparus acerosus* - river snail	*Lymnaea stagnalis* - great pondsnail	*Planorbarius corneus* - great ramshorn	**Terrestrial gastropods**	*Cepaea* sp.	*Helix lutescens*	Bradybaenidae (cf. *Fruticicola*)	**Fishes**	*Acipenser* sp. - sturgeon	*Cyprinus carpio* - wild carp	Cyprinidae - carps	*Esox lucius* - pike	*Silurus glanis* - Wels catfish	**Amphibians & Reptiles**	Anura - frogs and toads	Ophidia - snakes	*Emys orbicularis* - European pond turtle	**Birds**	*Cygnus* sp. - swan	*Anser anser* - greylag goose	*Anas platyrhynchos* - mallard	Anatinae (cf. *Anas platyrhynchos*) - cf. mallard	Anatinae (cf. *Aythya ferina*) - cf. common pochard	Anatinae - ducks	*Lyrurus tetrix* - black grouse	*Tetrax tetrax* - little bustard	*Ciconia* sp. - stork	Ardeidae (cf. *Ardea cinerea*) - cf. grey heron	**Mammals**	*Lepus europaeus* - brown hare	*Cricetus cricetus* - European hamster	*Spalax/Nannospalax* - mole rat	*Microtus* sp. - vole	Rodentia - rodents	*Vulpes vulpes* - red fox	*Capreolus capreolus* - roe deer	*Cervus elaphus* - red deer	Cervidae - deer	*Sus scrofa* - wild boar	*Sus* - wild boar/domestic pig	*Bos primigenius* - aurochs	*Canis lupus* f. *familiaris* - dog	Equidae - equid	*Equus ferus* f. *caballus* - horse	*Capra aegagrus* f. *hircus* - goat	*Ovis ammon* f. *aries* - sheep	goat/sheep	*Bos primigenius* f. *taurus* - cattle	aurochs/domestic cattle	unidentified fish remains	unidentified bird remains	unidentified mammal remains	unidentified mammal bone, with trace of working	Total
A	4			1							1																																									1	2					14		19
A	5																																																									2		2
A	6																																									1																1		2
A	7																																																									3		3
A	10																																																				2	1				8		11
A	11																																																					1				5		6
A	12																																													1								2				7		10
A	13																																																				1					3		4
A	15																																													1							8	3				1		14
A	16																																																									1	1	2
A	18																																																			1	2					4		7
A	19																																																									1		1
A	20																																																									1		1
A	21										1																																															4		5
A	26																																																					1				2		3
A	27																																										1										4	1				22		29
A	9 (=8)																																										1			1							1					6		9
A	-																																																					1				2		3
B	2			1			2				1																																1										10	6				12		34
B	3		1				11					2																									1															1	4	1				10		31
B	6										1																																															1		2
B	7		2	2			5	2			3																																1									1	11	7				31		65
B	8										1																																										2	1				8		12
B	9		1	2			9		1		4	4							2																			1														4	49	8				75		160
B	12		1	5			9	4				1					2		6																			2					1										5	3		4		35		78
B	14			3			1					1																																										2				2		9
B	15										1																																																	1
B	20			1																																																	2	1				6		10
B	22			1			3				1																																										1	1						7
B	25																																																									1		1
B/D	1						1				1																																																	2
B/D	2		2	8			7				5						1																					2														4	15	3				21		68
B/D	3						1																																																					2
C	1										1	1																																																2
C	2																																																					1				1		2
C	6																																																									1		1
C	8																																																									2		2
C	10											1																																												1		5		7
C	13																											1																								1		2				2		6
C	14										1																																																	1
C	15																																																				1					3		4
C	17																																																					2				2		4
C	18		1	3			1				4																															1					1		2				2	5	4			1	26		51
C	19								1																																													2				3		6
C	20																																																									1		1
C	21			1																																																	1	2				3		7
C	22																																																					2						2

Trench	Feature	**Freshwater bivalves**	*Unio pictorum* - painter's mussel	*Unio tumidus* - swollen river mussel	*Unio* sp.	**Freshwater gastropods**	*Viviparus acerosus* - river snail	*Lymnaea stagnalis* - great pondsnail	*Planorbarius corneus* - great ramshorn	**Terrestrial gastropods**	*Cepaea* sp.	*Helix lutescens*	Bradybaenidae (cf. *Fruticicola*)	**Fishes**	*Acipenser* sp. - sturgeon	*Cyprinus carpio* - wild carp	Cyprinidae - carps	*Esox lucius* - pike	*Silurus glanis* - Wels catfish
C	19/21																		
C	Ext. East																		
C	-			1							1	1							
D	2											1							
D	3																		
D	4										1								
D	8																		
D	14																		
D	15										1								
D	16										3	1							
D	17		2	5			7				9	6							1
D	20																		
D	20																		
E	2										3	1							
F	1										1								
F	2			1			1				2								
F	3										1								
F	4										2								
F	5										3								
G	1																		
G	2						2												1
G	5				1							2				1			
G	6		44	34			11	1	2		11	1				1	1	1	4
G	7		3	1			2	3	4		2					1			5
G	8		2	1			4				3	4							
G	10		33	5	2		62	27	14		9	7				5	3	1	14
G	12		3				5	8											
G	7 (10NW)																		1
G	7/10																54	47	12
G	9																		
G	-																		
G/H	9		38	30			15	1	2		3	2							
G/H	11																		1
G/H	-																		
H	2		1																
H	3		4	3			2				5								
H	5		1	2			1												
H	6																		
H	8										3								
H	9		15	15	3		17				15	5	2			1			2
H	10		75	61	1		44		4		26	2				3	3		
H	11						1	2											
H			1								1								
K	3																		
K	4																		
K	5															1			
K	6											1							
K	7		8	8	2		10	1	2		23	1	1					5	2

Trench	Feature	**Amphibians & Reptiles**	*Anura* - frogs and toads	Ophidia - snakes	*Emys orbicularis* - European pond turtle	**Birds**	*Cygnus* sp. - swan	*Anser anser* - greylag goose	*Anas platyrhynchos* - mallard	Anatinae (cf. *Anas platyrhynchos*) - cf. mallard	Anatinae (cf. *Aythya ferina*) - cf. common pochard	Anatinae - ducks	*Lyrurus tetrix* - black grouse	*Tetrax tetrax* - little bustard	*Ciconia* sp. - stork	Ardeidae (cf. *Ardea cinerea*) - cf. grey heron	**Mammals**	*Lepus europaeus* - brown hare	*Cricetus cricetus* - European hamster	*Spalax/Nannospalax* - mole rat	*Microtus* sp. - vole	Rodentia - rodents
C	19/21																					
C	Ext. East																					
C	-																					
D	2																					
D	3																					
D	4																					
D	8																					
D	14																					
D	15																					
D	16																					
D	17																					
D	20																					
D	20																					
E	2																					
F	1																					
F	2																			1		1
F	3																					
F	4																					
F	5																					
G	1																					
G	2																					
G	5																					
G	6						1					1								2		
G	7																					
G	8																					
G	10				5																	
G	12																					
G	7 (10NW)																					
G	7/10																					
G	9																					
G	-																					
G/H	9																					
G/H	11																					
G/H	-																					
H	2																		1			
H	3																	1	2			
H	5				1																	
H	6																					
H	8																					
H	9																		1			
H	10				1						1							3				1
H	11																					
H																						
K	3																					
K	4																					
K	5																	1				
K	6																					
K	7		1							1										1		

Trench	Feature	*Vulpes vulpes* - red fox	*Capreolus capreolus* - roe deer	*Cervus elaphus* - red deer	Cervidae - deer	*Sus scrofa* - wild boar	*Sus* - wild boar/domestic pig	*Bos primigenius* - aurochs	*Canis lupus* f. *familiaris* - dog	Equidae - equid	*Equus ferus* f. *caballus* - horse	*Capra aegagrus* f. *hircus* - goat	*Ovis ammon* f. *aries* - sheep	goat/sheep	*Bos primigenius* f. *taurus* - cattle	aurochs/domestic cattle	unidentified fish remains	unidentified bird remains	unidentified mammal remains	unidentified mammal bone, with trace of working	Total
C	19/21														1				3		4
C	Ext. East													4	2				40		46
C	-														1						4
D	2														1				3		5
D	3																		1		1
D	4																				1
D	8																				1
D	14													5					13		18
D	15																				1
D	16																				4
D	17												2		1				6	2	46
D	20														1						1
D	20																		1		1
E	2																		1		5
F	1																				2
F	2									1	1			4	6				15		35
F	3																				1
F	4														1				3		6
F	5																				3
G	1													1					4		5
G	2					1							1	4	17				17		43
G	5			1		1								5	2				11		25
G	6					3	1					1	2	20	9		3		64		218
G	7			1		1							1	8	1		1		20		57
G	8													1							16
G	10			1				1				3	7	80	10		14	4	168		480
G	12													2					2		20
G	7 (10NW)																				1
G	7/10																20				133
G	9																		1		1
G	-																		1		1
G/H	9					1		2						5	19				18		138
G/H	11													8	1				18		28
G/H	-																		5		5
H	2		1	1										2	5				5		16
H	3													10	11				14		53
H	5													8	1				9		25
H	6																		1		1
H	8																				3
H	9			1			2					2	5	34	9			1	58		202
H	10					1	1						2	22	13		4		103		378
H	11											1	1	2	1				7		15
H																			1		3
K	3																		2		2
K	4													1					1		2
K	5													1	1				7		11
K	6													1							2
K	7		1						1			3	2	43	20		1	1	140		279

Trench	Feature	**Freshwater bivalves**	*Unio pictorum* - painter's mussel	*Unio tumidus* - swollen river mussel	*Unio* sp.	**Freshwater gastropods**	*Viviparus acerosus* - river snail	*Lymnaea stagnalis* - great pondsnail	*Planorbarius corneus* - great ramshorn	**Terrestrial gastropods**	*Cepaea* sp.	*Helix lutescens*	Bradybaenidae (cf. *Fruticicola*)	**Fishes**	*Acipenser* sp. - sturgeon	*Cyprinus carpio* - wild carp	Cyprinidae - carps	*Esox lucius* - pike	*Silurus glanis* - Wels catfish	**Amphibians & Reptiles**	Anura - frogs and toads	Ophidia - snakes	*Emys orbicularis* - European pond turtle	**Birds**	*Cygnus* sp. - swan	*Anser anser* - greylag goose	*Anas platyrhynchos* - mallard	Anatinae (cf. *Anas platyrhynchos*) - cf. mallard	Anatinae (cf. *Aythya ferina*) - cf. common pochard	Anatinae - ducks	*Lyrurus tetrix* - black grouse	*Tetrax tetrax* - little bustard	*Ciconia* sp. - stork	Ardeidae (cf. *Ardea cinerea*) - cf. grey heron	**Mammals**	*Lepus europaeus* - brown hare	*Cricetus cricetus* - European hamster	*Spalax/Nannospalax* - mole rat	*Microtus* sp. - vole	Rodentia - rodents	*Vulpes vulpes* - red fox	*Capreolus capreolus* - roe deer	*Cervus elaphus* - red deer	Cervidae - deer	*Sus scrofa* - wild boar	*Sus* - wild boar/domestic pig	*Bos primigenius* - aurochs	*Canis lupus* f. *familiaris* - dog	Equidae - equid	*Equus ferus* f. *caballus* - horse	*Capra aegagrus* f. *hircus* - goat	*Ovis ammon* f. *aries* - sheep	goat/sheep	*Bos primigenius* f. *taurus* - cattle	aurochs/domestic cattle	unidentified fish remains	unidentified bird remains	unidentified mammal remains	unidentified mammal bone, with trace of working	Total
K	8		1	2			3	1			2																																															10		19
K	9			1			1																																														8	2				13		26
K	10			1				2																																																				3
K	11			2			4		2		6							2	1																							3											15	8				79		123
K	12			1							1																								1																					2				3		8
K	13		6	4			10	1	6		7	4																																			2						1	20	8				87		156
K	15																																																						1				1		2
K	16																																															1											1		2
K	19										1																																										1						2		4
K	20																																																					1					6		7
K	23		1	3					1		8																																											6	6				12		37
K	24										1	1																																										1					4		7
K	26											1																																										1	1				6		9
K	27			1									1																																														1		3
K	28																																																										1		1
K	29																																																												1
K				1	1						1	1																																										4	1				12		21
L	2																																																	1				1					3		5
L	3																																																					1					1		2
L	10																																																					2	1				5		8
L	11			2																														1																1			1	1					5		12
L	17		43	26			38	53	10		11	3	1		1	1	3	15	4				1						1							2		2		1		2	1		1						2	16	92	73		5	2	371	1	789
L	18																																																					1							1
L																																																							1						1
L/K	2				1																																																						2		3
L/K	3																																																					2					1		3
L/K	4																																																						1						1
L/K	5		2		1		1				1	1						1	2																												1						2	11	11				37		71
L/K	7										1																																																		1
L/K	8		8	5	1		1	1	1			1						1	1				1																														2	2	10				17		53
L/K	9						1																																															5	3				8		17
L/K	10																																																						1						1
L/K	11				1																																																2		6				7		16
L/K	13				1		1																																																						2
L/K								6	5																																													1							12
M	2																						1																																3				5		10
M	3		1																																																										1
M	4																																																2					1	4				4		11
M	5											1																																											1						2
M	6																																																										5		5
M	7																																												2									1				7		10
M	8																																						1						1								3	3				10		18
M	12																																																										1		1
M	13																																																						3				6		9
M	14											67																																																	67
M	15																																																										1		1
M	17											1																																										1					2		4
M	20			1																																																							1		2
M	21				1						1												1																		1													1	1				3		10

Trench	Feature	**Freshwater bivalves**	*Unio pictorum* - painter's mussel	*Unio tumidus* - swollen river mussel	*Unio* sp.	**Freshwater gastropods**	*Viviparus acerosus* - river snail	*Lymnaea stagnalis* - great pondsnail	*Planorbarius corneus* - great ramshorn	**Terrestrial gastropods**	*Cepaea* sp.	*Helix lutescens*	Bradybaenidae (cf. *Fruticicola*)	**Fishes**	*Acipenser* sp. - sturgeon	*Cyprinus carpio* - wild carp	Cyprinidae - carps	*Esox lucius* - pike	*Silurus glanis* - Wels catfish	**Amphibians & Reptiles**	Anura - frogs and toads	Ophidia - snakes	*Emys orbicularis* - European pond turtle	**Birds**	*Cygnus* sp. - swan	*Anser anser* - greylag goose	*Anas platyrhynchos* - mallard	Anatinae (cf. *Anas platyrhynchos*) - cf. mallard	Anatinae (cf. *Aythya ferina*) - cf. common pochard	Anatinae - ducks	*Lyrurus tetrix* - black grouse	*Tetrax tetrax* - little bustard	*Ciconia* sp. - stork	Ardeidae (cf. *Ardea cinerea*) - cf. grey heron	**Mammals**	*Lepus europaeus* - brown hare	*Cricetus cricetus* - European hamster	*Spalax/Nannospalax* - mole rat	*Microtus* sp. - vole	Rodentia - rodents	*Vulpes vulpes* - red fox	*Capreolus capreolus* - roe deer	*Cervus elaphus* - red deer	Cervidae - deer	*Sus scrofa* - wild boar	*Sus* - wild boar/domestic pig	*Bos primigenius* - aurochs	*Canis lupus* f. *familiaris* - dog	Equidae - equid	*Equus ferus* f. *caballus* - horse	*Capra aegagrus* f. *hircus* - goat	*Ovis ammon* f. *aries* - sheep	goat/sheep	*Bos primigenius* f. *taurus* - cattle	aurochs/domestic cattle	unidentified fish remains	unidentified bird remains	unidentified mammal remains	unidentified mammal bone, with trace of working	Total
M	22																																																				1					1		2
M	24																																																				1					4		5
M	26														1																																													1
M	27																																																									1		1
M	32																																																											1
M	33		1																																																									1
M	36																																																					1						1
M	38																																																											1
M	39																																																									3		3
M							2																																																					2
N	2																																																			1		1						2
N	3										2																																																	2
N	5											1																																														1		2
N	12																																								1																			1
N	15																																																					1						1
N																																																					2				1		3
N/O	4																																									1												3				2		6
N/O	5				1												3		3																																							3		15
N/O																							1																																					1
O	3																																																			1		1				4		6
O	4																																																				4	1			1	51		57
O	5											2																																																2
O									2								2	1	1																																			2		3		76		87
O/P	3																																																				1					1		2
O/P	4																																																			1	4	4				26		35
O/P							3																																						1										2			1	8		15
P	2																																																									9		9
P	3																																									3												1				37		41
P	4																																												1							1	7	7				131		147
P	5																																																				5	1				28		34
P	6		7	8			57		1		2	2																																	1								2	1				5		86
P	7		1				4																																			1											2	4				46		61
P	11																																								1											1	1	2				22	1	28
P	12		1	1	1		3	1			1	3																																								1	5	1				14		32
P											2	1																																																3
G?																																																				1	7					9		17
Q	2																																																									3		3
Q	3																																																									2		2
Q	4						1																																															4				1		6
Q	7																																																					1						1
Q	8																																																									1		1
Q	10											1																																																1
Q	13																																																				1					3		4
Q	17																																																											1
Q	17+19																																																									1		1
Q	-																																																				1							1
R	3				1						1																																									1	1	5				6		15
R	**4**																																																									**1**		**1**
R	**5**																																																									**7**		**7**

Trench	Feature	Freshwater bivalves	Unio pictorum - painter's mussel	Unio tumidus - swollen river mussel	Unio sp.	Freshwater gastropods	Viviparus acerosus - river snail	Lymnaea stagnalis - great pondsnail	Planorbarius corneus - great ramshorn	Terrestrial gastropods	Cepaea sp.	Helix lutescens	Bradybaenidae (cf. Fruticicola)	Fishes	Acipenser sp. - sturgeon	Cyprinus carpio - wild carp	Cyprinidae - carps	Esox lucius - pike	Silurus glanis - Wels catfish	Amphibians & Reptiles	Anura - frogs and toads	Ophidia - snakes	Emys orbicularis - European pond turtle	Birds	Cygnus sp. - swan	Anser anser - greylag goose	Anas platyrhynchos - mallard	Anatinae (cf. Anas platyrhynchos) - cf. mallard	Anatinae (cf. Aythya ferina) - cf. common pochard	Anatinae - ducks	Lyrurus tetrix - black grouse	Tetrax tetrax - little bustard	Ciconia sp. - stork	Ardeidae (cf. Ardea cinerea) - cf. grey heron	Mammals	Lepus europaeus - brown hare	Cricetus cricetus - European hamster	Spalax/Nannospalax - mole rat	Microtus sp. - vole	Rodentia - rodents	Vulpes vulpes - red fox	Capreolus capreolus - roe deer	Cervus elaphus - red deer	Cervidae - deer	Sus scrofa - wild boar	Sus - wild boar/domestic pig	Bos primigenius - aurochs	Canis lupus f. familiaris - dog	Equidae - equid	Equus ferus f. caballus - horse	Capra aegagrus f. hircus - goat	Ovis ammon f. aries - sheep	goat/sheep	Bos primigenius f. taurus - cattle	aurochs/domestic cattle	unidentified fish remains	unidentified bird remains	unidentified mammal remains	unidentified mammal bone, with trace of working	Total
R	6			2	1																																																	2				29		34
R	8																																													1												1		2
R	9																																																					1						1
R	15			1																																																		1				1		3
R	-																																																					1				13		14
S	3																																																				1					7		8
S	4		4	7	4		43				7	1					1		1																							3	3		3	1	1	1				5	32	36	2		1	320	1	481
S	6			1																																																						1		2
S	7						1																																														1					1		3
S	8										1																																																	1
S	9		1	1			3				1																														1														1				1		9
S	11						2		1																																												1					1		5
S	12		1	2			11				3																																1										1	2							22
S	13		1	4			3																																														1	5	4				11		29
S	14		44	23	6		172	4	7		22	7					1																										2	3	2	4						1	12	49	22			1	141		526
S	15		16	3			38	1			1						1																								2												2	6			1		29		102
S	16		1	1			5												1																																			2					4		14
S	19		4	3			11	2	1		4						1														1						1				1		1											7			1		109		147
S	21		22	15			59	8	4		9								1								1					1											2	5	1	1			2			1	10	45	30				164		382
S	22				1		2				1																																												1						5
S	24		14	3			72	27	29		2						4	1	1																						2												2	5	1				18		182
S	25		2		1		4	1	2			1					1						1																																1				3		17
S	26		1	2							1								1								1																	1										1					4		12
S	28						2																																																						2
S	29				1		4																																														5	4	1				3		18
S	31						1																																																						1
S	32				1																																																							1
S	33																																																						1						1
S	13/14		1																																																			1							2
S	-						1																																														1	3					11		16
T	3						3				4																																											1	3				3		14
T	4		6	4	1		50				8	4																																										4	3				37		117
T	5		28	28	4		262	1	2		57	26				1			3												1						1				1		1	2		1	1						4	50	26				87		587
T	6				1		2	1	1		1	1						1	1																																		1	5			1		8		24
T	7		11	6	1		10				1	1																																									1	1	3				5		40
T	8		1				13		1			1				1																																						2	1				3		24
T	9		1				8																																																						9
T	10		1	2			6	2	1																																													2	2						16
T	-																																																						2						2
Total			470	362	41		1152	161	107		326	178	5		2	16	81	76	72		1	1	12		1	1	2	1	2	1	2	1	1	1		10	9	6	1	11	1	21	29	3	24	14	5	8	3	1	14	116	851	533	2	59	13	3364	6	8268

Appendix 1 Inventory of the hand-collected animal remains at Bucova Pusta IV, arranged by trench and feature.

Appendix 2

Trench	C	G	G	G	G	G	G/H	H	H	J	J	K	L	L/K	P	P	P	S	S	S	S	S	S	S	S	S	S	Total
Feature	**18**	**6**	**7**	**10**	**10**	**7/10**	**G6/ H9**	**8**	**9**	**3**	**8**	**12**	**11**	**7**	**3**	**4**	**3/4**	**3**	**6**	**7**	**11**	**13**	**14**	**16**	**22**	**24**	**14 (and some parts of feature 13)**	
Freshwater bivalves																												
Unio pictorum - painter's mussel				1		4	7															1					13
Unio tumidus - swollen river mussel						2	3						1														6
Unio sp.								1												1		2	3		5			12
Freshwater gastropods																												
Bithynia tentaculata - faucet snail																					1	2	1					4
Gyraulus sp.																						2						2
Planorbarius corneus - great ramshorn						9	1				6	1	7					1				37	6		6		5	79
Valvata piscinalis - large-mouthed valve snail																					1	2						3
Valvata cristata - flat valve snail																								2	1			3
Theodoxus fluviatilis - river nerite																						2						2
Theodoxus sp.						4																						4
Lymnaea stagnalis - great pondsnail				13	3	83	10		1				74					28	6			197	58		60		24	557
Terrestrial gastropods																												
Bradybaenidae (cf. *Fruticicola)*												12																12
Cepaea sp.					1	1	2																					4
Helix lutescens											1																	1
Helicidae																		1	3	6		12	25	1	11	1	7	58
Vitrea sp.																			1			6	3		1			11
Vallonia sp.																		18	28			4	82				3	135
Cochlicopa lubrica - slippery moss snail																			1			3	1				1	6
Enidae (cf. *Chondrula tridens)*						1																						1
Chondrinidae																		**1**									**1**	**1**
cf. *Succinea oblonga*																		**1**										**1**
Oxychilus sp.																							**3**	**1**	**1**			**5**
Fishes																												
Abramis brama - bream									**1**																			**1**
Cyprinus carpio - wild carp						**31**	**15**					**3**	**8**				**1**	**5**	**4**			**30**	**32**		**15**		**6**	**150**
Rutilus sp. - roach									**1**															**1**				**2**
Tinca tinca - tench																							**1**					**1**
Cyprinidae - carps	**3**	**1**	**1**	**8**		**143**	**99**	**11**	**22**			**39**	**59**	**5**			**2**	**79**	**22**	**1**	**3**	**429**	**291**	**7**	**484**	**5**	**66**	**1780**
Misgurnus fossilis - weatherfish							**1**																					**1**
Cobitidae - loaches																		**2**	**1**			**9**	**15**	**1**	**1**		**3**	**32**
Esox lucius - pike	**1**	**1**		**4**		**75**	**34**	**6**	**8**			**20**	**13**	**1**	**3**	**2**	**4**	**26**	**8**		**3**	**155**	**151**	**6**	**171**	**2**	**41**	**735**
Sander lucioperca - pikeperch						**7**	**4**																	**2**	**1**			**14**
Percidae - perches						**11**	**8**	**1**	**2**								**1**	**14**	**1**			**111**	**66**		**18**		**11**	**244**
Silurus glanis - catfish		**1**		**1**		**9**	**20**	**2**			**1**		**4**					**4**	**1**			**75**	**12**		**14**		**5**	**149**

Trench	C	G	G	G	G	G	G/H	H	H	J	J	K	L	L/K	P	P	P	S	S	S	S	S	S	S	S	S	S	S	Total
Feature	18	6	7	10	10	7/10	G6/ H9	8	9	3	8	12	11	7	3	4	3/4	3	6	7	11	13	14	16	22	24	14 (and some parts of feature 13)	
Amphibians & reptiles																												
Bufo sp. - toad						1		1					2									1					1	6
Rana sp. - frog									2														1	1				4
Anura - frogs and toads	1					1	5	1	6			1		1						4		1	1					22
Ophidia - snakes	8					1	24		3			3		2				10	1			54	31		41	1	5	184
Birds																												
Strix aluco - tawny owl																		1										1
Mammals																												
Talpa europaea - mole																							1					1
Soricidae - shrews								1																				1
Lepus europaeus - brown hare																						1						1
Arvicola terrestris - water vole																		4					2					6
Mus musculus - house mouse																		1										1
Cricetus cricetus - European hamster							1																1					2
Microtus sp. - vole																		8	1			5	8	1			1	24
Rodentia - rodents																						1	3					4
Insectivora/Rodentia	1	3					6	3	9			2	1	1				6	2			4	15	3			1	57
Vulpes vulpes - red fox																						2			2			4
wild boar/domestic pig								1																				1
Ovis ammon f. aries - sheep															1							1						2
Capra aegagrus f. hircus - goat													1															1
goat/sheep				4								1	1					2	1			15	4	1	3	1		33
Bos primigenius f. taurus - cattle																		1				1						2
unidentified fish remains	4	2	1	5		148	48	11	10			33	1		1			15	5			203	26	3	220		13	749
unidentified bird remains				1														1										2
unidentified mammal remains	10	12	9	40		nc	28	17	68	2		56	nc		1			4				69	8					432

Appendix 2 Inventory of the animal remains from the sieved residues at Bucova Pusta IV, arranged by trench and feature.

Appendix 3

date	trench	feat.	species / element	measurements			
			Ciconia sp.				
				Did			
-	L	10	carpometacarpus	13.1			
			Anser anser				
				Did			
mixed	C	13	carpometacarpus	10.9			
			Anatinae cf. *Aythya ferina*				
				Bp	**SC**		
ENL	L	11	ulna	9.3	4.6		
			Lepus europaeus				
				SD	**Bd**		
ENL	H	9	femur	9.7	22.3		
ENL	S	16	femur		21.5		
ENL	T	4	femur		21.4		
				Bd			
ENL	L	11	tibia	17.5			
				BPC			
ENL	K	4	ulna	9.4			
			Sus scrofa				
				BG	**SLC**		
ENL	T	4	scapula	(36)	35.4		
				SD	**Bd**		
ENL	G/H	1	radius	(26)	(41)		
				LAR			
mixed	P	5	pelvis	42			
				GL	**Bp**	**SD**	**Bd**
ENL	G	7	phalanx 1	51.1	23	19.3	20.2
ENL	O/P	4	phalanx 1			15.5	17.6
				DLS	**Ld**		
(ENL)	M	6	phalanx 3	42	39.5		
			Capreolus capreolus				
				GLP	**LG**	**BG**	**SLC**
ENL	B	12	scapula	33.1	24.4	24	18.5
				Bd	**BT**		
ENL	S	19	humerus	30.9	25.7		
				Bd			
ENL	S	13	radius	24.1			
				Glpe	**Bp**	**SD**	**Bd**
(ENL)	K	10	phalanx 1	41.3		7.8	11.3
ENL	L	11	phalanx 1	42.1	13.8	8.6	12
mixed	S	3	phalanx 1	41.5	12.9	9	11.3
				Bp	**SD**		
ENL	K	6	phalanx 2	11.7	7.6		

date	trench	feat.	species / element	measurements			
			Cervus elaphus				
				BT			
mixed	A	27	humerus	52.5			
ENL	S	19	humerus	61.4			
				Bd			
ENL	G	10	radius	51			
				Bp			
mixed	S	3	tibia	80			
				GL			
ENL	T	4	calcaneus	130.7			
				GLl	**GLm**	**Dl**	**BD**
ENL	B	7	talus	56.9	53.9	30.3	35.6
(ENL)	P	2	talus	58.6	54	31.7	36.8
ENL	S	13	talus	63.7	60.9	35.8	40.8
				GB			
ENL	S	13	naviculocuboid	50.3			
				GL	**Bp**	**SD**	**Bd**
ENL	H	8	metatarsus				45
ENL	S	13	metatarsus	326	41.9	26.6	50.5
				Glpe	**Bp**	**SD**	**Bd**
mixed	S	3	phalanx 1	64.3	25.2	20.1	23.4
ENL	S	13	phalanx 1	63.5	25.5	19.4	22.9
				GL	Bp	SD	Bd
(ENL)	B	2	phalanx 2	44.6	25.5		21.9
ENL	S	13	phalanx 2	46.9	23.2	17.6	20.8
			Bos primigenius				
				Glpe			
ENL	G/H	1	phalanx 1	>73			
				GL	**Bp**	**SD**	**Bd**
ENL	G	10	phalanx 2	54.5	40.4	31.5	32.4
mixed	K	15	phalanx 2 (A?)	(51)	(>37.5)	29.5	31.4
			Canis lupus f. familiaris				
				GL			
mixed	S	3	metacarpus V	44.2			
			Equidae				
				GL	**Bp**	**SD**	
mixed	F	2	metacarpus	(280)	(51)	34.7	
			Capra aegagrus f. hircus				
				BG	**SLC**		
ENL	S	19	scapula	18.2	16.9		
				Bd	**BT**		
ENL	H	8	humerus	28.2	26.2		
ENL	L	11	humerus	28.6	26.3		
				Bd			
(ENL)	H	10	tibia	23.5			

date	trench	feat.	species / element	measurements			
				GLl	**GLm**	**Dl**	**Bd**
ENL	G	6	talus	24.4	23.3	14.2	16
ENL	S	13	talus	32.9	31.4	18	20
				GL	**Bp**	**SD**	**Bd**
ENL	K	6	phalanx 2	18.7	10.3	7.8	8.3
ENL	L	11	phalanx 2	20.1	10.8	8.6	9.2
			Ovis ammon f. aries				
				GLP	**LG**	**BG**	**SLC**
-	A	4	scapula	35	26.8	22.8	20.7
mixed	S	3	scapula			18.6	17.7
				SD	**Bd**	**BT**	
ENL	G	10	humerus		27.4	25.7	
ENL	G	10	humerus	13.2	27.4	26.6	
-	L	10	humerus			24.2	
ENL	S	22	humerus			26.8	
				Bp	**BFp**	**SD**	**Bd**
mixed	C	18	radius				24.8
mixed	G	2	radius	30	27.1	15.7	
ENL	G	10	radius	29.3		15.2	
ENL	G	10	radius				28.3
ENL	H	8	radius	29.6	26.8		
ENL	H	8	radius	28.3	25.5		
ENL	H	9	radius	(30)	28.2	16.8	
(ENL)	K	16	radius				25.8
ENL	L	11	radius	29.2	26.9		
(ENL)	N	1	radius				31.1
(ENL)	O	1	radius	32.3	29.3		
mixed	S	3	radius	27.5	25.1		
ENL	S	19	radius	29.7	26.9	15.7	
				BPC			
mixed	G	2	ulna	17			
				GL	**Bp**	**SD**	**Bd**
ENL	B	9	metacarpus		21.5		
mixed	D	17	metacarpus				23.8
ENL	G	6	metacarpus		20.2	12.5	
ENL	G	10	metacarpus		21.2		
ENL	K	12	metacarpus				22.43
ENL	L	11	metacarpus		(22.5)		
ENL	L	11	metacarpus	117.8	20.5	12	
ENL	S	13	metacarpus		19.5		
ENL	S	19	metacarpus			13.2	
ENL	T	4	metacarpus		20.5		
				Bp	**DC**		
ENL	L/K	10	femur	(46)	21.3		
ENL	S	13	femur	48	19.9		

date	trench	feat.	species / element	measurements			
				SD	**Bd**		
ENL	B/D	2	tibia	13.5	24		
ENL	L	11	tibia		23.2		
				GL			
ENL	G	7	calcaneus	53			
ENL	L	11	calcaneus	65.5			
ENL	T	4	calcaneus	52			
				GLl	**GLm**	**Dl**	**Bd**
ENL	B	9	talus		25.2		
ENL	B/D	2	talus	25.1	24.1	13.7	16.3
mixed	D	17	talus	25.3	24.8	14.5	16.7
ENL	L	11	talus	24.6	23.6	14	16.2
ENL	L/K	4	talus	25.4	24.3	14.1	15.7
ENL	S	13	talus	25.1	24	14.2	16.3
ENL	S	14	talus	25.3	24	14.4	15.9
ENL	S	14	talus	25.2	23.6	14.6	15.8
				GL	**Bp**	**SD**	**Bd**
mixed	A	18	metatarsus		21.2	12	
mixed	C	13	metatarsus				23.4
(ENL)	H	10	metatarsus		18.9	(11)	
ENL	L	11	metatarsus	(139)	18.9	11	
ENL	L/K	4	metatarsus		18.7	10.9	
ENL	L/K	10	metatarsus		19.4	12	
ENL	S	13	metatarsus		18.4	11.4	
ENL	S	19	metatarsus		19.5	11.3	
ENL	S	19	metatarsus		17.7	10.3	
ENL	S	19	metatarsus				20.5
ENL	S	19	metatarsus		18.2	10.9	
ENL	S	19	metatarsus		18.2	10.2	
ENL	T	5	metatarsus		17.1	9.5	
				GL	**Bp**	**SD**	**Bd**
ENL	B	9	phalanx 1	33.5	12	7.5	9.8
ENL	B/D	2	phalanx 1	35.4	12.4		10.6
ENL	G	6	phalanx 1			8..5	10.7
ENL	H	8	phalanx 1	32.5	12.5	9.1	10.7
ENL	L	11	phalanx 1	33		9.5	10.8
ENL	L	11	phalanx 1	37.4	12.6	9.9	11.8
ENL	G?	6	phalanx 1	34	11.7	8.5	10.8
mixed	S	3	phalanx 1	31.7	10.9	7.5	9.7
ENL	S	13	phalanx 1	33.2			
ENL	S	13	phalanx 1	33.8	11.8	8.9	10.4
ENL	S	13	phalanx 1			9.1	10.8
ENL	S	13	phalanx 1	38	12	9.3	11
ENL	S	19	phalanx 1	32.2	10.3	8.2	10.5
ENL	T	4	phalanx 1	36.7	11.5	8.6	10.8
ENL	S	13	phalanx 1	34.1	11.7	9.1	11.4
ENL	S	13	phalanx 1	37.4	12.2	9.2	11.2
ENL	S	28	phalanx 1	31.7	11.9	9.5	11.3

date	trench	feat.	species / element	measurements			
				GL	Bp	SD	Bd
ENL	B/D	2	phalanx 2	22			
ENL	H	8	phalanx 2	21.7	10.7	7.6	8.2
ENL	L	11	phalanx 2	22.5	10.6	7.3	8.7
ENL	O/P	3	phalanx 2	19.1	9.9	7.2	7.5
			Bos primigenius f. taurus				
				GLP	**LG**	**BG**	
ENL	S	19	scapula	74.8	61.4	49.4	
				Bd	BT		
ENL	S	13	humerus	102	91.5		
				Bp	**BFp**	**SD**	
mixed	C	22	radius	78.4	72.4	40	
				BPC			
ENL	L	11	ulna	39			
				Bd			
mixed	G	2	metacarpus	65.5			
(ENL)	K	20	metacarpus	(63)			
				LA			
ENL	L/K	9	pelvis	70			
				Bp	**DC**	**Bd**	
ENL	K	6	femur			90.5	
ENL	L	11	femur	117	49		
ENL	L/K	10	femur			97.2	
				Bp	**Bd**		
ENL	L	11	tibia		69		
ENL	L/K	10	tibia	100			
ENL	L/K	10	tibia		65		
				GLl	**GLm**	**Dl**	**Bd**
mixed	G	2	talus		60.2		
ENL	G	6	talus	67.4	63.9	39.6	41.9
ENL	H	8	talus	71.3		39.7	
ENL	O/P	3	talus	70	66.1	41	44.9
mixed	S	3	talus	68.4	63.8	38	46.9
ENL	T	3	talus	64.5	60.7	36.5	41.6
				GL			
ENL	T	7	calcaneus	139			
				GB			
mixed	H	2	naviculocuboid	65			
ENL	L	11	naviculocuboid	58.3			
				GL	**Bp**	**SD**	
mixed	C	22	metatarsus	(217)	43.8	24.7	
ENL	G	5	metatarsus			25.8	
mixed	P	3	metatarsus			26.1	
				Glpe	**Bp**	**SD**	**Bd**
ENL	G/H	1	phalanx 1	>73			
ENL	L	11	phalanx 1			27.2	29
(ENL)	B	2	phalanx 1A	56.8	31	26	28.3

date	trench	feat.	species / element	measurements			
mixed	D	2	phalanx 1A	69.08	38.1	32.0	34.3
ENL	H	8	phalanx 1A	61	34.2	32.0	31.4
ENL	H	8	phalanx 1A	63.3	36.7	30.2	36.7
ENL	L	11	phalanx 1A	59.2	32.5	21.8	29
ENL	L/K	7	phalanx 1A	63.1	31	24.5	28
ENL	S	22	phalanx 1A			25.2	30.2
mixed	G	2	phalanx 1P	60.3	29.6		
ENL	G/H	1	phalanx 1P	67		27	29
ENL	K	12	phalanx 1P	61.5		25	28
ENL	L	11	phalanx 1P	62.4	28.4	23.3	26.7
(ENL)	T	1	phalanx 1P			26.8	30.6
				GL	**Bp**	**SD**	**Bd**
ENL	G	10	phalanx 2	54.5	40.4	31.5	32.4
mixed	K	15	phalanx 2 A?	51	(>37.5)	29.5	31.4
ENL	G	5	phalanx 2A	39.6	31.3	24.1	26.7
ENL	O	5	phalanx 2A	39	31.5	25.3	27.7
mixed	S	3	phalanx 2A	46.8	39.6	32	34
ENL	B	9	phalanx 2P	46	33	25.8	27.6
mixed	C	21	phalanx 2P	43.8	28.9	22.7	24.3
ENL	P	4	phalanx 2P		30.1	23.5	26.2
				DLS	**Ld**		
ENL	L	11	phalanx 3	69.4	57.6		

Appendix 3 Measurements taken on the bird and mammal remains.

Appendix 4

datation	trench	feature	species	Grant (1982) Tooth Wear Stages					Payne age class
				Pd4	P4	M1	M2	M3	
ENL	P	11	Ovis				g		-
ENL	K	6	C/O	g		c	V		C
ENL	H	8	Ovis	g		d			C
ENL	G	10	C/O (Ovis ?)	h		c	V		C
ENL	L	11	C/O				V		C
ENL	B	9	C/O				V		C
ENL	G	10	C/O (Capra ?)			c	V/E		C
(ENL)	M	15	C/O			x	E		C
(ENL)	B	2	C/O (Ovis ?)	g					CD*
ENL	B	7	Ovis	g					CD*
ENL	B/D	2	C/O (Ovis ?)	g					CD*
ENL	G	7	C/O	g		e/f			CD*
ENL	B	9	C/O (Ovis ?)	h					CD*
ENL	B	9	C/O	h					CD*
mixed	C	18	Ovis	h					CD*
ENL	S	22	C/O	h					CD*

datation	trench	feature	species	Grant (1982) Tooth Wear Stages					Payne age class
				Pd4	P4	M1	M2	M3	
ENL	L	11	C/O	h					CD*
ENL	S	16	C/O	m		g	d/e		D
ENL	H	9	C/O	x		f/g	b		D
ENL	B/D	2	C/O (Capra ?)				d		D
(ENL)	K	10	C/O				d		D
ENL	B/D	2	C/O		x	f/g	d		D
(ENL)	D	14	C/O (Ovis ?)		U	g	e		D
mixed	P	3	Ovis					b	E
ENL	G	10	Capra		j	j	g	f	F
mixed	R	2	Ovis					f	F
ENL	P	7	Ovis			j(?)	g	f	F
ENL	L	11	Ovis		h	k	g	f/g	G
ENL	L	11	Ovis		g	h	g	g	G
ENL	L/K	7	Ovis		j		g	g	G
ENL	S	28	Ovis		j	l	g	g	G
ENL	L	11	C/O		k	m	j	g	H
-	K	8	C/O				h	h	I
ENL	L	11	C/O					h	I
ENL	T	4	C/O					h	I
mixed	A	10	C/O					h	I
ENL	T	4	C/O					m	I

datation	trench	feature	species	Pd4	P4	M1	M2	M3	Halstead age class
ENL	G	6	Bos						A
ENL	L	11	Bos	f		E			B
ENL	L	11	Bos			U/a			B
ENL	P	6	Bos	x		E/1/2			B
mixed	M	3	Bos			b			C
ENL	K	12	Bos					g	G
ENL	S	19	Bos	j					-
ENL	L	11	Bos	j					-
ENL	L	11	Bos	j					-
mixed	S	3	Bos		h	l			-
ENL	K	6	Bos			l			-

*: estimated using Grant (1982)

Appendix 4 Dental data of sheep/goat and cattle.

Chapter 16

Archaeobotanical studies on the Early Neolithic structures from Bucova Pusta IV

Elena Marinova

Introduction

The archaeobotanical study of plant macro-remains from Bucova Pusta IV which is presented here was conducted in the framework of the archaeological research project on the neolithisation of the Banat by the University of Tübingen (Raiko Krauß) and the Museum of the Banat in Timişoara (Dan Ciobotaru), which started in 2009 and is still ongoing. The field campaigns (2010 and 2012–2015) involved regular sampling of all structures which promised to provide archaeobotanical information. During the first year of excavation, 2010, due to the mixed character of the prehistoric horizon and its deterioration by Medieval burials, no archaeobotanical samples were processed. From 2013 onwards, all samples, including those from 2012, were processed by manual flotation. Thus, the study targeted numerous structures over the entire excavated area, aiming to obtain a large dataset, and thus to explore the general tendencies and variability over time and space of the archaeobotanical assemblages deposited at the site during the 58th century BC. Therefore, the design of the overall archaeobotanical study was intended to provide insight into the development of plant subsistence as representative for the Neolithic occupation of the Bucova Pusta IV site.

A preliminary study of the bioarchaeological assemblages from the site (Krauss et al. 2018a) also indicated rich and diverse archaeobotanical finds, dominated by einkorn, including not only grains, but also numerous chaff fragments (threshing remains) and weeds, i.e. by-products of crop processing. In the current study, we take the opportunity to focus on the Early Neolithic Criş IIB (~5700 calBC) period, which is important for understanding the neolithisation of the region, and relate to its societal and technological innovations. Moreover, the child inhumation structure unearthed give us the chance to discuss the associated botanical finds in respect to a possible ritual function.

Material and Methods

The material studied comprises charred and a few mineralised plant macrofossils, and charred wood (or woody vegetative remains) originating from soil samples taken in the excavation seasons of 2012–2015 from several trenches (G, H, K, L P, S) and resp. the structures uncovered there. All the material considered belongs to the Early Neolithic, being absolutely dated to the period of ca. 5750-5650 calBC (see Chapter 20). The sediment was mostly taken from ovens and

Fig. 1 Fruit fragments of water chestnut (Trapa natans) from the Early Neolithic layers of Bucova Pusta IV (left and central microphotograph, scale 1 mm) and recent fruits of the plant.

several pits, but also more generally from the cultural layer, and also from an inhumation. In order to extract the plant macro-remains, the sediment was processed by manual flotation. The sieve meshes for the flotation were sized 2 mm, 1 mm, and 0.3 mm, aiming also to capture the smallest plant macrofossils. The plant remains extracted by means of manual flotation were then studied at the field lab of the excavation, but primarily thereafter in the laboratory of Center for Archaeological Science, KU Leuven. The laboratory work included sorting and identification of the plant remains preserved in the samples, and the identification of the plant remains was finalised using the reference collections of RBINS, Brussels. This work was conducted with the aid of low magnification stereomicroscope (from 10x to 70x). A further important part of the laboratory work was the study and identification of wood and culm fragments under reflected light microscope. After the primary identification, all the archaeobotanical data (Tab. 1) was stored in the archaeobotanical database program ArboDat (Kreuz/Schäfer 2002), and thus in a format compatible for further analyses and comparisons. To evaluate the archaeobotanical assemblages, basic qualitative and quantitative approaches (such as calculations of concentration, diversity, or frequency of the plant remains) were also applied. The plant taxa identified were grouped into their main ecological and economic groups, and subsequently the proportions between the sums of these were calculated. In order to interpret the archaeobotanical evidence, the contextual information available on the different structures from which the plant remains hail was used.

Results

Macro-botanical analysis

Overall composition of the macrobotanical assemblages and preservation of the plant remains

The current study is based on total of 1353 identifiable plant macro-remains extracted from a total of 643 litres of sediment. Most of the archeobotanical finds are charred (94 % of the total) while mineralised remains (5 %) and few subfossils (1 %) play only a minor role. However, numerous remains of awn fragments, which are only semi-quantifiable, are also preserved in mineralised state, especially in the oven structures. The overall impression is that the samples from the Early Neolithic period are not rich in archaeobotanical finds. From the total of 32 archaeobotanically sampled Neolithic features, only 21 contained archaeobotanical remains. Therefore, the subject of the detailed analysis presented here comes from the 35

archaeobotanical samples taken from those 21 features. Most of the archaeobotanical assemblages found in those features demonstrate moderate preservation, and very variable diversity: They contain between 3–36 (in average 13) different plant taxa, and the concentration of the plant remains within them is on average ca. 5 identifiable items per litre.

The preservation of the charred plant remains, which represent the majority of the archaeobotanical finds, is rather variable. Most of the samples are dominated by finds, which due to bad preservation are identifiable only up to a very broad taxonomic level (i.e. genus, family, or even higher taxonomic group). Most of the samples contain typically small fragments of glume bases from hulled wheat (*Triticum monococcum/dicoccum/timopheevii*), and fragmented or not further identifiable due to their abraded surface "Cerealia" grains. Also commonly occurring in the samples category are the seeds of wild growing plants belonging to the goosefoot genus (*Chenopodium*) either part of the used at the site wild plant resources or of the ruderal flora accompanying the settlement. Finally, the frequency of remains of various gathered plants (*Cornus mas, Physalis alkekengi, Rubus caesius/idaeus, Prunus* sp., *Quercus* sp., *Stipa* sp., *Trapa natans*, Fig. 1) is also high, these come from variety of habitats such as wetland, grassland, and open woodland.

Macrobotanical composition of specific structures

Several feature types provided samples containing archaeobotanical remains: cultural layer (n=5), ovens (n=6), pits (n=7), a well (n=1), a vessel (n=1), and an inhumation (n=4); thus, a total of 21 different features provided representative archaeobotanical information (Appendix). Only one sample displays a very high concentration of plant remains (44 per litre). It comes from the contents of a vessel found in Feature I/J-13. The nature of the sample and advantageous conditions for preservation within the protective milieu of the vessel, thus differing from the rest of the samples, played a positive role in preserving these remains. In this sample, few sub-fossil remains were also identified together with the charred plant remains, this confirming once again its exceptional status. Here at trench I-J, the only finds of flax (*Linum usitatissimum*) from the site were also recorded.

Several samples coming from the oven features are of special interest. These samples (features G.6, K.12, S.15) alongside an example from a dwelling (D-19) display slightly higher concentrations of plant remains (6 to 13 per litre). In all the cases, this is related to a rather high concentration of glume bases of hulled wheat (*T. monococcum/dicoccum/timopheevii*). Furthermore, the samples are rich in mineralised chaff fragments; the majority of those which are recognisable are awn fragments. The archaeobotanical finds, which are strongly dominated by charred glume bases and further chaff remains like awns, could be related with some crop processing activity or the use of the chaff (threshing remains) as fuel. Next to the numerous charred glume bases, some charred grains of einkorn and Cerealia which could not be further identified were also found, along with seven fragments of oak fruits (acorns). The latter need usually to be at least roasted to become suitable for human consumption (Ayerdi et al. 2016).

Another structure deserving special attention is the inhumation, where four samples, with sediment volume comprising of 54 litres in total, delivered numerous fragments of cornelian cherries (*Cornus mas*), plums (*Prunus* sp.), and awn fragments of feather grass (*Stipa* sp.). Together with them, some remains of cereal chaff and some seeds/fruits

Feature type	**pit**	**pit**	pit	pit	pit	pit	pit	pit	inhumation	cultural layer	cultural layer	cultural layer	cultural layer	cultural layer	oven	oven	oven	oven	oven	oven	
sediment vol. [l]	5	65	16	6	75	51	24	43	54	10	5	4	8	75	19	5	90	10	36	11	
feature number	G6	G6/ H9	H8	H9	P4	S22	S22	S24	S14	C18	D19	G5	L/ K7	S13	G6	G7	G7/ 10	G10	K12	S15	**sum**
Oak forest																					**200**
Acer									9			1					4				14
Quercus	15	34		7	13	15	5	7	2				4	23	12		26	5	11		179
Viburnum									5			2									7
Oak forest edge/ shrubsland																					**89**
Cornus mas		9	3		2	6	2	1	4	2				8	3		12		5	1	58
Corylus avellana					3					1											4
Prunuoideae										4							3				7
Maloideae				5				3	7					5							*20*
Riparian vegetaion																					**173**
Alnus		5	2		4		6		2	4					7		6		4		40
Fraxinus	2																2				4
Ulmus		18			5			8	3					12	7		3		9		65
Salix/Populus					6			2						2			5				15
Phragmites		4	8		5	7	6	4			6			5			4				49
Sum identified wood fragmets																					**462**
not assigned																					
Monocotyledonae		12	7		4	3	11		8		14			9	5		19		7	2	101
stalk/ twig		9		3	12	13			21										12		70
Indet	2	15	3	2	7		5	14	3	2	7	3	8	2	1	2	5	3	7	4	95

Tab. 1 Wood charcoal dataset from the Neolithic, summarised by features.

of the wild growing vegetation could also be identified.

The plant remains from the house structure, the pits, and more generally from the cultural layer mostly contain smaller quantities, albeit more diverse assemblages of plant remains. However, these are also dominated by cereal chaff and grains, and some gathered plants, a pattern observable as a tendency common for the complete archaeobotanical assemblage of Bucova Pusta IV. Probably, this common feature is to be explained with the so called "background noise" sensu Bakels (1991), coming from the refuses scattered around the site, which became charred and finally incorporated in the cultural layer, whether intentionally or not.

Anthracological analysis

The material available for anthracological analysis demonstrated that the most numerous fragments are of oak (*Quercus* sp.), followed by elm (*Ulmus* sp.), cornel (*Cornus* sp.), and ash (*Fraxinus sp.*), and some minor components of wood occurring just as sporadic finds (alder, hasel, maple, poplar/willow, plum, Maloideae, *Viburnum*, see Tab. 1). In several samples, it was possible to identify fragments of reed culms (*Phragmites*) among the wood charcoals, probably reflecting use of wetland vegetation in some constructions or as matting at the site. The wood charcoals are strongly fragmented, and although most of the samples contain wood fragments, only a limited part of those fragments (n=462) was well preserved and reached the required size (over 0.5 mm) to be reliably identifiable. Various impressions of wood and reed are also preserved on the burnt fragments of hut clay, although these cannot be assigned to any specific taxa (see Chapter 8).

Discussion

The plant economy of the Early Neolithic period – Criş IIB

Cultivated plants

Einkorn wheat (*Triticum monococcum*) was a major cereal crop which was found regularly in the studied samples and probably represented the staple cereal crop at the site. Emmer (*Triticum dicoccum*) and barley (*Hordeum vulgare*) were also used, but they seem to be less common, and not so numerous in the studied archaeobotanical samples, thus being of less importance. The phytolith analyses from the site of Movila lui Deciov, the occupation of which begins somewhat earlier, but in its later phase chronologically overlaps with that of Bucova Pusta IV, and is situated only 5 km west from Bucova Pusta, also indicated the importance of barley in the plant economy of the area from the very beginning of the Neolithic in that region (Moravetz 2003). Another site from the Banat which delivered quantitative archaeobotanical assemblages from the Early Neolithic, namely Foeni-Sălaş (Greenfield/Jongsma 2008) also indicates einkorn as the main annual crop there. Early Neolithic sites belonging to the Starčevo and Körös Cultures, situated in the adjacent Danubian Sárköz area, also demonstrate the quantitative dominance of einkorn (Kreuz et al. 2021), while those situated in the north-east, in the Tisza catchment indicate the importance of barley, followed by the hulled wheats emmer and einkorn (Gyulai 2010). Quantitative evidence for this period from the adjacent regions of Serbia is still very scarce (Filipović 2014), but the quantified archaeobotanical assemblages as of yet available from the sites of Blagotin (Greenfield/Jongsma Greenfield 2014) and Starčevo (Medović 2011) also indicate einkorn as main cereal crop; in turn, einkorn is the main cereal crop along with barley at At II (de Vareilles et al. 2022). The dominance of einkorn and barley was also visible in the early phases of the Neolithic in sites with well-quantified archaeobotanical assemblages from North Bulgaria (Marinova 2009; Marinova/Krauß 2014) reflecting also similar agricultural adaptations between the regions of the Southern Carpathian/Pannonian Basin and the northern Balkans. This uniformity and reduction of the crop diversity compared to the earlier Neolithic sites from the south-east (the Sub-Mediterranean and Mediterranean zone) could also be related to the specific ecological gradients limiting the growth and productivity of some founder crops when introduced outside their natural distribution range (Krauß et al. 2018b; Ivanova et al. 2018).

The importance of pulses at Bucova Pusta IV is difficult to estimate, as many of the

finds are unidentifiable due to fragmentation and abraded surfaces of their seeds. The few identifiable seeds of leguminous crops belong mostly to lentil (*Lens culinaris*), and only one to pea (*Pisum sativum*). They occur only in 14 % of the studied features. This evidence suggests that the pulses were more likely a minor component of human diet at the site. The low number of pulses could possibly be explained with the importance of aquatic resources, which also provided additional source of proteins, as revealed by the studies of archaeozoological assemblages (see Chapter 15). The importance of aquatic resources in the northern Balkans and the Starčevo cultural area was revealed by residue analyses of pottery, and can be explained by the persistence of Mesolithic traditions in this area (Cramp et al. 2019). The geographically relatively closely situated site of Ecsegfalva, belonging to the Körös Culture also revealed an extremely low number of pulses (one lentil seed in 125 features studied, Bogaard et al. 2007). However, this could be also an artefact of poor preservation, as most of the Early Neolithic sites in the Pannonian plain and the Lower Danube contained a low amount of pulses, albeit frequently individually (Ivanova et al. 2018). In the continental zone to the south of the Banat at least, in central Serbia, the lentil and pea were of significance for the plant economy considering their storage finds from several sites belonging to the Starčevo Culture, i.e. Medurec, Drenovac, and Starčevo (see Filipović 2014 and literature cited therein). Further to the south-east at Ohoden Valoga, lentil and pea are present also only in individual finds, but occur in ca. 40 % of the features studied, which points to a greater importance of pulses in the economy compared to Bucova Pusta IV.

Thus, the combination of einkorn, barley, and lentil at Bucova Pusta IV indicates that the crops typical for the Early Neolithic in the Banat and the adjacent regions (see de Vareilles et al. 2022; Kreuz et al. 2020; Marinova/Krauß 2014) also predominated here and that pulses had less importance that the adjacent areas situated to the south and south east in the possible ancestral areas.

Remarkable is the occurrence of flax in the Neolithic layers of the site, present with several remains, but in only one trench (i.e. I-J), namely the vessel contents I/J-13, and a single charred seed in well/pit Feature I/J-10. Generally, flax is very rarely found in the Early Neolithic of the study region, attested with imprints of fibre, identified as flax from the Körös-Culture site of Gyomaendröd (Gyulai 2010), and considered to occur more frequently from the LBK period onwards (Kreuz et al. 2020b) in the broader region. Considering the adjacent areas in the southeast, a few single linseed finds are known from a burial context at the site of Ohoden Valoga and the cultural layer of the site of Koprivets in northern Bulgaria (Marinova 2009; Marinova/Krauß 2014). More systematic studies and better preserved archaeobotanical assemblages as well as the direct dating of the controversial remains will probably aid in resolving this presently unclear situation.

Gathering

In addition to cultivated plants, the archaeobotanical finds from Bucova Pusta IV display a large number and diversity of collected plants, i.e. at least eleven of the identified taxa can be considered as such (*Chenopodium sp.*, *Cornus mas*, *Corylus avellana*, *Fragaria/Potentilla*, *Malus/Pyrus*, *Physalis alkekengi*, *Rubus caesius/idaeus*, *Prunus sp.*, *Quercus sp.*, *Stipa sp.*, *Sambucus sp.*, *Trapa natans*). It is difficult to estimate the importance of the wild plant resources versus cultivated plants, but this diversity of wild plants and the frequent occurrence of these in the cultural layer of the site cannot

be ignored. The most common and numerous among the gathered plants in Bucova Pusta IV are the remains of cornelian cherry, plums, and water chestnut, respectively found in 52 %, 47 %, and 28 % of the features studied. The archaeobotanical assemblage from the site of Foeni-Sălaș, about 70 km to the south (Greenfield/Jongsma 2008) also indicates cornelian cherry as one of the most important gathered plants (29 % of the studied features). Cornelian cherry and plums are typical for the Early Neolithic of not only South-eastern Europe, but also of the Pannonian Plain, and are common in the Körös and LBK archaeobotanical assemblages (Kreuz et al. 2021).

The use of wild plant resources and their diversity is a common characteristic of both Mesolithic and Neolithic communities in the broader study area, and the possible ancestor areas of South-eastern Europe (Ivanova et al. 2018). Looking at the archaeobotanical evidence, it appears that same 'set' of taxa were consistently in use throughout the Late Mesolithic and Early Neolithic in the study area, suggesting unchanged availability of the (local) resources, as well as a continuity of the 'gathering aspect' of the subsistence economy (Marinova et al. 2013).

Another important component of the group of gathered plants is the water chestnut (Fig. 1), a plant typically found at Körös sites (see Bogaard et al. 2007; Kreuz et al. 2021), but also occurring in the south at several Neolithic sites in northern Bulgaria (Marinova/Krauß 2014), and continuing to serve as a component of the plant economy during the Late Neolithic and Chalcolithic in this region (Borojević 2009).

One very frequently occurring plant at Bucova Pusta IV is the goosefood (occurring in 57 % of the studied features), which originates from wet and damp areas, and was potentially gathered. Its frequent occurrence was also observed in the Starčevo, Körös, and LBK sites from Hungary (Kreuz et al. 2021), southern Poland (Mueller-Bieniek et al. 2018), and south-western Germany (Heidgen et al. 2020). Interestingly all the tree LBK areas with those finds are more or less marginal for the distribution of the culture, and probably were also orientated to exploit additional food resources from the wild growing vegetation.

Looking at the evidence from the gathered plants, it seems that the Neolithic population which came from the Balkans into the region of the western Carpathian basin (Transdanubia) adopted quickly to the local condition, by using habitats known from their ancestral areas in the south-east. The possible difficulties and irregularities in the agricultural production were probably supplemented with the extended reliance on wild growing resources from the wetlands, riparian forests, and open woodland areas, and even forests-steppes or stony outcrops, if we consider the frequent finds of feather grass.

Woodland vegetation and land use signals

Based on anthracological study of Bucova Pusta IV, it is evident that mainly open oak forests were developed in the site's surroundings, with rich undergrowth also including fruit-bearing small trees. Furthermore, oak was a component of the riparian forests, which were also developed in the site's vicinity according to the wood charcoal assemblages. The overall anthracological assemblage is well in line with the picture known for the same period in eastern Hungary, corresponding to a mosaic of diverse plant communities in which three major types could have predominated: oak dominated forest-steppe near the sites, oak–elm–ash forest in the river floodplain, and willow–poplar forest on the riverbanks (Moskal-del Hoyo 2013). The wetlands also played an important role in the plant economy of the site. This could

also be explained with the presence of those plant habitats in the site's surroundings, and the various uses of their resources, also attested by the results from the wood charcoal analysis. This is not only indicated by the wood from alluvial/riparian habitats (like poplar, willow, elm, ash), but also by the fact that ca. 8 % of identified "charcoals" belong to reed (*Phragmites* sp.), a plant growing in the shallow water area around swamps and riverbanks. This circumstance fits well to the natural conditions during the first half of the 6th millennium BC. Reed, along with twigs and narrower wooden beams, was also used as a construction material for building houses, as evidenced by imprints in the burnt clay walls. The landscape was characterised by numerous watercourses, and their vegetation cover, especially the reeds, was used at the settlement as building material, for matting, and possibly also as fuel. The palynological studies from the lowland of the Banat also confirm on a broader scale this mosaic character of the landscape during the Early Neolithic, consistently present from around 6000 calBC onwards. Finds of palynological anthropogenic indicators and charred particles point to the importance agricultural activities and the use of fire in the region's land management practices (Gumnior/ Stobbe 2021).

How the plant remains became incorporated into the cultural layer

The macrobotanical analysis revealed the dominance of plant remains coming from cereal crops (mostly by-products of crop processing like chaff and awns as well as weeds) and gathered fruits/seeds. All of these remains reflect the processing of plants which were later used for food. While most of them come from cultivated fields and open woodland, several elements of the wetland vegetation are also present. Feather grass, a plant typical for open grassland or steep hills, indicates that such habitats were accessible for the inhabitants of the site. It was probably brought to the site as a subject of gathering (i.e. for its fruits), but the awns could also have been used for decoration or some ritual activities (see Bieniek 2002 and literature cited therein).

Many of the cereal grains ("Cerealia indet.") and chaff fragments (*T. monococcum/ dicoccum/timopheevii*) could not be identified on account of the poor state of preservation. Nonetheless, they should mostly belong to einkorn, considering the identifiable grains and chaff. Their strong fragmentation and surface abrasion suggest either redeposition, or that they were abraded prior to charring and deposition, for example within food processing activities.

The majority of the archaeobotanical samples studied come from the cultural layer, and their composition has a mostly mixed character from different activities, representing the "settlement noise" as Bakels (1991) terms it (see above section "Macrobotanical composition of specific structures"). Cereal threshing residues were also regularly added to the clay used to build the houses (see Chapter 8) and are also found as organic admixtures in the matrix of the pottery (see Chapter 11).

The oven structures most probably contained the remains of combustion activities which at least partly reflect the fuel used in them. The high proportion of einkorn chaff can be explained by the fact that the by-products of de-husking were further used, and became incorporated into the fuel either as part of crop processing (kiln-drying before de-husking) or directly as waste. Most probably, the oakwood identified by means of the wood charcoal analysis originates from burning of fuel. This could be also the case for the fruit stones and shells, which could be discarded

there, but also as in the case of water chestnut, hazel, and acorns (see Borojević 2009; Holst 2010; Ayerdi et al. 2016) which could also be roasted prior to human consumption.

The archaeobotanical assemblage of the inhumation is dominated by finds of fruits, with cornelian cherry, plums, and oak numbering among them; however, chaff remains of cereal crops, some wild growing plants, and awn fragments of feather grass also occur. Cornelian cherries are known as burial goods from Mesolithic burials in the Danube Gorges (Filipović 2020), and the large quantity of cornelian cherry (n=19) in the presently examined inhumation could also be related with intentional placement. This could be also the case for the other fruit remains, i.e. plums and acorns. It is moreover interesting to mention that the feather grass (*Stipa* sp.) was also part of archaeobotanical burial finds at the site of Ohoden Valoga (Marinova 2009). Therefore, its presence Bucova Pusta IV must be considered with special attention. The chaff remains and other seeds which are generally common for the archaeobotanical assemblages of the site also suggest that a certain admixture of general settlement deposits to those of the inhumation is highly probable.

Conclusions

The archaeobotanical study of Early Neolithic macrobotanical assemblages from Bucova Pusta IV suggests that the main annual crops used during the period were hulled wheats (mostly einkorn and to a lesser extend emmer), accompanied by barley as well as some pulses (at least lentil and pea), all known as principal crops in the study area already from the beginning of the Neolithic. The most common weeds generally typical for the study period such as *Galium* sp., *Polygonum convolvulus* also predominate among the potential weeds from Bucova Pusta IV, showing that the site´s agricultural practices fit well with those from the eastern Carpathian basin. The finds of flax add another element to the Neolithic plant economy; however, they are scarce and occur in few features, so further studies must confirm or reject their status in the Early Neolithic economy of the region.

Further elements of the plant economy were gathered plants (fruits and nuts) originating from diverse habitats in the sounding like wetlands or damp places (*Chenopodium* sp., *Physalis alkekengi*, *Trapa natans*), open woodland/shrubland, which partly can also belong to the riparian forests (*Cornus mas*, *Corylus avellana*, *Malus/Pyrus, Prunus* sp., *Quercus* sp., *Sambucus* sp.), and even grassland (*Stipa* sp.). Considering the diversity of food potentialy originating from wild plants, it seems that gathering played a prominent role in the subsistence economy of Bucova Pusta IV in addition to cereal cultivation.

Although dominated by oak, the wood charcoal assemblages demonstrate a wide diversity, and also a considerable proportion of small trees and shrubs demanding light, as well representatives of the riparian vegetation. This composition suggests a rather diverse mosaic character of the vegetation cover developed in the surroundings of Bucova Pusta IV, and that all those different habitats were accessed by the sites inhabitants on regular basis.

Hence, apart from the cultivated fields, the open woodland, the wetlands and forest-steppe habitats also played a significant role in the plant economy of the site, providing not only food resources, but also fodder, fuel, and construction materials. This is an essential feature of the archaeobotanical assemblages studied, and underlines an important aspect in the economy of this

settlement also observed by means of the other environmental archaeological disciplines. Thus, besides the Neolithic arable crops introduced into the area, the local, terrestrial and aquatic resources played a significant role, too. The overall composition of the archaeobotanical assemblages studied strongly suggest that crop and food processing along with fuel were the main source of the macro-botanical remains deposited in the Early Neolithic structures.

Appendix *(next pages)*

Macrobotanical dataset from the Neolithic of Bucova Pusta IV (BucP IV)

Abreviations:

Type of remains (TR): Sa/Fr=seed/fruit, Kapz=capsule fragment,Veget=vegetative part, Frfl=fruit flesh, BGF=bread/porridge/ fruit flesh

Preservation type (PT): ch=charred, mi=mineralised, sf=sub-fossil

Sample nr.	Feature name	Feature Type	sample volume [l]	sum plant remains	concentration of plant remains per liter	diversity (umber taxa per sample)	Riparian/ Floodplain Vegetation: *Bolbo-schoenus* Sa/Fr ch	*Carex spec.* Sa/Fr ch	*Eleocharis palustris agg.* Sa/Fr ch	*Glyceria spec.* Sa/Fr ch	*Polygonum lapathifolium/ persicaria* Sa/Fr ch	*Trapa natans* Sa/Fr ch	Grassland Vegetation: *Phleum pratense s.l.* Sa/Fr ch	*Stipa spec.* Sa/Fr ch	*Stipa spec.* Awn ch
BucP IV 14/7	I/J13	vessel content	1	44	44,0	14									
BucP IV 15/42	I/J10	well	18	125	6,9	9									
BucP IV 15/45	I/J10	well	20	27	1,4	9									
BucP IV 15/46	I/J10	well	16	22	1,4	9									
BucP IV 13/1	G6	pit	5	16	3,2	6									
BucP IV 14/1	G6/ H9	pit	65	35	0,5	15									
BucP IV 13/4	H8	pit	6	27	4,5	7						1			
BucP IV 13/5	H8	pit	5	12	2,4	5						1			
BucP IV 13/8	H8	pit	5	11	2,2	6						1			
BucP IV 13/9	H9	pit	6	16	2,7	7									
BucP IV 15/7	P4	pit	75	185	2,5	35	1			1	2			3	5
BucP IV 15/37	S22	pit	27	45	1,7	11						1			
BucP IV 15/44	S22	pit	24	30	1,3	9									
BucP IV 15/31	S24	pit	43	87	2,0	16									
BucP IV 15/18	S14	inhumation	19	24	1,3	7									5
BucP IV 15/19	S14	inhumation	15	15	1,0	5									
BucP IV 15/36	S14	inhumation	5	21	4,2	6							1		4
BukP IV 15/29	S14	inhumation	15	27	1,8	9			2					1	5
BucP IV 13/3	C18	cultural layer	5	15	3,0	7									
BucP IV 13/7	C18	cultural layer	5	18	3,6	5									3
BucP IV 13/6	D19	cultural layer	5	57	11,4	5									
BucP IV 13/2	G5	cultural layer	4	11	2,8	5									
BucP IV 14/13	L/K7	cultural layer	8	16	2,0	7									
BucP IV 15/25	S13	cultural layer	45	46	1,0	14						1	1		1
BucP IV 15/33	S13	cultural layer	30	54	1,8	10			1		1				
BucP 12/17	G6	oven	12	27	2,3	12								1	2
BucP 15/21	G6	oven	7	93	133	11						1		2	5
BucP IV 13/10	G7	oven	5	26	5,2	3									
BucP IV 14/2	G7/ 10	oven	90	26	0,3	12									
BucP IV 13/11	G10	oven	10	19	1,9	7						1			
BucP IV 14/11	K12	oven	12	43	3,6	9									
BucP IV 14/12	K12	oven	15	10	0,7	5									
BucP IV 14/15	K12	oven	7	14	2,0	7						1		1	
BucP IV 14/16	K12	oven	2	12	6,0	5									
BucP IV 15/38	S15	oven	11	93	8,5	11		1							
sum								1	3	1	3	8	2	8	30
frequency in %								3	6	3	6	23	6	14	23

	Trifolium spec.	*Verbena officinalis*	**Ruderal Vegetation**	*Chenopodium album*	*Chenopodium spec.*	*Malva spec.*	**Crops**	*Hordeum vulgare undiff.*	*Hordeum vulgare undiff.*	*Triticum dicoccum*	*Triticum dicoccum*	*Triticum monococcum*	*Triticum monococcum*
	Sa/Fr	Sa/Fr		Sa/Fr	Sa/Fr	Sa/Fr		Sa/Fr	rachis	Sa/Fr	chaff	Sa/Fr	chaff
Sample nr.	ch	ch		ch	ch	ch		ch	ch	ch	ch	ch	ch
BucP IV 14/7													
BucP IV 15/42													26
BucP IV 15/45					1								2
BucP IV 15/46				1	3								
BucP IV 13/1												2	6
BucP IV 14/1					2			8		1		2	
BucP IV 13/4					2								
BucP IV 13/5												1	2
BucP IV 13/8								3				1	
BucP IV 13/9												1	1
BucP IV 15/7	2			4	7	1		2		1	2	8	6
BucP IV 15/37	1				18			5					
BucP IV 15/44	2				4	1							
BucP IV 15/31	2				5	1		1	1			2	8
BucP IV 15/18													
BucP IV 15/19													
BucP IV 15/36					4								
BukP IV 15/29					1								
BucP IV 13/3	1							3					
BucP IV 13/7													1
BucP IV 13/6												4	12
BucP IV 13/2					2								
BucP IV 14/13								2	1			1	
BucP IV 15/25		1											
BucP IV 15/33				9	16							2	
BucP 12/17	3							2				1	
BucP 15/21					2							5	12
BucP IV 13/10												5	
BucP IV 14/2				2		1		3				2	
BucP IV 13/11					1								2
BucP IV 14/11					1			1					18
BucP IV 14/12													1
BucP IV 14/15													
BucP IV 14/16													1
BucP IV 15/38								6				2	
sum	11	1		18	66	4		36	2	2	2	39	98
frequency in %	17	3		11	43	11		31	6	6	3	43	40

	Triticum monococcum/ dicoccum		*Triticum monococcum/ dicoccum*		*Triticum monococcum/dicoccum*	*Cerealia indet.*		*Lens culinaris*		*Pisum sativum*		*Fabaceae (kult.)*		*Linum usitatissimum*		*Linum usitatissimum*		*Linum usitatissimum*		*Ajuga chamaepitys*	
	Sa/ Fr		chaff			Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		style		Sa/ Fr	
Sample nr.	ch		ch	chaff	sf	ch		ch		ch		ch		ch		sf		ch		ch	
BucP IV 14/7			3		1									2		5				1	
BucP IV 15/42	78					2		2				1									
BucP IV 15/45			7																		
BucP IV 15/46			4											2		6		2			
BucP IV 13/1	1					3															
BucP IV 14/1	2		7			4		1													
BucP IV 13/4	3		13			6															
BucP IV 13/5			5			3															
BucP IV 13/8			2			3															
BucP IV 13/9			3			7						1									
BucP IV 15/7	5		54			28		3		1		16		1							
BucP IV 15/37			9			2		1													
BucP IV 15/44	3		11			5														1	
BucP IV 15/31	9		33			17														1	
BucP IV 15/18			3			1															
BucP IV 15/19			4																		
BucP IV 15/36			2																		
BukP IV 15/29																					
BucP IV 13/3			2			6						1									
BucP IV 13/7			12			1															
BucP IV 13/6	7		25			9															
BucP IV 13/2			4			3															
BucP IV 14/13	4					6															
BucP IV 15/25	4		17			14															
BucP IV 15/33			12			9															
BucP 12/17	1		7			4														1	
BucP 15/21	3		47			14															
BucP IV 13/10			18			3															
BucP IV 14/2	7					5															
BucP IV 13/11	1		4			9															
BucP IV 14/11	2		12			6															
BucP IV 14/12	1		2			5															
BucP IV 14/15			3			5															
BucP IV 14/16			2			4															
BucP IV 15/38	15		37			21															
sum	146		364	1		205		7		1		19		5		11		2		4	
	49		86	3		83		11		3		11		9		6		3		11	
Potential Weeds																					

	Avena/Hordeum		*Bromus* spec.		*Galium spurium*		*Polygonum convolvulus*		*Setaria verticillata/viridis*		*Vicia hirsuta/tetrasperma*		**Deciduous Forests/ Shrubbery**		*Cornus mas*		*Corylus avellana*		*Malus/ Pyrus*		*Physalis alkekengi*		*Physalis alkekengi*		*Prunus* spec.	
	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch			Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	ch	Sa/ Fr	sf	Sa/ Fr	ch
Sample nr.																										
BucP IV 14/7																1						4		19		
BucP IV 15/42																5								2		
BucP IV 15/45																						1		6		
BucP IV 15/46																										
BucP IV 13/1																		1				3				
BucP IV 14/1											2					1						2				1
BucP IV 13/4							1																			1
BucP IV 13/5																										
BucP IV 13/8																1										
BucP IV 13/9			1				2													1						
BucP IV 15/7					2		7				3					1	2			1						2
BucP IV 15/37							2															3				2
BucP IV 15/44																2										1
BucP IV 15/31					2		2									1										1
BucP IV 15/18																8						3				2
BucP IV 15/19																6										3
BucP IV 15/36																										
BukP IV 15/29																5						4				7
BucP IV 13/3			1																							1
BucP IV 13/7																										
BucP IV 13/6																										
BucP IV 13/2											1															
BucP IV 14/13					1											1										
BucP IV 15/25	1						1				1							1								
BucP IV 15/33					2				1																	1
BucP 12/17							2				2															
BucP 15/21			1																							
BucP IV 13/10																										
BucP IV 14/2			1								1					1		1								
BucP IV 13/11																										
BucP IV 14/11					1						1					1										
BucP IV 14/12							1																			
BucP IV 14/15			1																			1				
BucP IV 14/16																										1
BucP IV 15/38							4				3															2
sum	1	5	5	14	7	11	23	37	1	3	14	23			34	37	5	11	1	3	21	23	25	9	25	37
frequency in %	3		14		11		37		3		23				37		11		3		23		9		37	

	Quercus spec.	*Rubus fruticosus/ idaeus*	*Rubus fruticosus/ idaeus*		*Caryophyllaceae*		*Cyperaceae*		*Fabaceae*		*Poaceae*		*Polygonum/ Rumex*		*Potentilla* spec.		*Solanaceae*		*Solanaceae*		*Solanum* spec.		*Stachys* spec.	
	Sa/ Fr	Sa/ Fr			Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr		Sa/ Fr	
Sample nr.	ch	ch	mi		ch		ch		ch		ch		ch		ch		sf		ch		ch		ch	
BucP IV 14/7															2		3							
BucP IV 15/42																	8		4					
BucP IV 15/45					1								1				9							
BucP IV 15/46															2									
BucP IV 13/1																			1					
BucP IV 14/1													1											
BucP IV 13/4																								
BucP IV 13/5																								
BucP IV 13/8																								
BucP IV 13/9																								
BucP IV 15/7		2	4		1		2				1				2				2					
BucP IV 15/37																					1			
BucP IV 15/44																								
BucP IV 15/31													1											
BucP IV 15/18																			2					
BucP IV 15/19									1														1	
BucP IV 15/36		9																						
BukP IV 15/29							1				1													
BucP IV 13/3																								
BucP IV 13/7											1													
BucP IV 13/6																								
BucP IV 13/2											1													
BucP IV 14/13																								
BucP IV 15/25	1								1				1											
BucP IV 15/33																								
BucP 12/17									1															
BucP 15/21											1													
BucP IV 13/10																								
BucP IV 14/2											1													
BucP IV 13/11											1													
BucP IV 14/11																								
BucP IV 14/12																								
BucP IV 14/15	2																							
BucP IV 14/16	4																							
BucP IV 15/38		1											1											
sum	7	12	4		2		3		3		7		5		6		14		9		1		1	
frequency in %	9	9	3		6		6		9		20		14		9		9		11		3		3	

Varia

Sample nr.	*Stellaria* spec. Sa/Fr	ch	**Other**	*Indetermi-nata* Sa/Fr	ch	*Indetermi-nata* Sa/Fr	mi	*Indetermi-nata* BGF	ch
BucP IV 14/7									6
BucP IV 15/42									
BucP IV 15/45									
BucP IV 15/46	1								
BucP IV 13/1									
BucP IV 14/1									
BucP IV 13/4									
BucP IV 13/5									
BucP IV 13/8									
BucP IV 13/9									
BucP IV 15/7							3		
BucP IV 15/37									
BucP IV 15/44									
BucP IV 15/31									
BucP IV 15/18									3
BucP IV 15/19									6
BucP IV 15/36	1								
BukP IV 15/29									2
BucP IV 13/3									
BucP IV 13/7									
BucP IV 13/6									
BucP IV 13/2					1				
BucP IV 14/13									
BucP IV 15/25	1								
BucP IV 15/33									4
BucP 12/17					5		1		
BucP 15/21									
BucP IV 13/10									
BucP IV 14/2	1								
BucP IV 13/11									
BucP IV 14/11									
BucP IV 14/12									
BucP IV 14/15									
BucP IV 14/16					3				
BucP IV 15/38									
sum	4				9		4		15
frequency in %	11				9		6		11

The Chalcolithic burials of Bucova Pusta IV

Raiko Krauß

Through fortunate circumstances, we were able to clarify the period to which the mound which Gyula Kisléghi Nagy called Bucova Pusta IV dates during our excavations. Although the focus of his excavation in 1904 was focused precisely on the tumulus, and covered large areas of the mound fill, his excavation stopped immediately above the main burial. During our first inspection of the site in the summer of 2009, the mound was only recognisable as a very low elevation in the ploughed field. In the geomagnetic imagery, the outline of the tumulus was still faintly visible, but was heavily obscured by the traces of the old excavation. We had positioned our excavation Trench M in order to better understand the methodology of Kisléghi Nagy's own excavations. Numerous Medieval burials (see Chapter 19) had been excavated by him at the time, but not the original grave over which the mound had initially been heaped. This is how we were able to excavate, document, and scientifically evaluate this grave.

The grave numbered feature M13 lies in approximately the middle of the mound, about which we have only scarce information on account of the old excavation. The homogeneous structure of the sediment, still found in places unaffected by Kisléghi Nagy's excavations, indicates that the mound was filled at one time (Fig. 1). The burial pit was oriented east-west, with a slight deviation to the north (280°). Three post holes on the narrow sides of the slightly trapezoidal burial pit indicate a burial chamber supported by wooden posts. At the bottom of the grave, the remains of a dark material could still be detected in places, which could have come from a lining of the chamber floor with wood or a mat (Fig. 2).

The buried body lay with its head to the west, in a supine position and with slightly bent upper and strongly folded lower legs. Crouched in this way, the legs were tilted to the left. From the feet to the eastern end of the grave pit, there was a free space of about 40 cm, so that the person could also have been buried with outstretched legs. The bones of both hands were found in the area of the lower abdomen and were originally either superimposed or interlocked there.

In terms of anthropology, the skeleton was determined by Steve Zäuner to be female. A genetic analysis by the Max Planck Institute for Evolutionary Anthropology in Jena/ Leipzig confirmed the female sex. In addition, the mitochondrial haplogroup K1c1 could be determined. The ochre grave of Bucova Pusta IV thus lies in a genetic field between the ochre graves of the Eastern European steppes and the burials of the Corded Ware in northern Central Europe. Again anthropologically, the age of the

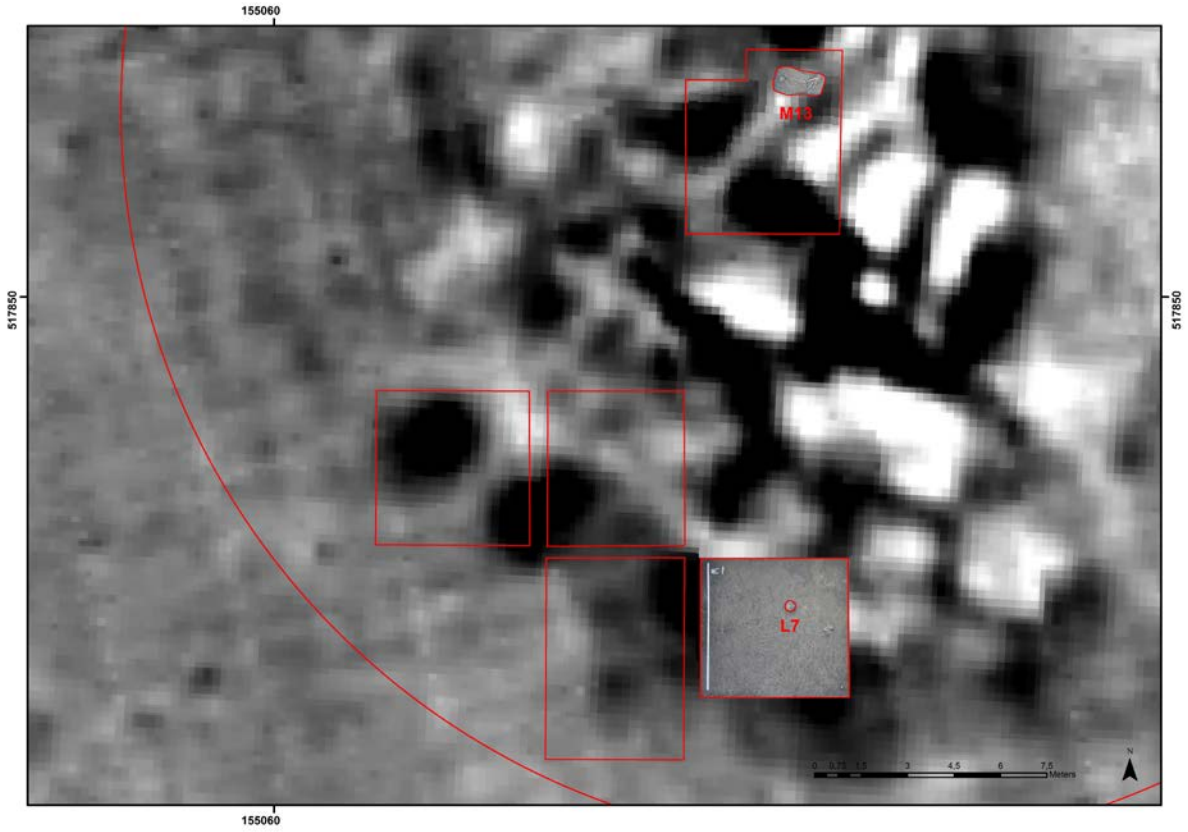


Fig. 1 Geomagnetic mapping of the site (Eastern Atlas Berlin) with the approximate extent of the Bucova Pusta IV tumulus, the location of the excavation trenches and the Chalcolithic burials therein.

woman was determined by Zäuner to be at least 40 years. The spongy structure of the bones indicates degeneration, especially in the area of the spine.

The only grave good found was a compact piece of red ochre above the woman's right shoulder (Fig. 3). Also conspicuous in the grave were a large number of terrestrial snails (*Helix lutescens*), which apparently only entered the grave over the course of the decomposition process, and cannot be regarded as grave goods (see Chapter 15).

The type of burial under a mound, the orientation of the grave, the posture of the body, and the design of the grave correspond to the ochre grave phenomenon, which spread from the east to the Carpathian Basin between the end of the 4th and the beginning of the 3rd millennia BC (Ecsedy 1979; Heyd 2011; Frînculeasa et al. 2015). One incisor tooth was selected from the burial for AMS dating. The date Poz-66988 (4190 ±35 BP), with its calibrated range of 2940–2620 calBC, fits very well into the data series of later ochre burials in the Carpathian Basin, and is within the range of the latest Baden Culture dates.

About 20 m southeast of this inhumation grave, a cremation grave (L7) was found in the southern periphery of the mound, covered with an overturned bowl (Fig. 4; 5,3). The traces of the burial pit could not be detected. This feature was not encountered very deep below the present field surface, and the vessel had already been damaged by ploughing. The outside of the bowl displays a decoration of intersecting incised lines, and can be assigned to the Coţofeni Culture on the basis of its shape and

Fig. 2 Redrawing, in situ photograph, and emptied grave of the ochre grave M13.

characteristic ornamentation (Roman 1977). The evaluation of the burned bones indicates the cremation of a young woman. That inhumation and cremation graves occur together is not unusual in this period. The Baden Culture in particular is known for its variety of burial rituals.

Apart from these two burials, further individual finds from Bucova Pusta IV can be assigned to the Late Chalcolithic. A fragment of a heavily worn stone axe hails from a deep depression south of the burial mound (Fig. 5,1). On the surface of the field, in the area of the mound, a sherd with the characteristic incised pattern of a vessel of the Baden Culture was found

Fig. 3 The piece of ocher found to the right of the head of the burial M13.

Fig. 4 Chalcolithic cremation grave L7 with a bowl (cf. Fig. 5,3) placed over it.

(Fig. 5,2). Two further vessel fragments with decorative motifs characteristic of Coţofeni pottery come from mixed contexts in the vicinity of the tumulus (Fig. 5,4–5). The mound of Bucova Pusta IV is part of a group of tumuli between Sânnicolau Mare and Dudeştii Vechi, north of the road connecting the village with the town. The present mapping could be updated by a field survey with the former history teacher Constantin Kalscov in 2021 (see Chapter 5, Fig. 4). The map of the Josephinische Landesaufnahme of 1769–1772 displays many more mounds, most of which have been levelled today (Fig. 6). As the distribution of the tumuli does not seem to follow any visible terrain feature, it can be assumed that they were built in a single cultural-historical era.

About 1 km south of Bucova Pusta IV, a larger mound is still preserved, which has largely been spared from destruction by modern agriculture because of a topographical measuring point on its top. The tumulus is known as "Hunca Mare" or in Kisléghi Nagy's scheme as Bucova Pusta IX. We can learn from Kisléghi Nagy's surviving excavation diary that he also excavated this mound, and found a burial similar to the tomb of Bucova Pusta IV, which he assigned to the Early Bronze Age. This burial also lay on its back with the knees crouched and was oriented east-west with the head to the west (Fig. 7). Thus, this burial is directly comparable to the central Grave M13 of Bucova Pusta IV.

The development of the older Ochre Grave Culture in the northern Pontus is related to the development of the Chalcolithic cultures in the Balkan region. Copper and gold objects appeared for the first time in this period. In our region, this is tangible in the Late Neolithic/Early Chalcolithic graves of Movila lui Deciov, one of which contains several small copper beads as part of a jewellery set. These are thus among the oldest metal objects in the region. While the development of the burial custom with ochre as a grave good in the steppe region is more or less continuous, two chronologically separated phases of the occurrence of these graves can be recorded in Southeast Europe: an older one around 4000 calBC, and a younger one around 3000 calBC (Heyd 2016).

Burials with ochre appear in the region of the Lower Danube as early as the 5th millennium. In the Balkans, however, they occur in cemeteries, and in the steppe region as individual burials under mounds. Both burial customs are only connected by the addition of ochre. Graves with ochre can be traced, for example, in the cemetery of Varna I until its end around 4300 calBC (Krauß et al. 2016).

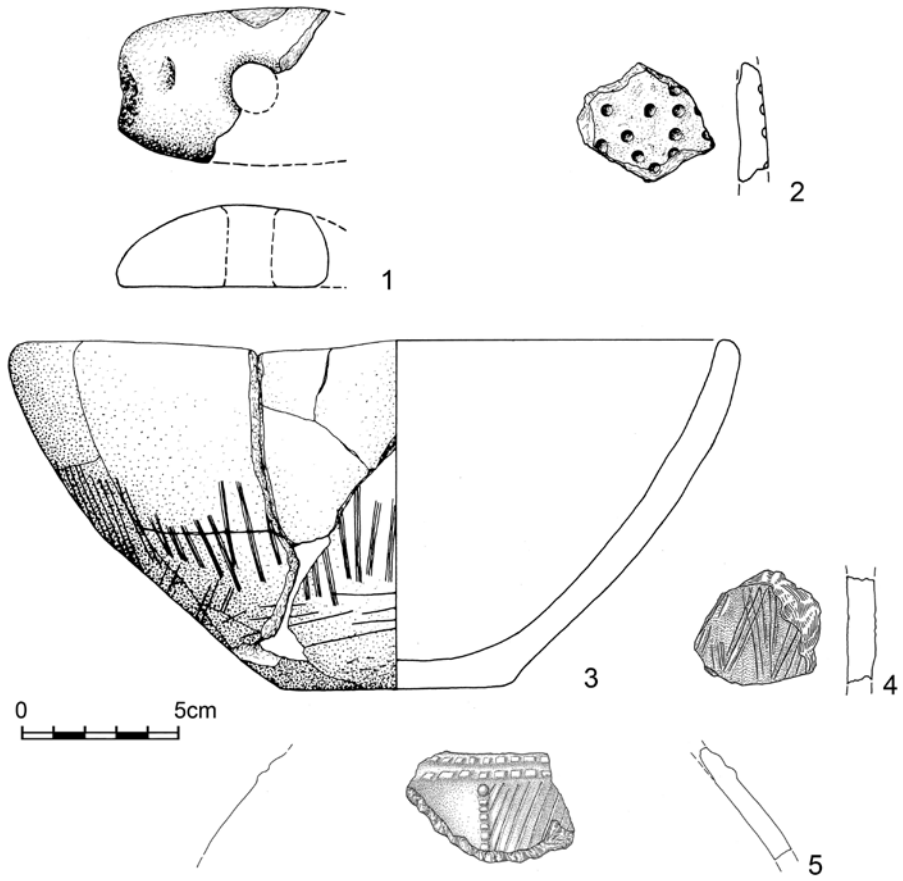


Fig. 5 Chalcolithic finds from Bucova Pusta IV. 1 fragment of a stone axe from the surface, 2 fragment of a Baden vessel from the surface, 3 bowl from the cremation burial L7, 4 Chalcolithic sherd from the filling of the tumulus, 5 Coțofeni sherd from feature R5.

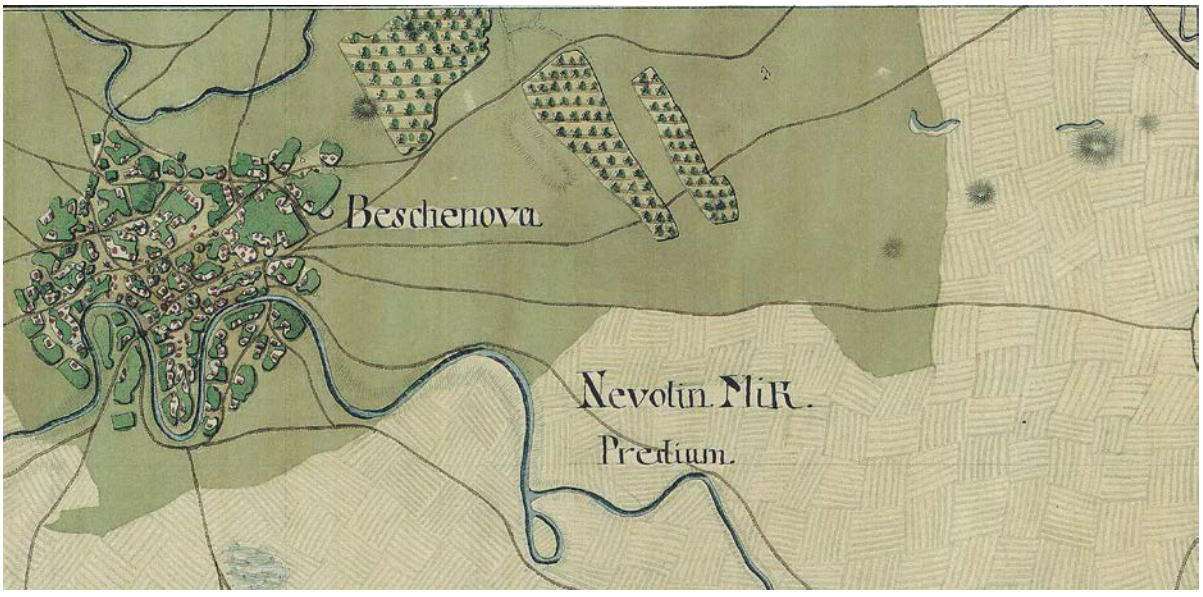


Fig. 6 Section of the Josephine map (cf. Chapter 1, Fig. 5) showing burial mounds north of the road to Sânnicolau Mare.

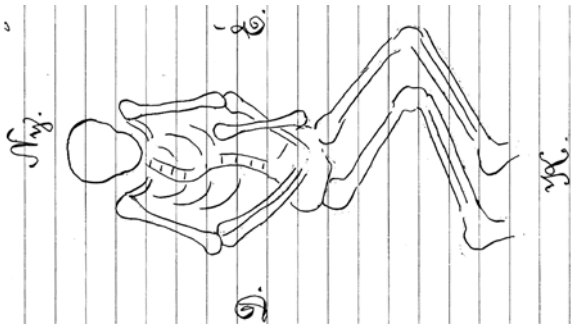


Fig. 7 The Chalcolithic burial from the Hunca Mare tumulus (Bucova Pusta IX) as documented by Gyula Kisléghi Nagy.

Around this time or only shortly afterwards, but at the latest around 4200 calBC, the occupation of all tell settlements on the lower course of the Danube also ends. In the immediately ensuing period, the graves with strongly individualised burial rituals of the steppe area also appear south of the Danube. These already show all the characteristics of the later pit or ochre graves. In the south, the groups with this specific burial ritual reach the northern Bulgarian Danube lowlands, and individual finds from Thrace indicate that they also temporarily crossed the Balkans. In the west, this first movement of groups with ochre burials covers at least Transylvania, and also the Tisza region in isolated advances, as evidenced by the grave of Csongrád-Kettőshalom (Ecsedy 1979, 11–13). The few radiocarbon dates presently available for the horizon of these older ochre graves still belong to the last centuries before 4000 calBC. However, since they occur mainly in the milieu of Cernavodă I, a younger date in the 4th millennium would also be expected.

After that, ochre graves along the Lower Danube and into the eastern Carpathian Basin do not occur again until after 3400 calBC. There is no evidence for a continuous development of the ochre burial custom in South-eastern Europe from its earliest appearance because the regular burial rites of Cernavodă III are largely unclear, and cremation seems to predominate in the Boleráz area.

While the emergence of the older ochre graves can still be discussed as occurring either under the influence of the Chalcolithic cultures of the Balkan-Carpathian region (Govedarica 2004), or as an infiltration of groups of people originating in the northern Pontic steppe region (Heyd 2016), their reappearance at the end of the 4th millennium cannot possibly be explained from the local cultural groups. The appearance of the younger ochre graves in the south as far as the Thracian Plain and in the west as far as the Carpathian Basin seems rather to be directly related to structural changes taking place in the region east of the Carpathians (Manzura 2005). The younger horizon of the ochre graves can be narrowed down on the basis of the radiocarbon dates to approximately the time between 3400–2400 calBC. A subdivision of this total duration into two chronological subunits before and after 3000 calBC was proposed by Frînculeasa et al. (2015). Within this periodisation, the newly discovered Grave M13 from Bucova Pusta IV clearly belongs to the younger unit (Fig. 8).

Changes triggered by the advance of groups with ochre burial could be the cause of the divergence of cultural development at the turn of the Early Bronze Age in Thrace and north-western Anatolia, on the one hand, and in the Carpathian Basin, on the other, because from about 3200 calBC onwards the material culture in the two macro-regions is no longer comparable in the same manner. The Chalcolithic finds in the Balkan-Carpathian area suggest intensive previous contacts between the different regions south and north of the Lower Danube, which ultimately go back to the time of neolithisation and are possibly an expression of a common world of ideas. The Carpathian Basin and the Balkan region were linked in the 5th millennium

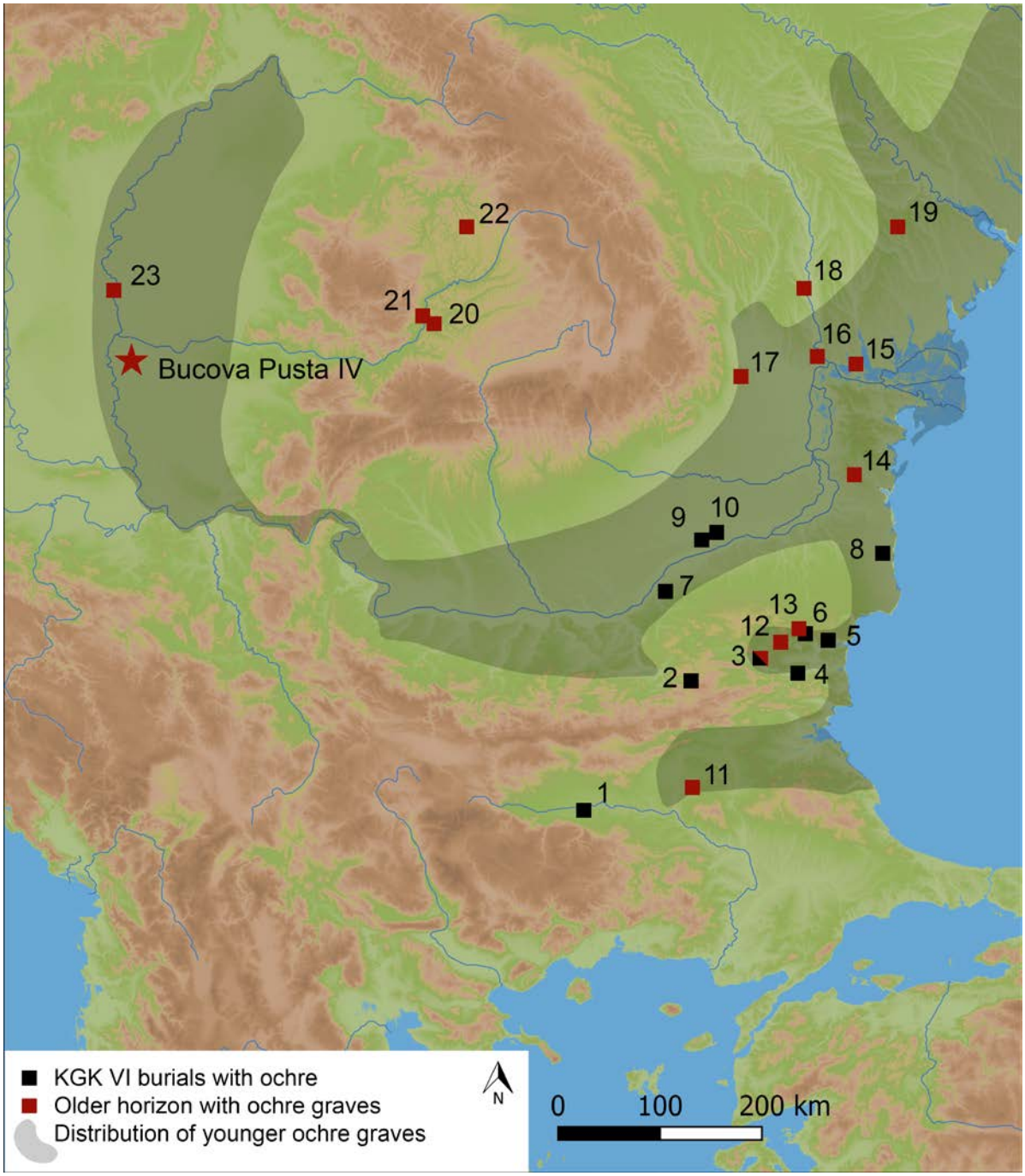


Fig. 8 Mapping the different phases of the occurrence of ochre graves in the Balkan-Carpathian region. 5th millennium BC Kodzhadermen-Gumelnița-Karanovo VI (KGK VI) graves: 1 Vinica, 2 Lilyak, 3 Smyadovo, 4 Golyamo Delchevo, 5 Varna, 6 Devnya, 7 Ruse, 8 Durankulak, 9 Căscioarele-D'aia Parte, 10 Chirnogi. Ochre graves of the 4th millennium BC: 11 Gonova Mogila, 12 Kyulevcha, 13 Reka Devnya, 14 Casimcea, 15 Suvorovo, 16 Giurgiulești, 17 Fundeni-Lungoci, 18 Fălciu, 19 Cainari, 20 Meșcreac, 21 Decea Mureșului, 22 Feldioara, 23 Csongrád-Kettőshalom.

by tell settlements, and even later in the 4th millennium by the custom of inhumation burials in extramural cemeteries and by common metallic forms. It was not until the emergence of the Baden Culture in the Carpathian Basin and the Early Bronze Age in Thrace and north-western Anatolia that both regions went their own cultural ways.

The differences not only in material culture, but also in settlement and burial customs far outweigh the similarities, and hence the advance of individual graves with ochre across the Lower Danube into the Carpathian Basin from 3400 calBC onwards represents a cultural barrier between Thrace and north-western Anatolia, on the one hand, and the Carpathian Basin, on the other. Punctual similarities in the pottery can be traced across the Central Balkan region (Němejcová-Pavúková 1981; Maran 1998).

The advance of groups with ochre burials into the Carpathian Basin is accompanied by other important innovations. The introduction of the wheel and cart, horse domestication, and more generally the use of animal labour is reflected in the Carpathian Basin in the well-known pictorial motifs of ox teams and cart models. In Thrace and north-western Anatolia, on the other hand, this innovative thrust led to a changed settlement structure, now concentrated in a few larger sites, which is then characteristic of the Early Bronze Age in the region.

The burial mounds established in the Banat during this period formed important landmarks for the longest period of cultural history. These sites were also revisited time and again in later periods, for example to continue burial there. In this otherwise flat landscape, they were clear testaments to the past, which only disappeared with modern agricultural land use.

The Bronze and Early Iron Ages

Mario Gavranović

The excavations at the site of Bucova Pusta IV revealed pottery finds indicating occupation during the Bronze and/or Early Iron Ages. A further piece of evidence is provided by a bronze fragment (Fig. 1), which could represent a modified heart-shaped pendant as one of the distinctive metal forms of the Bronze Age in the wider area of the Carpathian Basin (Mozsolics 1967, 86; Hänsel 1968, 115; Furmánek 1980, 26).

General outline

According to the established and generally accepted chronological and cultural sequence, the period of the advanced Early and Middle Bronze Age, or the time between 2000 and 1500 BC in the northern part of the Banat, is characterised by the sites of the Mureş Culture, on the one hand (Soroceanu 1991; Gogâltan 1999, Fig. 52; Nicodemus/O`Shea 2015, 693), and sites of the so-called Cornești-Crvenka Group of the Vatin Culture, on the other (Gogâltan 1996a, 46; Gumá 1997, 109; Ihde 2001, 358; Gogâltan 2004, 82). Crucial for the definition of the two different pottery styles are finds from tell-type settlements such as Pecica (Mureş Group) or Cornești-Iarcuri (Cornești-Crvenka Group), with a number of radiocarbon dates pointing to a partial chronological overlap (Gogâltan 2015, 72). Florin Gogâltan assumes a longer persistence of the Mureş group into the Middle Bronze Age (Bz A2) for a region between the Mureş and Aranka Rivers, while the material described as Cornești-Crvenka prevails in other areas of northern Banat (Gogâltan 2015, 55).

The beginning of the Late Bronze Age is associated with the end of tell settlements and the appearance of the Cruceni-Belegiš I Group, which corresponds in relative terms to Stages Bz C and Bz D, or the period between 1600 and 1400 BC (Gumă 1993, 151; Tasić 2002, 184; Szentmiklosi 2006; Sava 2020). The definition of the Cruceni-Belegiš I Group was mostly made on the basis of the grave finds from urn cemeteries such are Belegiš (Tasić 1974; Vranić 2002), Karaburma (Todorović 1977), or Kaluđerske livade (Petrović 2006) in Serbia, and Cruceni in Romania (Gumă 1997). The study of Alexandru Szentmiklosi offered also a good overview and synthesis of pottery from the settlements of Cruceni-Belegiš group in Banat (Szentmiklosi 2021). As the recent investigations of megafort sites in the Banat area such as Cornești (Heeb et al. 2017; Lehmphul et al. 2019), Sântana (Gogâltan/Sava 2010), and Iđoš (Molloy et al. 2020) have demonstrated, the emergence of these

Fig. 1 Heart-shaped pendant made from a bronze foil. Bucova Pusta IV, Feature A27.

remarkable places in terms of absolute dating, and the appearance of distinct pottery also corresponds with Cruceni-Belegiš I Group (Harding 2017; Sava 2020, 258; Szentmiklosi 2021). Throughout the 13th century BC, most of the mega-forts ceased alongside traces of violent acts, indicating larger cultural transformations in the area (Sava 2020; Sava/Ursuţiu 2021).

The defining cultural traits of Phase Ha A1–Ha A2 are the channelled pottery, often described as the Gáva pottery-type or complex (Gumă 1993, 181; Bukvić 2000), and a strong increase in metal depositions (Petrescu-Dîmboviţa 1978, Pl. 297; Vasić 1995, 257; Jovanović 2010, 16). Based on the continuity of the urn cemeteries from the previous period, most Serbian researchers use the term Belegiš II for this stage (Tasić 2002). This is also partly accepted in Romania, where the terminology employed is Cruceni-Belegiš II (Morintz 1978; Szentmiklosi 2006; Szentmiklosi 2021) or Belegiš II-Bobda (Gumă 1997, 65). The unilateral identification of channelled pottery occurrences with the dispersion of the new Gáva Culture, as, for instance, assumed for the territory of the southern Banat (Bukvić 2000), appears, however, to be far too simple; this is especially the case in the light of recent studies on channelled pottery from Romania (Pankau 2004; Metzner-Nebelsick 2012; Dietrich 2015; Sava/Ursuţiu 2021) and Serbia (Bulatović et al. 2021). Besides the dispersion of certain pottery shapes and decorations, which are, however, often made in a local manner, there is no tangible evidence that the general acceptance of the new style of pottery with channels is somehow linked with larger population movements.

The ensuing development is marked by the pottery style named after sites Gornea in Romania (Gumă 1993, 196) and Kalakača in Serbia (Medović 1978, 15; id. 1988; Medović/Medović 2010, 18). With regard to relative and absolute chronology, the pottery of the Gornea-Kalakača Style corresponds largely with Stage Ha B and the time of 10th and 9th centuries BC (Hänsel/Medović 1991, 62). Significant for the start of Gornea-Kalakača stage is the end of large, long-occupied urn cemeteries (Cruceni-Belegiš I and II), and the onset of new settlements with the sites of Kalakača (Medović 1988) and Gradina na Bosutu (Medović/Medović 2010) in Serbia being the most prominent examples. One noteworthy exception is the plateau Feudvar near Titel, with the finds pointing to an uninterrupted occupation between the Belegiš II and Kalakača Horizons (Hänsel/Medović 1991, 69).

The multilayered settlements of Gradina na Bosutu and Feudvar also provide detailed insights into the transition between Gornea-Kalkača and the Basarabi Cultures (Ha C1). Distinct continuity between these two phenomena has also been observed for the area of the Romanian Banat, with a number of sites which existed throughout the 8th century BC (Gogâltan 1996b, 51). Generally, there is also a clear increase of number of sites come the 8th century BC, particularly in the southern Banat along the bank of Danube (Gumă 1993, 216).

Bucova Pusta IV – the nearby surroundings

The lack of documented structures makes it difficult to estimate the nature of the Bronze and Iron Age occupation at Bucova Pusta IV. The spectrum of pottery forms, including bowls, pots, cups, and storage vessels, most probably indicates a settlement site. In this context, it should be mentioned that intensive surveys in the Serbian part of Banat identified the banks of Aranka/Zlatica river, which is located just 1.5 km to the south, as one of the primary settlement areas during the Late Bronze and Early Iron Ages on the strength of a number of newly discovered sites (Jovanović 2016, 335 and Map 159). Survey on the on the Romanian side also led to the discovery of numerous Bronze Age sites suggesting a similar density of sites along the stretch of the Aranka River (Măruia et al. 2011, 471; Stavilă 2015, 229). To be emphasised are several locations in the vicinity of Dudeştii Vechi, which are assigned to the Early and Middle Bronze Age Mureş Culture (Rogozea/Rogozea 2016, 172), and the site Sânnicolau Mare-Selişte which bears traces of a Cruceni-Belegiš I and II settlement and necropolis (Stavilă 2015).

A cemetery of Cruceni-Belegiš Group was also discovered in Sănpetru German in the upper course of Aranka River (Gogâltan 1998, 295). Further traces of urn cemeteries associated with Cruceni-Belegiš I are registered in Cherestur, from Bucova Pusta IV 10 km to the northwest, and in Nerau, about 10 km to the southwest, yet detailed information is unavailable (Gumă 1993, 167, Fig. 3; Gogâltan 1998, 205).

Located on the bank of Aranka River 35 km to the east is also the site Munar, with large earthwork enclosures and traces of occupation between Middle and Late Bronze Age (Gogâltan/Sava 2010, 60).

The number of documented sites from other Bronze and Early Iron chronological stages is modest (Gumă 1993, 284, Fig. 11; Gogâltan 1996b, 51, Fig. 13). Notable is a settlement site at Sânnicolau Mare assigned to the Basarabi Culture (Gumă 1983, 71; Vulpe 1986, 66), and another at Periam, with the pottery finds indicative of the Gornea-Kalakača Style (Gumă 1983, 196; Gogâltan 1996b, 51).

Other notable finds in the surroundings of Bucova Pusta IV include an urn grave from Sânnicolau Mare with parts of "passement" fibula of Stage Ha A2–Ha B1 (Bader 1983, 56, Pl. 56A), a bronze hoard of Stage Ha A2 (Jupalnic – Turia phase) in Cenad, about 5 km to the northeast (Petrescu-Dîmboviţa 1978, 137, Pl. 216B–217A), and a hoard of Stage Ha A1 (Cincu-Suseni Phase) in Igriş, some 18 km to the east (Petrescu-Dîmboviţa 1978, 122, Pl.119C–120A).

Finds

Analogies to the recovered pottery fragments provide the approximate and more general chronological framework for the Bronze and/or Iron Age occupation in Bucova Pusta IV, without offering the opportunity to discuss stages or phases in detail.

The bowls with an inverted rim and with horizontal or slanted facets from Bucova Pusta IV (Pl. 2:3.8; 3:10) are one of the most characteristic finds of Gornea-Kalakača pottery in northern Serbia and western Romania. Bowls with horizontal facets (Pl. 2:3) occur both at the eponymous sites (Medović 1988, Fig. 311,8.19; Gumă 1993, PL. LIV, 11) and also at a number of other sites, including Perlez in the Serbian Banat (Medović 1978, Pl. 29,8), and in the multilayered site of Gradina na Bosutu in Syrmia (Medović/Medović 2010, Fig. 31. 16–17). Bowls of this type are common for different regions of western and

central Balkans, yet they seem not to appear in the area of Banat before the Stage Ha A1–Ha A2 (Bulatović 2009, 92). In this context, the description of the one bowl from the nearby site Dudeştii Vechi-Mihoc/Ferma Cociohat as a find of the Early and Middle Bronze Age Mureş Culture (Rogozean/Rogozea 2016, Pl. XI, 1) is somewhat unclear. Currently, there is no evidence that this vessel type was present in the Banat prior to Gornea-Kalakača (Gogâltan 2004; Szentmiklosi 2006). On the other hand, their persistence throughout the Gornea-Kalakača (Ha B) Stage and into that of Basarabi (Ha C1) has been documented in a number of sites, with the tendency that younger finds have usually more narrow facets (Gumă 1993: Pl. XLIX, 4; LXV, 5–6; LXVII, 1–3; Gogâltan 1996b, Fig. 8,4; Medović/Medović 2010, Fig. 93,4).

The bowls with wider, slightly slanted facets (Pl. 2: 8; 3:10) also belong to a typical Gornea-Kalkača spectrum (Medović 1988, Fig. 311, Type 24; Gumă 1993, Pl. XLII, 6; Gogâltan 1996b, Fig. 8,4; Medović/Medović 2010, Fig. 31,7). In the area of the northern Carpathian Basin and western Balkans, however, bowls with very similar facets already start to appear from Stage Bz D–Ha A1 onwards (Bulatović 2009, 92; Gavranović 2011, 47). There are also few finds indicating an earlier occurrence of this type among the contemporary groups in the region of Banat (Cruceni-Belegiš I and Cruceni-Belegiš II –"Gáva" – Bobda", see Bukvić 2000, Pl. 9, 1; Stavilă 2015, Pl. 3, 4–5), but its widespread acceptance corresponds with the Gornea-Kalakača Stage (Gumă 1993, PL. XXXI, 3.6).

The bowl with an inverted, simple rim (Pl. 2:9) is a more common Late Bronze and Early Iron Age type with a broad chronological span. Wide, shallow bowls are attested both at the site of Kalakača (Medović 1988, Fig. 311, Types 2, 3 and 6), and at the site Gornea (Gumă 1993, Pl. LIV, 9). However, very similar vessels appear throughout the Early Iron Age (Ha C1–Ha D) (Medović 1978, T. LXXXVI, 3–7), as well as in the periods preceding Gornea-Kalakača (Gumă 1993 200).

Apart from bowls with inverted rims, there are also some other finds pointing to Gornea-Kalakača as one of the probable occupation periods at Bucova Pusta IV. The decoration of the fragments with incised horizontal and vertical lines, occasionally grouped in bundles of two and three lines (Pl.4: 4; 5: 5) displays a clear resemblance to distinctive ornaments of Gornea-Kalakača pottery. The number of analogies from the sites of Kalakača (Medović 1988, Fig. 318. 7–12; Fig. 323), Feudvar (Hänsel/Medović 1991, Pl. 34,5; 35,11; 48,4), and Gradina na Bosutu (Medović/Medović 2010, Fig. 31,6.8.14; 35,5; 60,12) underlines the high frequency of this motif. In terms of vessel categories, the investigations in Kalakača demonstrated that incised lines were often used for the decoration of beakers and bowls.

More characteristic of the preceding period Ha A1–Ha A2 are fragments with wider incised lines at a distance to each other (4: 7.10.13; 5:1) with good parallels among the material described as "Gáva-Mediaş" by Sebastian Morintz (1978). This pottery represents the late development of the Gáva Culture in Transylvania (Pankau 2004; Bader 2012), but the area of the distribution apparently also involved the fringes of the Banat (Gumă 1993, Pl. XXXI, 11; XXXII, 1–2; XXXIII, 1; Metzner-Nebelsick 2012, 72). However, simple decorations with incised lines are also present in some sites of the Cruceni-Belegiš I Group such as for instance, Foeni-Gomila Lupuli II (Szentmiklosi 2006, Pl. V, 5–9), and at the sites with pottery of the Gornea-Kalakača Style (Medović 1988, Fig. 10, 8; 25, 6; 214, 3–4).

In respect to fragments with irregular arrangements of incised lines (Pl. 5: 12. 18), the corresponding analogies from the nearby multilayered site Foeni-Gomila Lupului in Banat date to Cruceni-Belegiš' earlier phase with absolute dates pointing at 15th and 14th centuries BC (Szentmiklosi 2021, Pl. 37, 1.3; 38. 11–12; 45: 2). On the other hand, the analogies are also known from the markedly younger sites of the Gornea-Kalakača phase (10th century BC) both in in the Banat, as for instance in Senta-Makošpart (Medović 1978, Pl. XLI, 7), and in Syrmia with the Kalakača settlement (Medović 1988, Fig. 231, 1; 248, 8). A similar situation applies to fragments decorated with shorter grooves (Pl. 1: 1–2; 5: 16) with matching finds from the sites of Cruceni Belegiš phase like Deta-Dudărie or Foeni-Gomila Lupului (Szentmiklosi 2021, Pl. 14:2; 59:7), and from significantly younger complexes in Kalakača (Medović 1988, Fig. 13,5; 45, 10), and sites of this period in the Serbian part of the Banat (Medović 1978, Pl. XXVI: 3).

Another group of finds from Bucova Pusta IV affiliated with the Gornea-Kalkača repertoire are the fragments of larger vessels, presumably pots, with plastic ribbons additionally decorated with oval or round stiches (Pl. 5: 2. 7–8.13–14), or just with rows of oval and round stiches (Pl. 4:6). Plastic ribbons with finger impressions (Pl. 1: 9; 4: 15; 5: 15. 20) and pots with oval stiches on the slightly everted rim (Pl. 79:2) can also be included within this category.

The parallels from the Romanian part of Banat include finds from sites such as Iaz (Gumă 1993, Pl. LIX: 9. 17. 30. 41–42), Caransebeş (Gumă 1993, Pl. LVII: 17), Gornea-Căuniţa des Sus (Gumă 1993, PL. LII), Satchinez (Gumă 1993, Pl. XLIV: 4; XLV: 1. 10), and Giroc-Mescal (Gogâltan 1996b, Fig. 12: 3.5). Comparanda from Serbia include abundant finds from the settlement of Kalakača (Medović 1988, Fig. 9: 6; Fig. 10: 10; Fig. 11: 1.3.12; Fig. 12:1; Fig. 83: 6–10; Fig. 248: 9; Fig. 299: 2; Fig. 312), and fragments from many other sites including Banatska Palanka, Jabuka, Jasenovo-Židovar, and Veliko Središte in the Banat (Medović 1978, Pl. LXXIV: 3; LXXV: 1; LXXXVII: 1–6).

Of particular interest are also two well-preserved S-shaped vessels with remains of handles, indicating an amphora or beaker (Pl. 1: 6.8). The decoration of the almost completely preserved vessel with a distinctly everted rim consists of two horizontal grooves on the shoulder and three vertical grooves on the central part. Most of the parallels for undecorated beakers or amphorae come from the site of Kalakača (Medović 1988, Fig. 310, Type 12), although there are also some comparable finds from the surrounding areas, which date to Ha A1 and Ha A2 (Bukvić 2000, Pl. 31:11; 39:5, Marta 2009, Pl. 5). Indicating an even older age are some analogies from sites in Banat attributed to Cruceni-Belegiš group, with the vessel from the Timişoara-Fratelia being the best example (Szentmiklosi 2021, PL. CLV: 1). According to Szentmiklosi, the vessel from Timişoara-Fratelia can be compared with some urns from the cemeteries of Cruceni-Belegiš groups, and dates to Bz C2–Bz D (Szentmiklosi 2021, 246). With regard to the decorated amphora, one can point to similar finds from the Kalakača Phase at the multilayered settlement Gradina na Bosutu (Medović 1978, Pl. XXXIX: 5); yet, in terms of the grooves, there are also certain similarities with the pottery of preceding Ha A1-Ha A2 Period (Bukvić 2000, Pl. 43:6). In the stratigraphy of the settlement of Feudvar, comparable groove decorations occur in the early stage of the Kalakača Horizon, which is conceived as a direct connection with the previous stage (Hänsel/Medović 1991, Pl. 35:8).

Considering the chronological determination of fragments with channels (Pl. 1: 7; 4: 9. 11–12) and plastic ribs (Pl. 2:2; 4:3), most of the analogies from the area of the Banat suggest the period Ha A1–Ha A2 (Cruceni-Belgiš II) as the most likely solution (Sava 2020). Finds with comparable decorations are documented at the nearby site of Sânnicolaul Mare-Selişte (Stavilă 2015, Pl. 3: 1.4), and at the settlements of Aradac and Orešac-Židovoar (Bukvić 2000, Pl. 42:3; 57:3). Far more numerous are grave finds from the cemeteries in Ticvanuil Mare (Gumă 1993, Pl. 34–35), Opovo (Bukvić 2000, Pl. 5), and Vojilovica (Pl. 20: 1: 26: 3: 34: 3). On the other hand, the similar decoration of vessels with plastic ribs and channels is also documented among Late Bronze Age material from the settlement of Petea-Csengersima in the region of Satu Mare, attributed to a local Sucia des Sus Group of Stage Bz C–Bz D (Marta 2009, Pl. 3 B).

Yet, the finds from Bucova Pusta IV are too small and too fragmented to attempt any kind of vessel reconstruction. Therefore, it seems difficult to estimate the dating, especially since channelling seems to be present not only in the early stage of the subsequent Gornea-Kalakača Stage (Hänsel/Medović 1991, Pl: 34:7), but also in the Late Bronze Age groups which precede Cruceni-Belegiš II (Marta 2009, Pl. 3F). In this context, reference should also be made to the fragments of smaller vessels with everted rims and channelled decoration on the inside (Pl. 1: 4–5), since analogies from Feudvar indicate the early stage of Gornea-Kalakača (Hänsel/Medović 1991, Pl: 35:5).

Comparisons for undecorated pots with cylindrical, concave (Pl. 2: 4; 3:4;), or funnel shaped necks (e- g-., Pl. 2:1) can also be made among the finds of Gornea-Klakača (Medović 1988, Fig. 308, 2 - 3, 6. 12), although these simple forms are usually not of chronological significance since they appear in different regions, and over large time spans.

In sum, based on the majority of diagnostic finds and analogies from the territory of the Banat and from adjacent regions in Serbia and Romania, the occupation in Bucova Pusta IV falls most probably in time between Ha A1/ Ha A2 (Cruceni-Belegiš II) and Gornea-Kalakača (Ha B1–HA B2/3). There are also a few fragments which also correspond to a certain extent with earlier stage (Bz C–Bz D) which would equal the earlier phase of Cruceni-Belegiš in this area (Szentmiklosi 2021).

On account of the fact that all fragments are relatively small, and that the reconstruction of shapes was rarely possible, a more precise estimation cannot be made at the moment, although most of the finds are reminiscent of Gornea-Kalakača. The existence of open, lowland settlements during this time in the area of the Banat was already attested in previous research (Medović 1988, Fig. 1). However, in contrast to fortified hilltop sites such are Gradina na Bosutu, Kalakača, or Feudvar, knowledge about lowland settlements is still insufficient. Bearing in mind that the previous period (Bz D–Ha A1/Ha A2) was characterised by the emergence of mega-sites like Corneşti and Iđoš, it remains open as to what happened in the open landscape of the Banat in the aftermath, and which dynamics led to the establishment of open and probably smaller settlements along smaller river courses like the Aranka.

Plates

1 DNr 463a; ID 12352; Feature M3; rim; Fabric Group 3; surface untreated; Fluting decoration; diameter at mouth 26.00 cm; Iron Age.

2 DNr 463b; ID 24968; Feature M3; rim; Fabric Group 3; surface untreated; Fluting decoration; diameter at mouth 20.00 cm; Iron Age.

3 DNr 513; rim; surface untreated; Fluting decoration.

4 DNr 342; ID 16155; Feature H9; rim; Fabric Group 1; rounded pot; surface untreated; undecorated; diameter at mouth 16.00 cm.

5 DNr 439; ID 2782; Feature C19; rim; Fabric Group 3; surface untreated; Fluting decoration; diameter at mouth 12.00 cm; Iron Age.

6 DNr 93e; ID 24393; Feature A15; rim; Fabric Group 3; jar with Strap handle; surface untreated; undecorated; diameter at mouth 16.00 cm; Iron Age.

7 DNr 203a; rim; surface untreated; Fluting decoration.

8 DNr 237; ID 24394; Feature C17; complete vessel; Fabric Group 3; jar with flat bottom and Strap handle; surface untreated; Fluting decoration; height complete vessel 14.20 cm; diameter at mouth 17.70 cm; max. diameter 18.40 cm; Iron Age.

9 DNr 418; ID 24589; Feature R7; complete vessel; Fabric Group 3; biconical pot with flat bottom; surface untreated; strip of finger dabs; height complete vessel 33.30 cm; diameter at mouth 16.80 cm; max. diameter 33.60 cm; Iron Age.

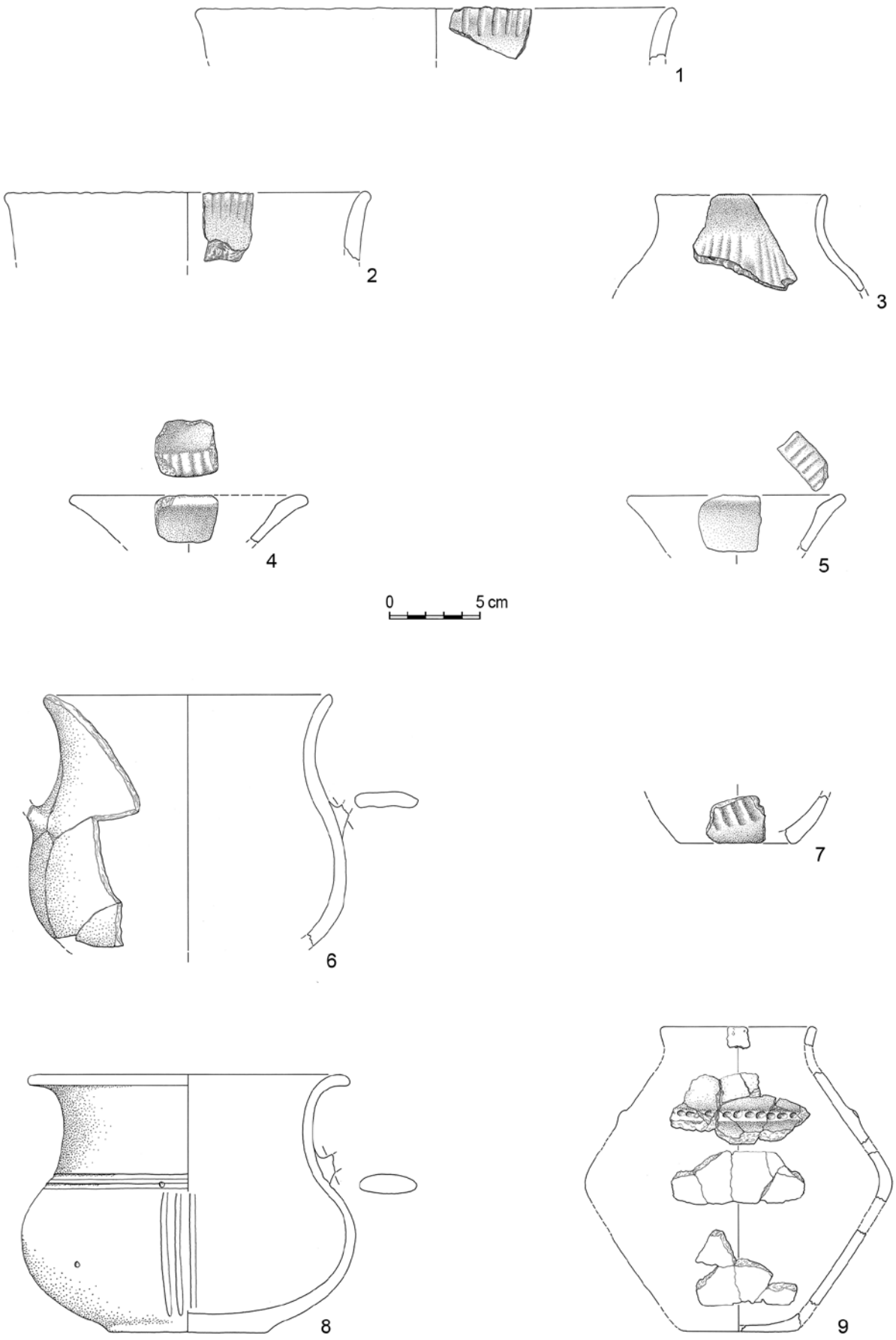


Plate I

1 DNr 87b; ID 1051; Feature A Profil O; rim; Fabric Group 5; pot; Iron Age.

2 DNr 88c; ID 398; Feature A8; middle fragment; Fabric Group 3; surface untreated; notched rim; diameter at mouth 22.00 cm; Iron Age.

3 DNr 92c; ID 331; Feature A5; rim; Fabric Group 3; bowl; surface untreated; undecorated; diameter at mouth; 24.50 cm; Iron Age.

4 DNr 96c; ID 24376; Feature A1; rim; Fabric Group 3; surface untreated; undecorated.

5 DNr 91; ID 24388; Feature A6; rim; Fabric Group 3; surface untreated; Iron Age.

6 DNr 96a; ID 24374; Feature A4; rim; Fabric Group 3; surface untreated; undecorated; diameter at mouth 11.00 cm; Iron Age.

7 DNr 87a; ID 24972; Feature A Profil O; rim; Fabric Group 3; surface untreated; Finger grooves; diameter at mouth 60.00 cm; Iron Age.

8 DNr 96b; ID 24375; Feature A1; rim; Fabric Group 3; bowl with rolled rim; surface untreated; undecorated; Iron Age.

9 DNr 327; ID 63; Feature A3; rim; Fabric Group 4; bowl; surface untreated; undecorated; diameter at mouth 36.40 cm; Iron Age.

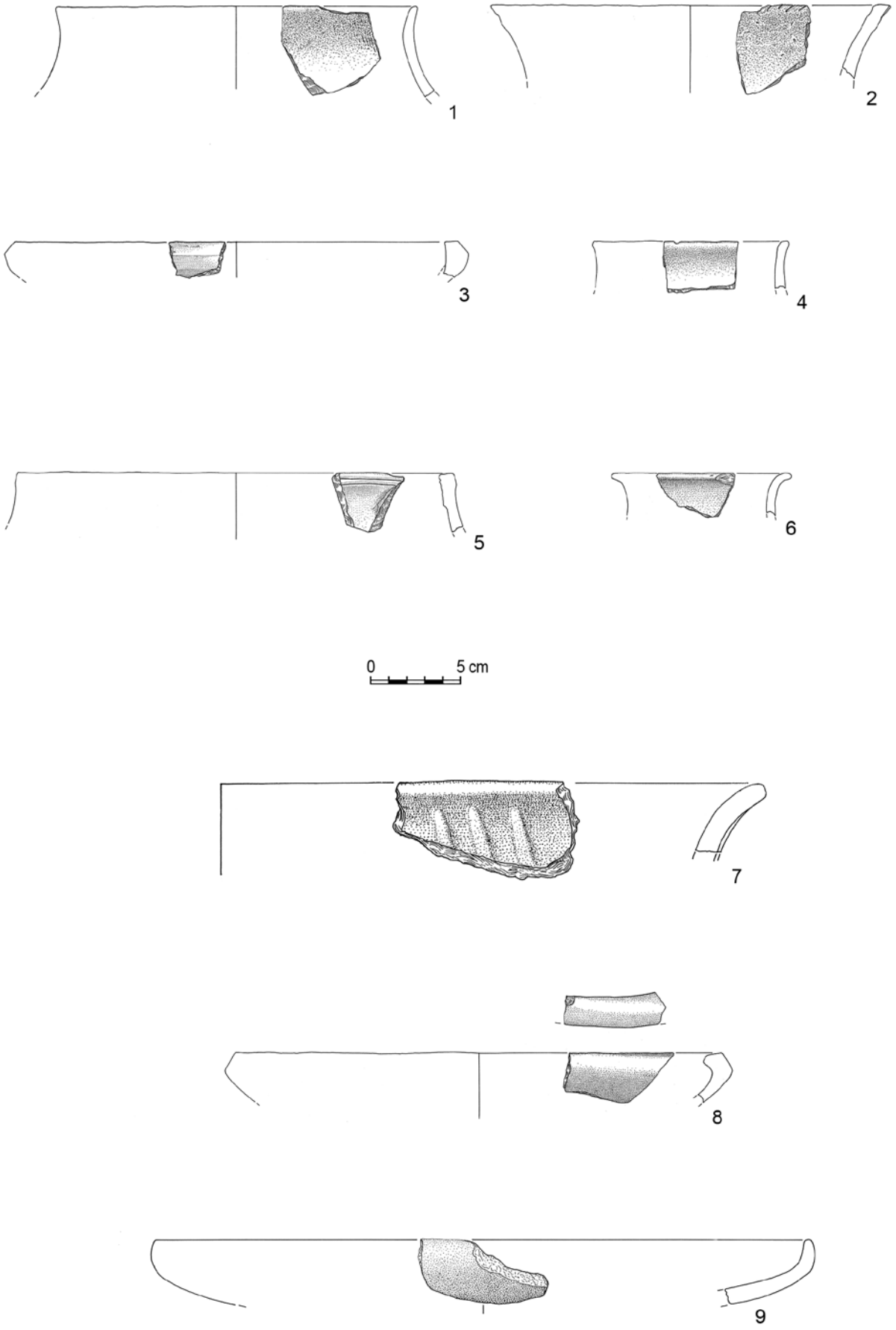


Plate 2

1 DNr 79d; ID 24382; Feature A27; middle fragment; Fabric Group 5; roughened surface; undecorated.

2 DNr 605; middle fragment; surface untreated; undecorated.

3 DNr 162; ID 24539; Feature H2; rim; Fabric Group 3; surface untreated; notched rim; Iron Age.

4 DNr 93c; ID 24391; Feature A15; rim; Fabric Group 3; surface untreated; undecorated.

5 DNr 207a; ID 13747; Feature CEXT; rim; Fabric Group 6; surface untreated; undecorated.

6 DNr 92d; rim; surface untreated; undecorated.

7 DNr 89b; ID 491; Feature A10; rim; Fabric Group 3; surface untreated; undecorated; diameter at mouth 18.00 cm.

8 DNr 372; ID 24964; Feature H2; rim; Fabric Group 3; surface untreated; Fluting decoration; diameter at mouth 3.50 cm; Iron Age.

9 DNr 370; ID 7003; Feature H2; rim; Fabric Group 3; surface untreated; undecorated; diameter at mouth 20.00 cm.

10 DNr 604; rim; surface untreated; undecorated.

11 DNr 398; ID 13937; Feature Q5; rim; Fabric Group 3; surface untreated; undecorated; diameter at mouth 20.00 cm.

12 DNr 11b; ID 1110; Feature B1; rim; Fabric Group 1; surface untreated; notched rim.

13 DNr 630; rim; surface untreated; notched rim.

14 DNr 7a; rim; surface untreated; notched rim.

15 DNr 455; ID 12426; Feature M4; rim; Fabric Group 3; surface untreated; strip of finger dabs.

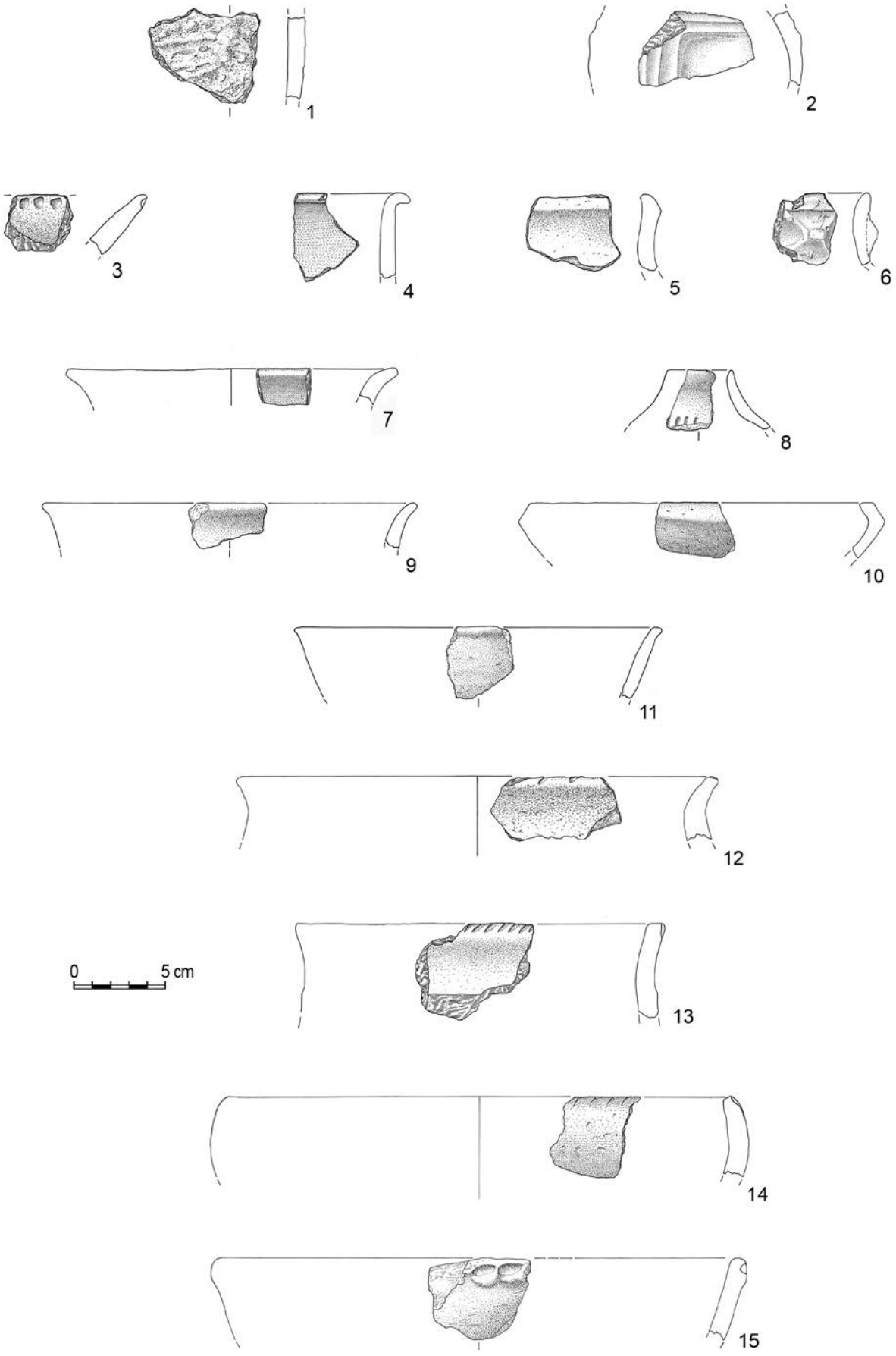


Plate 3

1 DNr 438; ID 13680; Feature G10; middle fragment; Fabric Group 3; Strap handle; surface untreated; undecorated; Iron Age.

2 DNr 367; ID 24969; Feature H2; middle fragment; Fabric Group 3; Strap handle surface untreated; undecorated; Iron Age.

3 DNr 139b; ID 3860; Feature F2N; middle fragment; Fabric Group 3; surface untreated; Fluting decoration; Iron Age.

4 DNr 503; ID 16367; Feature D14; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

5 DNr 328; ID 66; Feature A3; middle fragment; Fabric Group 3; Strap handle; surface untreated; undecorated; Iron Age.

6 DNr 112a; ID 24971; Feature H2; middle fragment; Fabric Group 3; surface untreated; strip of finger dabs; Iron Age.

7 DNr 456; ID 10929; Feature L2; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

8 DNr 456b; ID 10930; Feature L2; middle fragment; Fabric Group 4; Strap handle surface untreated; Fluting decoration; Iron Age.

9 DNr 371; ID 7005; Feature H2; middle fragment; Fabric Group 3; surface untreated; Fluting decoration; Iron Age.

10 DNr 504; ID 6743/16318; Feature H3; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

11 DNr 454; ID 12719; Feature L-K1; middle fragment; Fabric Group 3; surface untreated; Fluting decoration; Iron Age.

12 DNr 369; ID 24970; Feature H2; middle fragment; Fabric Group 3; surface untreated; Fluting decoration; Iron Age.

13 DNr 561; ID 24966; Feature R5; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

14 DNr 562; ID 14376; Feature R5; wishbone; Fabric Group 3; surface untreated; undecorated; Iron Age.

15 DNr 566; ID 14597; Feature R5; middle fragment; Fabric Group 3; surface untreated; strip of finger dabs; Iron Age.

16 DNr 592; ID 14578; Feature R5; middle fragment; Fabric Group 3; surface untreated; Fluting decoration; Iron Age.

17 DNr 602; ID 13708; Feature T4; middle fragment; Fabric Group 1; handle; surface untreated; undecorated; Iron Age.

18 DNr 601; ID 24005; Feature T4; handle; Fabric Group 1; surface untreated; undecorated; Iron Age.

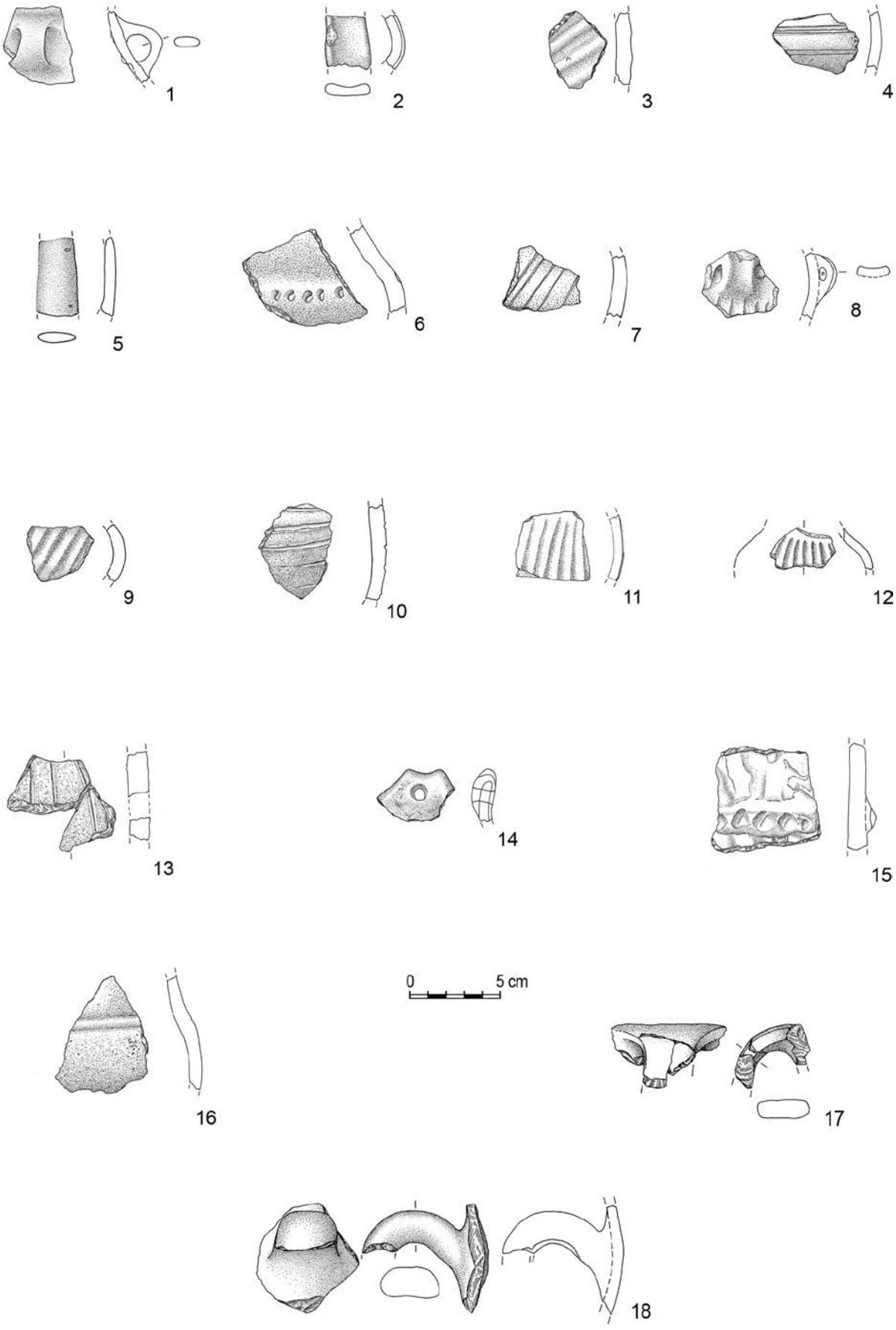


Plate 4

1 DNr 79e; ID 24383; Feature A27; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

2 DNr 79f; ID 24384; Feature A27; middle fragment; Fabric Group 3; surface untreated; Plastic ledge; Iron Age.

3 DNr 79g; ID 24385; Feature A27; middle fragment; Fabric Group 3; surface untreated; undecorated; Iron Age.

4 DNr 88e; middle fragment; handle; surface untreated; undecorated.

5 DNr 89c; ID 24973; Feature A10; middle fragment; Fabric Group 1; surface untreated; incised decoration; Iron Age.

6 DNr 93a; ID 24389; Feature A15; middle fragment; Fabric Group 1; Strap handle; surface untreated; undecorated; Iron Age.

7 DNr 93b; ID 24390; Feature A15; middle fragment; Fabric Group 1; surface untreated; strip with finger dabs; Iron Age.

8 DNr 86e; middle fragment; surface untreated; strip of finger dabs.

9 DNr 88d; middle fragment; handle; surface untreated; undecorated.

10 DNr 79i; ID 24387; Feature A27; middle fragment; Fabric Group 3; surface untreated; Buckel; Iron Age.

11 DNr 79c; ID 24381; Feature A27; middle fragment; Fabric Group 3; surface untreated; incised decoration; Iron Age.

12 DNr 94; ID 1053; Feature A Profil O; middle fragment; Fabric Group 4; surface untreated; Besenstrich; Iron Age.

13 DNr 121; ID 3126; Feature C13; middle fragment; Fabric Group 3; surface untreated; Plastic ledge; Iron Age.

14 DNr 204; ID 13752; Feature C17; middle fragment; Fabric Group 3; surface untreated; strip of finger dabs; Iron Age.

15 DNr 88g; middle fragment; surface untreated; strip of finger dabs.

16 DNr 329; ID 172; Feature A3; rim; Fabric Group 3; surface untreated; incised decoration; Iron Age.

17 DNr 400; ID 13708; Feature F6; middle fragment; Fabric Group 1; surface untreated; Fluting decoration; Iron Age.

18 DNr 306a; ID 13749; Feature CEXT; middle fragment; Fabric Group 3; surface untreated; Besenstrich; Iron Age.

19 DNr 93d; ID 24392; Feature A15; middle fragment; Fabric Group 3; surface untreated; Besenstrich; Iron Age.

20 DNr 79h; ID 24386; Feature A27; middle fragment; Fabric Group 3; surface untreated; strip of finger dabs; Iron Age.

21 DNr 96d; ID 24377; Feature A1; middle fragment; Fabric Group 3; surface untreated; strip of finger dabs; Iron Age.

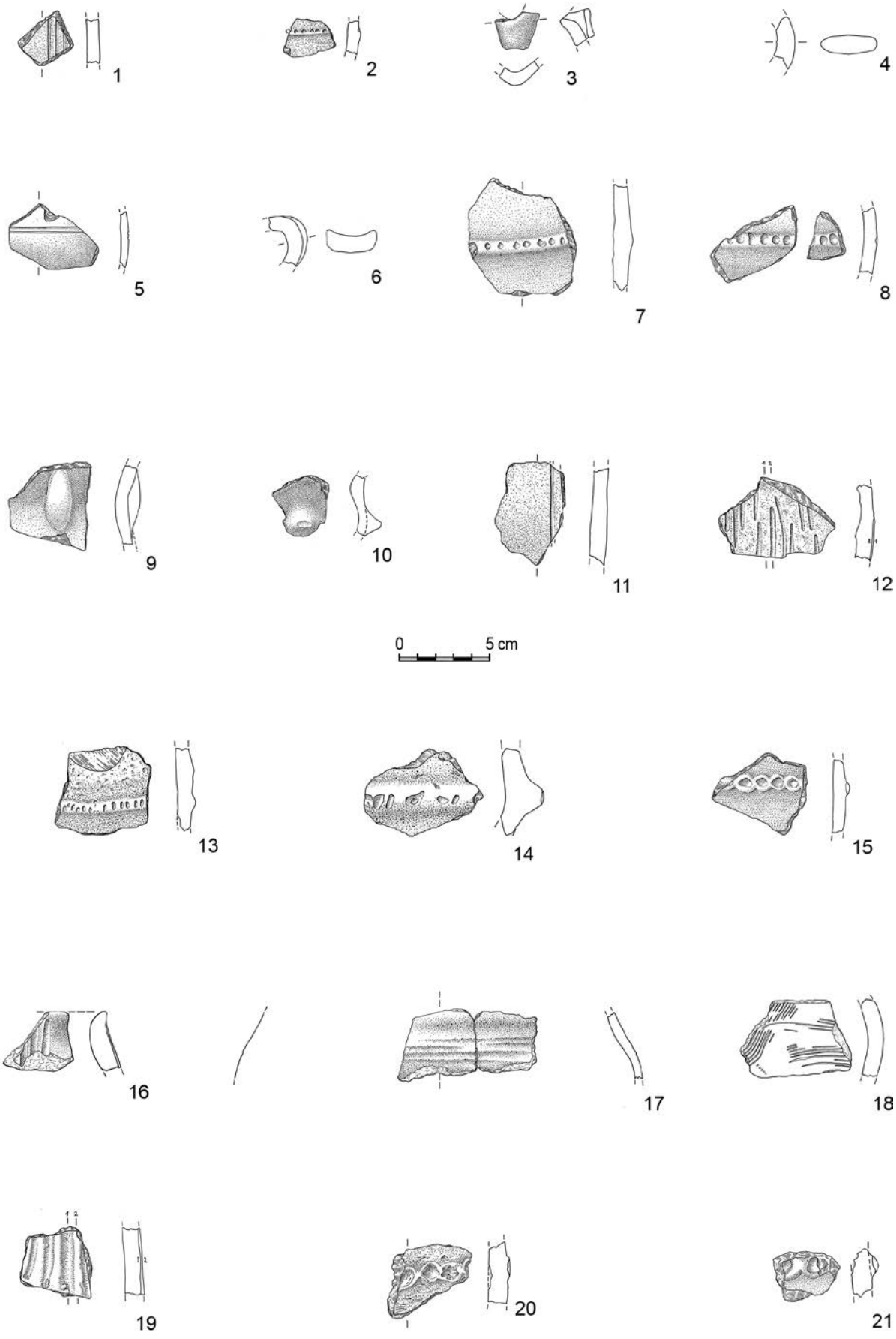


Plate 5

The Medieval burials

Erwin Gáll
with anthropological observations by Steve Zäuner

The area of the Chalcolithic tumulus Bucova Pusta IV, which was laid out in the north-eastern area of the Early Neolithic settlement, once again served as a burial ground during the Middle Ages. Some of the burials were already uncovered by the excavations of Gyula Kisléghi Nagy (Fig. 1). Further Medieval burials were discovered and documented by the more recent excavations of the University of Tübingen in cooperation with the National Museum of the Banat (Fig. 2). The following is a description of the graves in the order in which they were uncovered. The final evaluation partially includes the burials uncovered by the old excavation.

1. Description of the graves

Medieval graves

Feature A4 (Grave 1)

Shape of the grave: Only a part of the burial pit was excavated; it probably had a rectangular form (Fig. 3). Once the planum had been documented, the northern profile was excavated in order to recover the skull from the burial. Depth of the pit: 130 cm.

The skeleton is supine and well preserved; the skull and northernmost shoulder reach into the N-profile and thus could be uncovered only partially. The arms are crossed above the pelvic area (Pos. XIII), and the legs were stretched out. From the pigmentation of the soil, the outline of a valuable coffin can be inferred (Fig. 4).

Orientation: NW–SE. Sex: Female. Age: 50–55 years old. Without an inventory.

Anthropological observations (S. Zäuner)

Large parts of the skeleton have survived. Part of the facial skull and the base of the skull are loose, the rest of the cranium is preserved as calvaria. Even the hyoid bone is present. Only the 10th thoracic vertebra and the lowest two lumbar vertebrae are missing from the spine. Some carpal bones of the right hand are missing, as well as several bones from the metacarpals and fingers of both hands. Of the lower extremities, the right fibula and some foot bones on both sides are missing. According to the usual criteria for age and sex determination (Heberer et al. 1970; Ubelaker 1978; Ferembach et al. 1979; Knußmann 1988, 424ff; Schutkowski 1989; Herrmann et al. 1990) a woman aged 55–65 years can be assumed. Her long bones are of medium robustness (Cochol 1961) and

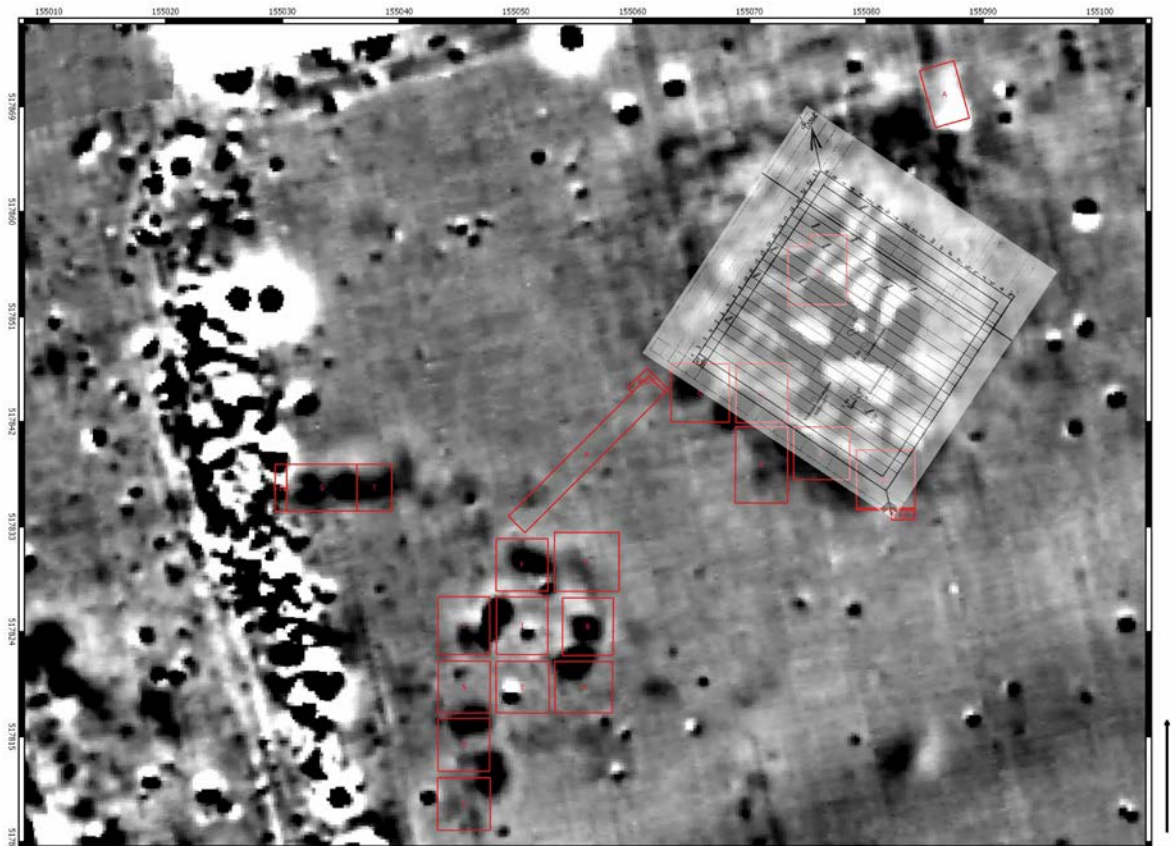


Fig. 1 Geomagnetic mapping of the Bucova Pusta IV site with location of the excavation trenches and the adjustment of the grid of the old excavation by Gyula Kisléghi Nagy.

show a rather strong muscle mark relief. According to Trotter/Gleser (1952), the estimated body height is 160.5 cm for white women and 156.4 cm for black women, 157.4 cm according to Pearson (1899), 158.9 cm according to Olivier/Tissier (1975) and 159.9 cm according to Bach (1965). The average height is therefore around 158 cm.

The teeth show strong to very strong tartar, which can be interpreted as an indication of a high proportion of proteins in the diet. Enamel hypoplasia on some of the teeth indicates that the teeth had been exposed to deficiency or stress situations during early childhood. Deep transverse grooves in the upper incisors suggest that they were also used as tools, as a "third hand", for example when working with leather (Fig. 5). Two out of 10 teeth show slight caries. There is a fistula and another apical process in the upper jaw. The palate was also inflamed in the area of the anterior teeth. The central upper incisor on the right side had already fallen out during the individual's lifetime, presumably as a result of periodontitis on the upper jaw or caries. There is periodontitis on the lower jaw. Cribra orbitalia, another sign of deficiency or disease, is suspected. There is an osteoma on the right side of the frontal bone. The left and right parietal bone each show a depression. This could be the result of blunt trauma or, more likely, a growth disorder. Severe arthrosis (spondylarthrosis) is found on the 2nd cervical vertebra and on some thoracic vertebrae. There is also spondylosis deformans. Severe arthritic changes are found also in the right shoulder, the right elbow joint and the right hand.

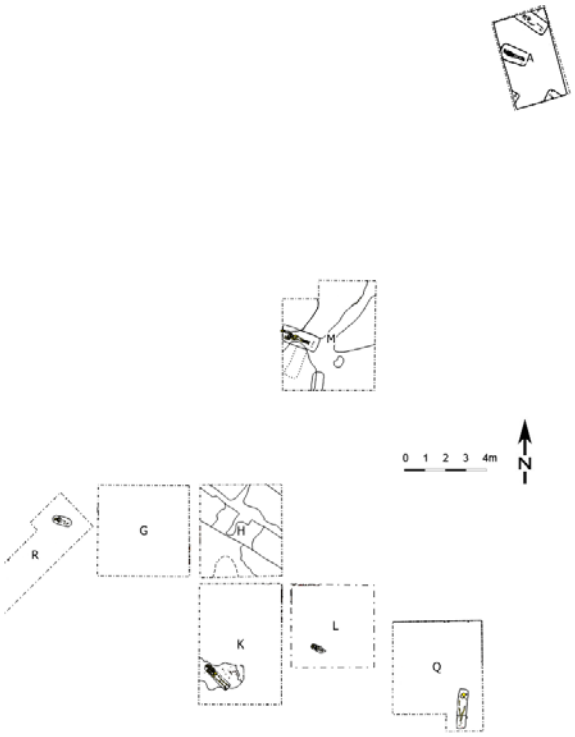


Fig. 2 Location of the Medieval burials at Bucova Pusta IV.

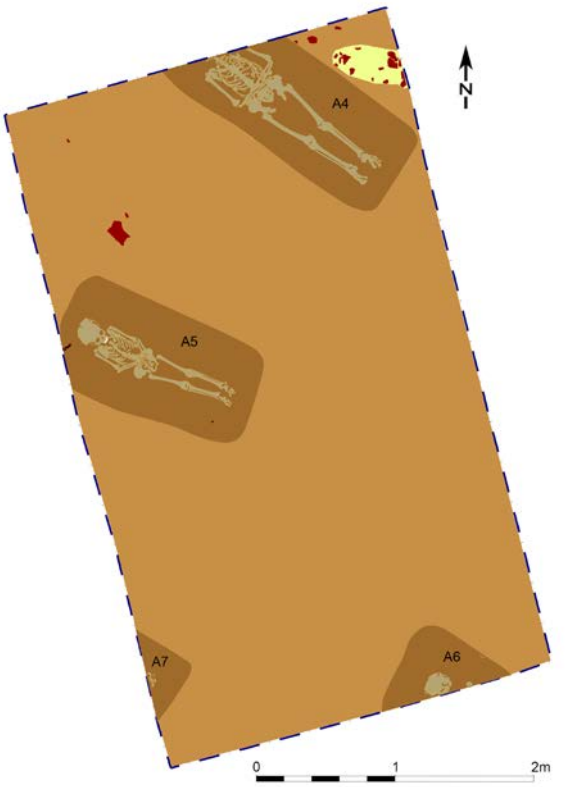


Fig. 3 The Medieval burials in trench A.

Mild osteoarthritis is found in the right hip (coxarthrosis), more severe in the sacroiliac joint. There are several exostoses in the pelvis. Mild osteoarthritis is found in the knees, moderate osteoarthritis in the feet. Severe exostosis formation on the kneecaps and the heel bones (Fig. 6–7) indicate heavy strain on the tendons in these areas. The position of the proximal epiphyses of the tibiae shows that the lower legs were turned slightly outwards. The right tibia is recognisably stronger than the left. There is also a lesion in the area of the tibial tuberosity. A partial (?) tendon rupture is conceivable.

There is a suspicion of a stool facet, a sign of frequent lingering in a squatting position. A proven, so-called rider's facet refers to activities in which the legs are spread apart, typically when riding.

Feature A5 (Grave 2)

Inhumation. Orientation: NW–SE. The shape of the grave: Roughly trapezoid form, narrowing and shortening downwards. Dimensions of the grave pit: 140 x 80 cm. Depth: 81 cm.

The skeleton was supine; its skull is slightly deformed through sediment load (Fig. 8). The arms were placed on the sacrum bone with the left hand resting upon the right. From the position of both the arms and especially the legs, the body was most likely wrapped in a cloth made of some organic material. The bones of the skeleton are well preserved. Coffin burial: 1. around the height of the skullcap an arch/ring-shaped end iron object west of the skull with a needle/tweezer-like ending dips in the direction of the skull > sloping (Fig. 9,1). On the basis of its position, it is much more probably an iron nail of the

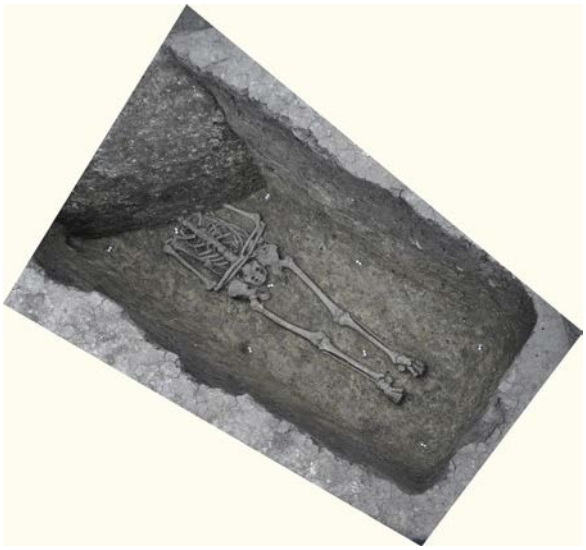


Fig. 4 Photogrammetry of feature A4 (Grave 1).

coffin; 2. barbell-like iron item immediately above the right leg bones which must have been the other nail of the coffin. Smaller than 15 cm.

Sex: Child, probably girl, around 10 years old (Infans II); length of the skeleton: under 118 cm.

Inventory: A flat-sheet-like fragment of an iron piece south of the lower leg bones near the border of the burial pit. Its function remains problematic (length: under 5 cm).

Anthropological observations (S. Zäuner)

Large parts of the calvaria are present as individual pieces. Only some hand and tarsal bones as well as finger and toe bones are missing from the postcranium. The state of bone fusion and the dental status indicate that the child is about 10 years (±1 year) old. The usable features are more in favour of a girl. According to Telkkä (1962), the estimated height would be just under 119 cm. Compared to today, this would correspond to the height of girls of school age.

Fig. 5 Feature A4; upper central incisor on the left: Tooth use as a "third hand".

Fig. 6 Feature A4; right patella from the front.

Fig. 7 Feature A4; right kneecap: severe exostosis formation.

In addition to suspected periodontal disease, sinusitis was also diagnosed. The extremely pronounced cribra orbitalia in both orbital roofs indicates at least severe stress, if not a severe infection (Fig. 10–11). The latter is supported by further evidence. There are clear pits on the tabula interna of the frontal bone. Meningitis may have been present. There are also signs of this on the inside of the left parietal bone. The left humerus shows a pit-like lesion on its proximal diaphysis.

Fig. 8 Photogrammetry of feature A5 (Grave 2).

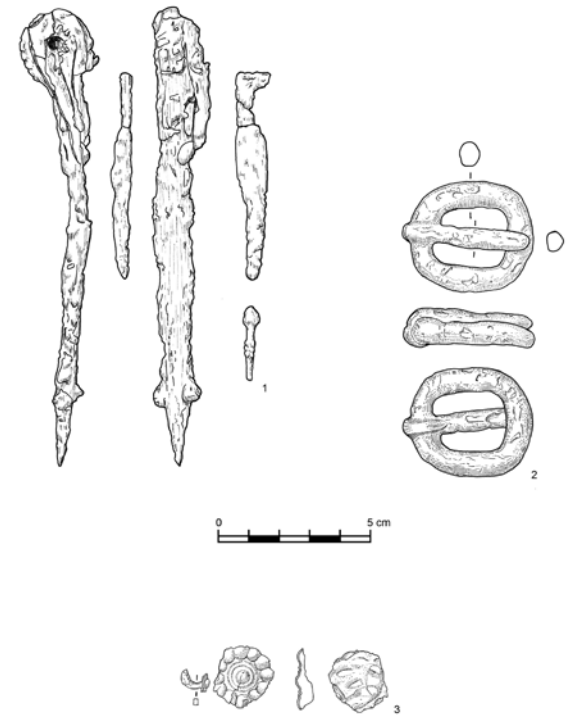


Fig. 9 Redrawing of metal finds from Medieval graves. 1 Iron object from feature A5, 2 Iron belt buckle from feature Q10, 3 Fragments of bronze trimmings from a belt set from feature Q10.

Feature A6 (Grave 3)

Only part of the grave pit was excavated, unearthing only a human skull at the eastern border of the burial pit, most likely

Fig. 10 Feature A5; facial skull.

Fig. 11 Feature A5; cribra orbitalia in the left orbital roof.

as part of a confirmed burial (Fig. 12). The skull is preserved well, but fragmented and compressed. Orientation: NW–SE. Depth: 62 cm; the human skull was 50 cm below the surface.

Without inventories.

Anthropological observations (S. Zäuner)

The calva with parts of the base of the skull, parts of the upper jaw and zygomatic bones, pieces of the sphenoid bone, and the lower jaw including four teeth are all preserved *in situ*. The assessable features suggest an age

Fig. 12 Photogrammetry of feature A6 (Grave 3).

Fig. 13 Feature A6; left maxilla and zygomatic bone.

Fig. 14 Feature A6; inflammation of the periodontium.

between 55 and 65 years. The criteria for the gender diagnosis clearly point to a male.

The teeth present are heavily tartarised. Enamel hypoplasia is present on at least one tooth. One posterior tooth shows severe caries. There are typical signs of periodontitis along the associated tooth socket (Fig. 13–14). A fistula was located at the root of the diseased tooth. There are clear signs of a healing tendency. The adjacent first molar has fallen out during the individual's lifetime, and the tooth pocket is in the process of closing. The 2nd molar also indicates a fistula, which, however, shows no signs of healing. The inflammation was therefore still present at the time of death. Furthermore, there is a suspicion of sinusitis. It cannot be completely ruled out that the inflammation in the upper jaw could have been partly responsible for the death. Infected teeth have an effect on the heart muscle and can also lead to septicaemia.

Feature A7 (Grave 4)

Only a small part of the burial pit in its eastern side has been researched (Fig. 15). Depth: 51 cm.

Without inventory.

Anthropological observations (S. Zäuner)

In addition to some tarsal bones, all metatarsal bones on both sides are present, along with some toe bones. The overall impression of the bones suggests an adult individual (aged 20 to 60 years at the most). It was not possible to make any definite statements about the sex. Pathological or other abnormalities on the bones were not visible to the naked eye.

Feature K11 (Grave 5)

Inhumation. Orientation: WNW–ESE. Shape of the grave pit: the shallow burial pit had

Fig. 15 Photogrammetry of feature A7 (Grave 4).

Fig. 16 Overview of feature K11 (Grave 5).

an elongated rectangular form (Fig. 16). Dimensions of the grave pit: 175 x 42 cm. Depth: the skull was at 100 cm, while the bottom of the pit was recorded at ca. 120 cm. The burial pit is very narrow.

The skull of the well-preserved supine skeleton had fallen to the left; the arms were crossed over sacrum, the right resting over the left one, while the legs were stretches out. Sex: male. Age: 40–45 years old.

Without inventory.

Feature L18 (Grave 6)

Inhumation. Orientation: WNW–ESE. Shape of the grave pit: the shallow burial pit had an elongated rectangular form, narrowing at the legs. Dimensions of the grave pit: 90 x 39 cm. The burial pit is very shallow, depth around 25–30 cm (Fig. 17).

The skull of the supine child skeleton fell to the right; its arms were laid beside the body, while the legs were stretched out. The whole skeleton is badly preserved. Sex: unidentifiable. Age: 3–5 years old (Infans I).

Inventory: A globular black glass bead with white inclusions (diameter: 1.2 x 1.0 cm) (Fig. 18,3) and a triangular white-brownish glass bead (diameter: 1.4 cm) (Fig. 18,2).

Feature M20 (Grave 7)

Inhumation. Orientation: WNW–ESE. Shape of the grave pit: the burial pit had a rectangular form running into the western profile, preventing the excavation of the entire pit. Dimensions of the grave pit: ca. 200 x 90 cm (Fig. 19).

The skull of the supine skeleton is slightly deformed through sediment load and had fallen to the left. Initially, the arms were placed

Fig. 17 Overview of feature L18 (Grave 6).

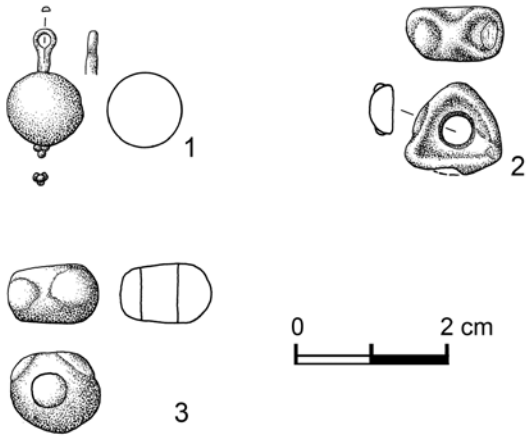


Fig. 18 Beads from the Medieval graves. 1 spherical bronze bead cast as a hollow body from feature M20, 2 glass bead with a fine layer of glass paste from feature L18, 3 blue glass bead with three white dots at the edge from feature L18.

on the sacrum bone, but they had moved. The left Ulna and Radius were twisted on the torso (Fig. 20). From the position of the arms, and especially of the legs, the body was most likely wrapped in a cloth. The bones of the skeleton have shown a good conservation. Sex: male. Age: 25–35 years old. Coffin burial: 1. A coffin nail was found under the right Scapula (Fig. 21); 2. Iron structures in the area of the feet (Fig. 22).

Inventory: A bronze bead was found next to the right scapula. The pearl was cast of two soldered sheet metal globes with a round ear, and on the bottom with a soldered line made of three granulated ornamentations followed by a ring and finally a big granulation at the end. Height: 1.75 cm; Diameters of the globe: 1.1 x 1.0 cm (Fig. 18,1).

Feature R4 (Grave 8)

Inhumation. Orientation: WNW–ESE. Shape of the grave pit: the shallow burial pit had an elongated rectangular form, narrowing at the head and the legs. Dimensions of the grave pit: 100 x 40 cm. Depth: 70 cm (Fig. 23).

The skull of the supine skeleton is slightly deformed through sediment load. The right hand was placed on the stomach, flexed at 90°, while the left hand was placed under of this, the arm flexed at ca. 80°. The skeleton is moderately preserved and is 90 cm long (in situ). Sex: unidentifiable. Age: 5–6-years old child.

Inventory: A bronze ring was found in the chest area, near the fingers (Fig. 24).

Early Middle Age (Avar-era grave)

Feature Q10 (Grave 9)

Inhumation. Orientation: N–S. Shape of the grave pit: the shallow burial pit had an elongated rectangular form. Dimensions of the grave pit: 200 x 50 cm. Depth: around 30 cm (Fig. 25).

The grave pit was disturbed; the missing or secondary position of the human bones suggests that the grave was robbed and the torso bones removed from their original position, or cast out of the grave. Thus, the middle part of the grave was severely damaged by an old intervention bisecting the burial. The upper extremities of the body were found in dislocated positions above and around the skull and upper part of the body. In turn,

Fig. 19 Overview of feature M20 (Grave 7).

Fig. 20 Close-up of the area of the lower abdomen of the burial feature M20. The dislocated left forearm is clearly visible.

Fig. 21 Photo of the right scapula with an adhering iron object (coffin nail?) from the burial feature M20.

the iron objects were found in dislocated, secondary positions in the grave fill, above the skeleton.

As we can reconstruct, the skeleton was supine; its arms lay alongside of the body. There are just a few tarsal bones and foot phalanges. The right tibia is on the right side of what could be the thorax and abdomen.

Sex: without data. Age: adult.

Inventory: Iron rectangular buckle (Fig. 9,2). Bronze fragments possibly related to the belt, perhaps rivets of the belt, stabilised with rectangular washer plate (Fig. 9,3).

2. Analysis of the uncovered graves

Nine graves were discovered in the six trenches (A, K, L, M, R, Q), which can be dated to the Early and Late Middle Age based on their orientations, and the poor material culture exhibited by their funerary inventories. The ascriptions are as follows:

Q10 (Grave 9) to the Early Middle Age.

A4 (Grave 1), A5 (Grave 2), A6 (Grave 3), A7 (Grave 4), K11 (Grave 5), L18 (Grave 6), M20 (Grave 7), and R4 (Grave 8) to the Late Middle Age.

2.1 General aspects of the funerary sites: the "conception of the afterlife"

Along with birth, death is the most unequivocal liminal event in a human's life. Funerary acts reflect how a community thinks about death and the afterlife, and how the community maintains its continuity after losing one of its members[1]. The grave is the focal point of the whole ritual, and, as such, it presents an insight into funerary practices.

1 In cultural anthropology and ethnology, the concept of "ritual" has been considered an intellectual construction.

Fig. 22 Close-up of the lower part of the burial feature M20. The twisted position of the right thigh, for example, is also clearly recognisable here. Further iron objects (coffin nails?) were found in the area of the knees and feet.

Fig. 23 Photogrammetry of feature R4 (Grave 8).

2.1.1 Analysis of Feature Q10 (Grave 9)

This grave presents a quite different orientation to the other eight, also presenting particularities regarding its inventory. Despite its robbing, the general characteristics of its inventory (judging by the few surviving pieces, and the lack of the remains of animal sacrifices or traces of deposited weapons) present a clear image of a poor grave owner. From a sociological perspective, the apparent lack of attention given to the arrangement of the burial pit may be interpreted as a sign of the inferior status of the buried individual. Thus, we can here exclude a ritually complex burial act, since not even the most insignificant archaeological traces support this; whether the grave robbing was simple plunder or a ritual act is unclear.

The skeleton of the robbed grave Q10 was orientated N-S, which is an unusual, if well-known custom for the deceased in the Avar age. In the micro-region of Dudeştii Vechi –Bucova Pusta IV, this custom also occurs at Vizejdia – Mound VI (Nagy 2010, 20), Klárafalva – Site B (Szentpéteri 2002, 204f.), and Sânpetru German (Dörner 1960, 423–433). These funerary sites have been discovered 18, 22, and 44 km away from Dudeştii Vechi and Bucova Pusta IV (Gáll/Romát 2016, 443), but it is also well documented in other regions, such as, for example, in the case of Ártánd-F 14211 Határkő (Mesterházy 1987), and Tótkomlós (Rózsa 2002, 341) (Early Avar period), Apátfalva-Vámház (Bende 2017, 15f.), Csárdaszállás (Bende 2017, 17), Hajdúnánás-Fürj-halom-járás (Rácz/Szenthe 2009, Fig. 3), Hódmezővásárhely-Gorzsa (Bende 2017, 30f.), Nădlac 7M (Cociş et al. 2016, 5–27), Örménykút (Bende 2003, 189-192), Rákóczifalva (Schmid 2015, 24), Stara Moravica-Koplalo (Ric 1979, 38, 40; Mrkobrad 1980, 89, 583; Balogh 2016, 88), and Szentes-Kaján (Korek 1943, 50) (Late Avar period), etc. Based on these occurrences,

Fig. 24 Close-up of the thorax area of the burial feature R4, with a bronze spiral ring in the area of the child's right hand.

Fig. 25 Photogrammetry of feature Q10 (Grave 9).

it can be stated that this orientation custom is well-attested both in the early and late Avar period, albeit uncommonly (Bende 2017, 250–253).

Usually, the orientation of the skeletons is attributed to the community's conception of the afterlife (Kovács 1944, 418).

The deceased's arms were laid alongside the body, a common feature of Avar-era graves.

Much like other burial grounds in this region such as Nădlac-1M (Gáll/Mărginean 2020, 373–407), Pecica-Smart Diesel (Mărginean et al. 2022, 242), or Vizejdia – Mound VI (Nagy 2010, 20), Grave Q10 has a very poor inventory, and only certain objects related to the belt can be considered datable finds.

Here, the rectangular iron buckle is a very common item in the graves of the Avar age[2]. From a chronological standpoint, the rivets of the belt stabilised with a rectangular washer plate are slightly more informative, as this object has close counterparts in both early Avar age burials such as Biharkeresztes-Lencséshát (Mesterházy 1987, 222, Fig. 8.1–9), Nădlac-9M Grave 1 (Gáll 2017, Pl. 6/14–17; Pl. 228/1.b, 12), as well as in late Avar age cemeteries such as Székkutas-Kápolnadűlő Graves 125, 126 (Nagy 2003, 52, Fig. 15, 25), etc.

In conclusion, without items permitting a more precise dating, the Grave Q10 can be dated to between the 6th–9th centuries on the basis of its orientation and inventory, albeit radiocarbon analysis could further precise this (Fig. 26).

2 In this sense, see the statistical analysis of the buckles: Gáll 2017, 74–78.

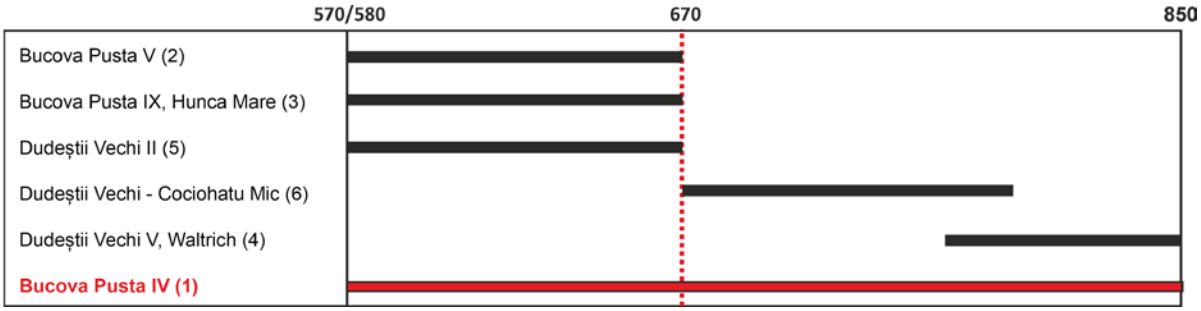


Fig. 26 Dating of the Early Medieval graves at Bucova Pusta IV in comparison to the neighbouring burial sites.

2.1.2 Analysis of the graves from the Late Middle Age

Judging by the general plan of the excavation, the other eight graves excavated in six trenches at Bucova Pusta IV belong to one funerary site. Based on the lack of burials in the south-western end of Trench R, the cemetery's extent can be delimited only at its south-western edge. At the same time, the four graves excavated in Trench A illustrate that the northern edge of the cemetery remains unknown. While further excavations are necessary to resolve this problem, the eastern limits of the cemetery can be estimated with some certainty by comparing the field maps of the excavations of 2010 and 2014 with the map prepared by Kisléghi.

The relative depth of the pits varies between 25 cm and 130 cm. The depth data of the graves cannot be statistically evaluated on account of the lack of context, i.e. the small number of the graves and the disturbances which they had suffered. In some cases, the pit gradually narrowed.

The eight recently excavated burials almost uniformly present a WNW–ESE orientation, as with most of the 12 graves researched by Gyula Kisléghi Nagy in 1903 (Nagy 2010, 97–98); this is a general tendency after the 11th century[3], proving that the recently found burials and those excavated by Kisléghi belonged to the same cemetery.

When analysing the position of the arms, we may first take into consideration factors unrelated to the deposition of the corpse, but rather with the natural decay process. In order to approach more systematically the issue of the positioning of the arms and the burial rite, we took a categorisation from other, previous studies with 18 differentiated positions as a starting point (Ritoók 2004, 119, Fnt. 37), to which we then added six more in our previous, monographic work, grouping these 24 positions into seven main categories (Gáll 2004–2005, 360f., Fig. 8).

From these 24 positions, we could identify five of these at Dudeştii Vechi and Bucova Pusta IV; these were as follows:

Arms laid alongside the corpse (L18) (Pos. I).

Hands folded or resting on the pelvis (A4, R4) (Pos. XIII).

3 In the case of the 10th century's burial grounds, the great majority of the deceased were orientated in W-E, NW-SE directions; however orientations such as E-W, N-S, and S-N are known as well (Gáll 2004–2005, 344–347).

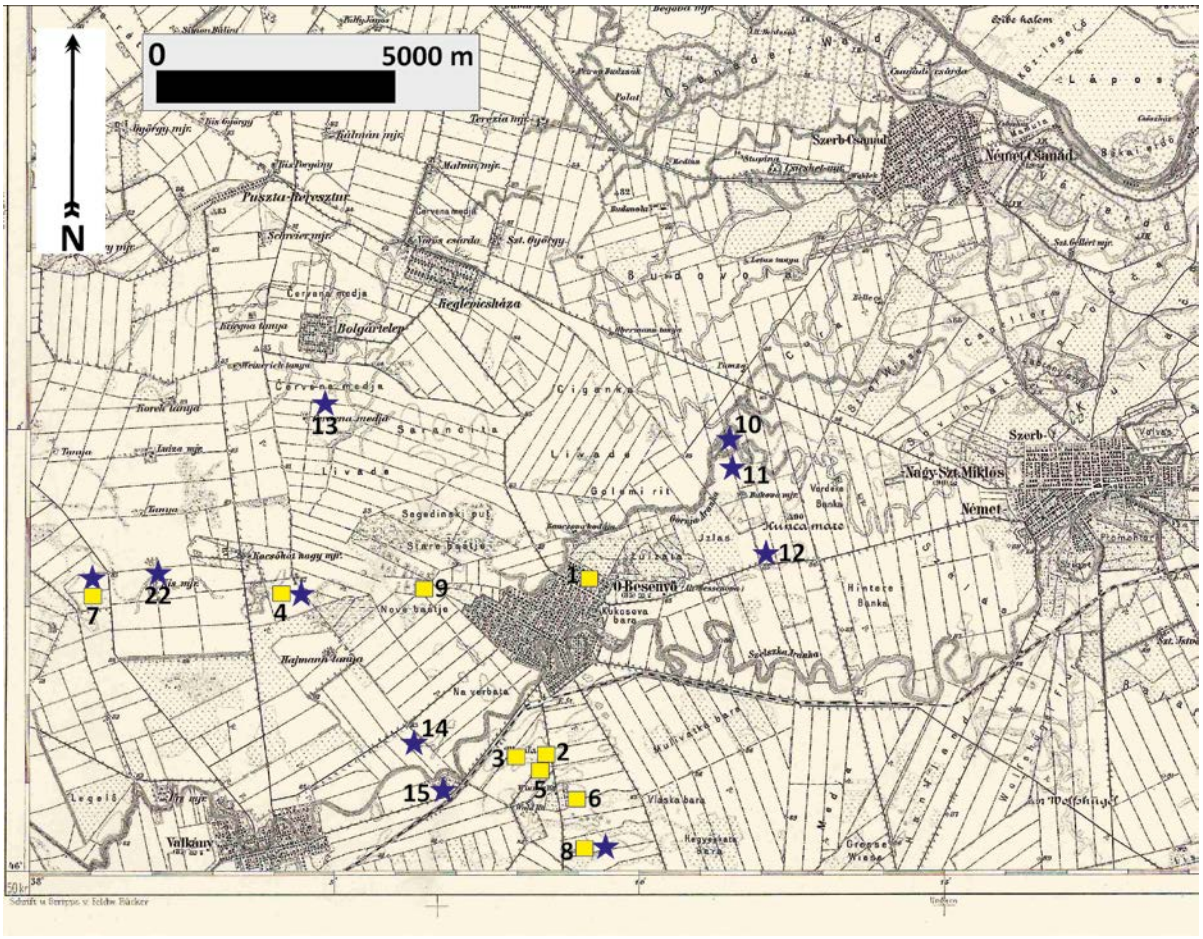


Fig. 27 Archaeological sites from the 3rd to 5th centuries AD, respectively in the Middle Age near Dudeştii Vechi (Map of the 3rd Military Survey). 1 Dudeştii Vechi – property no. 217, 2 Dudeştii Vechi – Dragomirs mound, 3 Dudeştii Vechi II, 4 Dudeştii Vechi – site 32, 5 Dudeştii Vechi – site 34/Movila lui Mândul, 6 Dudeştii Vechi – site 37, 7 Dudeştii Vechi – site 43, 8 Dudeştii Vechi – site 45, 9 Dudeştii Vechi – site 46, 10 Bucova Pusta – plot 4953, 11 Bucova Pusta – plot 4955/4181, 12 Bucova Pusta I, 13 Dudeştii Vechi – 1 km south of Colonia Bulgară, 14 Dudeştii Vechi – right bank of the Aranka river, 15 Dudeştii Vechi – left bank of the Aranka river, 22 Dudeştii Vechi – Cociohatu Mic.

Arms folded in the shape of a cross or clasped in a prayer gesture on the sacrum, or positioned one above the other (A5, K11) (Pos. XIV).

Without data: A6, A7, M20.

In the case of the graves excavated by Kisléghi, the hands lay folded on the sternum in five cases, and they laid alongside the body in seven.

As conclusion to these observations, we can remark that the placement of the arms in the cemetery of Bucova Pusta IV was a very heterogeneous aspect, resembling the contemporaneous graveyards in the neighbouring geographical region (the southern part of the Great Plain, between the Tisza and the Danube) analysed by Erika Wicker[4].

4 In this sense, see for example: Gaál 1982, 133–157; Wicker 2008, 61–65. The positioning of arms in the 16th–17th centuries in the southern part of the Carpathian Basin has been systematized by Wicker 2003, XIII, Tab. 2.

Fig. 28 Burials from the Avar Age near Dudeştii Vechi (Map of the 3rd Military Survey). 1 Bucova Pusta IV, 2 Dudeştii Vechi V, 3 Bucova Pusta IX/Hunca Mare, 4 Bucova Pusta V, 5 Dudeştii Vechi II, 6 Dudeştii Vechi – Cociohatu Mic.

Archaeological research has demonstrated a shift in the positioning of the forearms of the deceased throughout the entire European continent during the 13th–14th centuries (Ritoók 2010, 486, Fnt. 92, including the subject bibliography) from that of the previous (11th–12th) centuries, presenting a diversification of positions; this new tendency persists as late as even 15th–17th centuries, which is also observable for the cemetery at Bucova Pusta IV.

Based on the available documentation, several wooden structures and chests/coffins could be identified as well in these (usually disturbed) graves, usually signalled by the discolorations of the soil from the decayed wooden planks (A4), or the presence of coffin nails (A5, M20). Regarding the coffin burials, we could not observe any tendencies: a senilis female was buried in A4, and a child (probably a girl) in A5, and finally an adultus male in M20 respectively.

Grave M20 proved to be a more interesting case due to the coffin nail with arch/ring-shaped end discovered near the right side of the head.

In some cases, Wicker observed the presence of only one or two of the coffin-nails in burials at 16th–17th century cemeteries, usually at the corners, at the bottom, or ca. 30 cm above the skull (Wicker 2003, 25; Wicker 2008, 66). In

A5, the coffin nail registered in the grave was found at the bottom of the pit. The presence of only a single coffin nail in a burial (albeit with a ca. 15 cm length) has also been registered in another cemetery of this period at Bácsalmás (Wicker 2008, 66).

Perhaps another coffin type may be conjectured from the somewhat smaller coffin nail found under the right scapula of the individual buried in M20, as well as by the supposed nail-fragments found in the area of the feet.

In respect to the 12 graves researched by Gyula Kisléghi Nagy, we have no precise data regarding the coffins beyond their existence.

In conclusion, these three cases in which we have data on the use of coffins constitute a relatively high percentage in the context of this partially excavated cemetery.

In her analysis, Wicker paints a diverse picture regarding the use of coffins with nails, stating that their proportion in the cemeteries of the southern part of the Carpathian Basin differs between each community (Wicker 2008, 65–66).

The inventories of these burials were poor, with only three graves presenting grave goods, all of very modest means.

Indeed, two glass beads were documented in the neck area of an Infans I in Grave L18. These different types of beads do not provide an accurate means of dating. Both of them are types used over a large timespan, from the Early Medieval period to the modern age[5]. Wicker (2008, 113) already remarked the small number of the beads utilised as a necklace, as evident here.

A sheet-metal button ornamented with granulations found in Grave M20 next to the right scapula of an adultus male renders the dating of the cemetery possible. This clothing closed with just a single button may have been a shirt or some kind of light textile outerwear (Wicker 2008, 124). As in other situations registered by the excavators, the button was found in the region right of the middle section of the neck in Grave M20. As an analogy, we can evoke a dress type widespread both among adults and children in the northern part of Bačka through the 16th–17th century, closed with only a single button (Wicker 2008, 124f.). Thus, the closest analogies of the button in terms of typology in the larger region are the finds from Bácsalmás Graves 6, 253, 388 (Wicker 2008, Pl. VII, Tab. 6, 9–10), Dombóvár Graves 7, 37, 103 (Gaál 1982, Pl. I, IV), Katymár Grave 40 (Wicker 2008, VII, Pl. 4.), Kecskemét-Kossuth tér Grave 19 (Biczó 1976, Fig. 12), and Zombor-Bükkszállás Grave 88 (Korek 1994, 88). However, they are known throughout the whole of Eastern and Central Europe[6]. All of these were dated to the 16th–17th centuries, offering us an accurate chronological marker for the cemetery at Bucova Pusta IV.

Other finds such as the finger ring from Grave R4, or the flat-sheet-like fragment could not be dated more precisely.

In terms of the inventory of the graves excavated by Gyula Kisléghi Nagy in 1903, he mentioned a hairpin on the skull of the deceased from the Grave G-6. Similar examples have been registered at Bácsalmás, Bükkszállás, Dombóvár, Katymár, and Madaras (Wicker 2008, 97, Tab.). In Grave L17, he documented a button (of unknown type), and an iron fragment with an unknown function in Grave E13.

5 Regarding their analyses in a neighbouring region in the Late Middle Age, see: Wicker 2008, 113–115.

6 On the 16th-17th centuries' buttons ornamented with granulations in the Carpathian Basin and Balkans, see: Bajalović-Hadži-Pešić 1984, T. LXI; Wicker 2008, 124.

Taking into consideration the data presented, these graves (those excavated by Kisléghi, and those recently excavated) constitute a part of a cemetery used over the course of the 16th–17th centuries. The poor inventory of the graves most probably points towards a rural community of modest means, with possible connections to the communities living in the region between the Danube and Tisza[7], or the participation of its members in commercial trade activities.

To conclude, as a result of excavations at Bucova Pusta IV in the first years of the 20th century and in the first decades of the 21th century respectively, one grave from the Avar period, five graves from the 10th century, and 20 graves datable to the 16th–17th centuries have been identified beside the prehistoric sites.

3. The evolution of the habitat in the microregion of Dudeștii Vechi from the so-called Migration Period to the Late Middle Age

In the era of Gyula Kisléghi Nagy, the area of Dudeștii Vechi became the subject of series of intensive (if in some aspects amateurish) archaeological investigation. As a result, several sites dated from the 3rd–4th centuries to the Late Middle Age were excavated, mainly to the east, south, and north of the village.

Among Kisléghi Nagy's discoveries regarding the period of the 3rd–5th centuries, two sites are notable (Fig. 27), one of them is Dudeștii Vechi-street of Nerău (cremation urn) (the place is unidentifiable), and the other a probably destroyed site at Dudeștii Vechi-Mound II (Nagy 2010, 103f., 137). Inside the built-up area of the village, at the realty no. 217, a grave with a jug has been discovered, which could be dated to the 4th–5th centuries (Ronkov et al. 2006, 33). South of the village, at a place named Movila lui Dragomir, other graves were also unearthed, belonging to a "Sarmatian" burial ground, which, based on its inventory has been dated by Daniela Tănase (2002–2003, 233–244) to the 4th–5th centuries. A settlement dated to the 3rd–4th century has been localised west of Cociohat channel (the place is unidentifiable) (Ronkov et al. 2006, 41). In previous years, several other archaeological sites have been identified (mainly settlement features), dated very broadly to between the 2nd and 4th centuries: Site 32, Site 34, Site 37, Site 43, Site 45; however, at Site 46 a child grave considered "Sarmatian" with a S–N orientation, has been destroyed (Micle/Rogozea 2017, 489–492).

In terms of funerary sites, the Avar period (Pohl 2018) is much better represented in the area of Dudeștii Vechi (Fig. 28). At mound no. V, located on the territory of Dudeștii Vechi commune, the graves of two horsemen have been unearthed. In both cases, Kisléghi recorded the partial interment of a horse and of harness pieces; in grave no. 2, a straight double-edged sword was also found. Based on analogies, the two graves can be dated to the early Avar period, most probably to the first half of the 7th century (Nagy 2010, 106–108; Tănase/Gáll 2012).

Not far from Mound V, Kisléghi identified a cenotaph (or perhaps a severely robbed grave?) in 1906, in which he found a reed-shaped spearhead, a rectangular iron application, knife fragments, and a belt tongue (Bucova Pusta IX, Hunca Mare) (Nagy 2010, 129f.). Most probably, the graves in Mound II near Dudeștii Vechi can also be dated to the early Avar period (Nagy 2010, 103f.). Those of Bucova Pusta V (Waltrich) are also to be ascribed to the Avar period (8-9th centuries), on the basis of the typology of the stirrups (Nagy 2010, 99f.).

7 This community undoubtedly preceded the Bulgarian settlers, who came after the Austrian "reconquista", during the 18th century (Ronkov et al. 2006, 86).

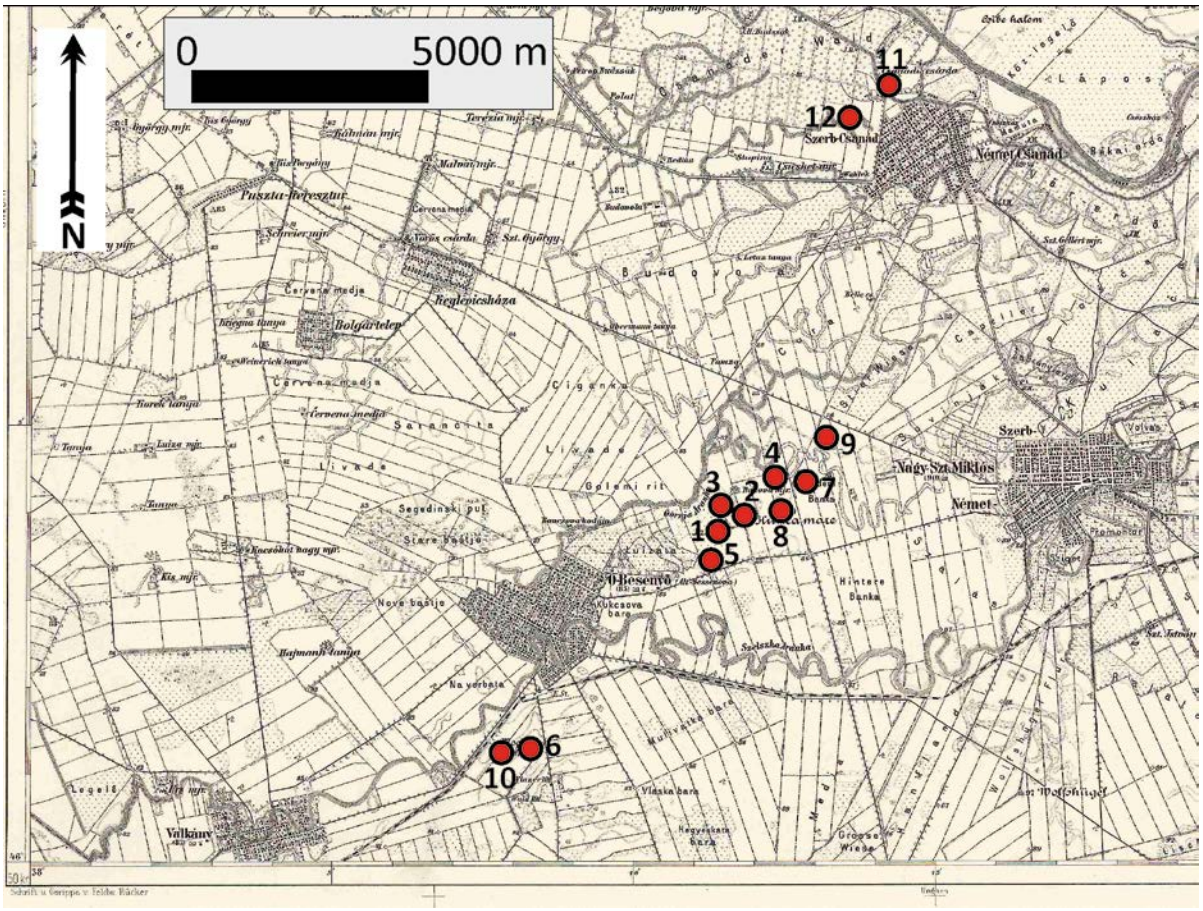


Fig. 29 Burials from the 10th – 11th centuries AD near Dudeştii Vechi (Map of the 3rd Military Survey). 1 Dudeştii Vechi I, 2 Bucova Pusta II, 3 Bucova Pusta III, 4 Bucova Pusta IV, 5 Dudeştii Vechi V, 6 Dudeştii Vechi VI, 7 Bucova Pusta VIII/Anton Balthazar Walter, 8 Bucova Pusta IX/Hunca Mare, 9 Bucova Pusta V (Waltirich), 10 Dudeştii Vechi – Dragomirs mound, 11 Cenadul Sârbesc 1 (field of the Greek community), 12 Cenadul Sârbesc – Poiana III.

Similarly, a grave at Cociohatu Mic can be dated to the second half of 7th century and/or in the 8th century as well, based on the orientation of the deceased and the inventory (Craiovan 2021, 10–15). With Grave Q10 at Bucova Pusta IV, we can count a total of six funerary sites from the Avar period in the area of Dudeştii Vechi.

The chronology of the 10th century funerary sites near Dudeștii Vechi

During his excavations between 1903 and 1909, Gyula Kisléghi Nagy (2010, 67–69, 78–87, 95–98, 100–103, 108f., 114f., 121f.) investigated eleven sites (Fig. 29), unearthing burial grounds, as well as single graves, which could be dated to the age of "Hungarian conquest"[8]. Some of them can be dated to the

8 The archaeological inheritance of the "conquering Hungarians" should not be regarded as ethnospecific, but rather as a regional cultural "conglomeration" which was characteristic of the Carpathian Basin in the 10th century, and therefore of cultural habits of the pastoral population in the Carpathian Basin during that age. The society of this steppe-state (by Walter Pohl's definition: Pohl 2003, 71–72) was composed of the members of the so-called "warrior society" and of the rural population whose interest was in agrarian production and trade. The spatial and chronological development of the Hungarian power structure in the 10th century is marked by the geographical distribution of certain types of objects (sabretache plates and mounts, sabres with gold and silver fittings) indicating a so-called "prestige chain network". According to this center-periphery model, the need to acquire and own

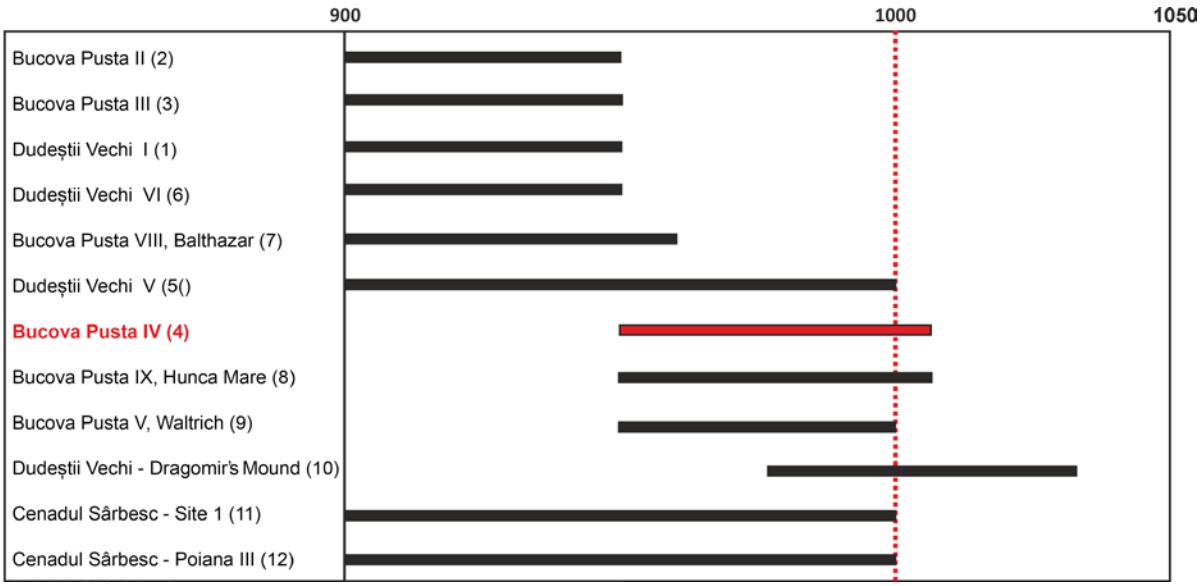


Fig. 30 Dating of the Late Medieval graves at Bucova Pusta IV in comparison to the neighbouring burial sites.

first two-thirds of the 10th century (Bucova Pusta II, III), while others date to the second half of the 10th century (Bucova Pusta Mound IV, IX) (Gáll 2013, Vol. I, 812, Fig. 282).

Kisléghi's observations regarding some aspects of the funerary acts are most valuable, particularly regarding the position of the objects inside the graves, the reconstruction of which is of utmost importance. Among others, his observations regarding the position of the quiver in a grave is still considered to be a great achievement. For quite some time (almost half a century) after the discovery of the first grave from the age of conquest, researchers still did not recognise the role of the iron rods found near the skeletons. After Géza Nagy, who was the first in this field who correctly analysed the find in Piliny (Nagy 1890, 294; Nagy 1893) and András Jósa (1900, 216–221), Kisléghi made a precise description of the position of the quiver in a grave (Bucova Pusta III and VIII) (Nagy 2010, 79).

While unrecognised by his contemporary peers, a similar achievement of his was establishing the orientation of the first grave from Bucova Pusta II. Despite its publication, we were unable to find any mentions of it by other archaeologists in his era. In the case of the female grave at Bucova Pusta, he observed that the corpse had not been interred in a W-E direction, as was the custom of the "Hungarian conquerors", but rather in an E-W direction. At the same time, on the basis of the earrings with a cast-bead row pendant, the open-work braid discs, and the recycled belt mounts found in the grave in Bucova Pusta, it can be stated, that the interred person wore objects and jewellery characteristic of the furnishings of female graves of classic horse-weapon burials.

prestige goods could trigger various military, political, and social phenomena. These types of objects – as top archaeological finds – were emblematic of the elite of the Conquest Period. Their geographical distribution clearly outlines spatial patterns, which can be observed also in connection to other – simpler – finds dating from the 10th century. In regard to cultural customs and material culture, previous studies already pointed out the cultural influence of a core region (including, e.g. the Upper Tisza region). The integration of the local population into the power network could be indicated by the expansion of the Hungarian cultural milieu.

The reversely oriented (E-W) burials are often explained in the literature as representing a fear of the dead returning (Kiss 1983, 158; Szabó 1964, 120–129; Fodor 1996, 39). Nevertheless, on the basis of data shown in three of our studies, the reversed, E-W orientation cannot be related with this belief, or only in some exceptional cases (Gáll 2004–2005, 338–347; Gáll 2010, 294–303; Gáll 2013, Vol. I, 597–601). If there is only one grave in a cemetery with such an orientation, then the cause could be ritual, as in the case of this female grave from Bucova Pusta II (NE-SW orientation). Yet, it could also archaeologically prove cultural assimilation of the defeated population. Some of Kisléghi's other observations might also aid in better understanding the burial customs of the age of conquest. For instance, he observed the use of coffins in the grave with a weapon at Bucova Pusta IX, Hunca Mare. The fact that it is the only known burial with a coffin in the Banat (belonging now to Romania) demonstrates the importance of his discovery. He also managed to register a vessel in the fourth grave from Bucova Pusta V, a grave with a weapon. Five rhombus-shaped gilded bronze shift ornaments were also discovered in this grave, as well as five arrowheads and a piece of iron, supposed by Kisléghi to be part of a quiver.

One of the significant aspects of burial customs in this age of conquest is the presence of ceramic vessels containing food and drink in the graves. This custom, considered "Slavic" until the beginning of the last century, was registered in an ever-growing number of cemeteries from the 10th–11th centuries; thus, Attila Kiss (1969, 175–185) refuted this ethnicising thesis some fifty years ago. We consider this particular finding an important one, because graves furnished with both weapons and vessels are quite rare in the 10th century.

Kisléghi also noticed a burial custom quite possibly dating to the age of conquest in the Banat region; this was an animal bone (probably a sheep femur) at the upper end of the grave, behind the skull, in the grave with the find of a weapon from Bucova Pusta III.

After Kisléghi's research activity in the area of Dudeștii Vechi, no archaeological research was performed in respect to the 10th–11th century burial grounds until 1989. It was only after 1990 that some graves were excavated at Dragomir's Mound; based on their inventories (trapezoid-shape stirrups), these can be dated to between the end of the 10th century and the first part of the 11th century (Tănase et al. 2005; Gáll 2013, 427–431) (Fig. 30).

The Medieval and the early modern age archaeological sites

Although there is a considerable number of Medieval and Early Modern sites (11th–17th centuries) near Dudeștii Vechi, these are somewhat less well researched. In 1902, Gyula Kisléghi Nagy excavated a site which he called Bucova Pusta-Plot 4953, where he probably discovered a church surrounded by graves, datable from coins of Louis I, Mary I, and Vladislaus I (14th–15th centuries) (Nagy 2010, 70f.). South from here, he also identified a Medieval settlement in 1906 (Nagy 2010, 122–124). Perhaps another Medieval grave was also discovered at Mound I (Nagy 2010, 71f.).

In the last decades, particularly after 1989, several other Medieval sites have been registered west of the commune: 1) a Medieval settlement (ca. 11th–12th centuries) between Dudeștii Vechi and Colonia Bulgară (circa 1 km south of the latter) (Ronkov et al. 2006, 39; Craiovan/Prian 2016, 441–446), 2) a Medieval settlement (ca. 11th–12th centuries) next to the right bank of Aranka, near the Hanva Kanal, and 3) the ruins of

a Medieval church next to the left bank of Aranka respectively (Ronkov et al. 2006, 41). In the recent years, other Medieval settlement features have also been identified: Site 32, Site 45, and perhaps Site 43 (Micle/Rogozea 2017, 489, 491f.).

Conclusions

In total, we could count nine sites from the 2nd–5th centuries, six funerary sites from the Avar period, and eleven burial grounds belonging to the age of Hungarian conquest respectively, alongside ten churches, churchyards, and settlement features of the Middle Age.

On the strength of this data, we can state that only preliminary investigation has occurred, of which the most important was at Bucova Pusta IV. The continuation of this research is of paramount importance for understanding the archaeology of the Banat region.

Chapter 20

Absolute chronological framework of the site of Bucova Pusta IV

Raiko Krauß

A series of 19 AMS dates is available from the site of Bucova Pusta IV, all of which were measured at the Poznán Radiocarbon Laboratory (Tab. 1).

Two dates on charcoal samples from sediment drilling cores in the silted-up river course north of the site were used to determine the time of this geographical unit, and cannot be reconciled with archaeological evidence. The older date (Poz-71458: 14000±190 BP) is calibrated before the Younger Dryas, and thus within the range of the European Upper Palaeolithic, roughly parallel to the Magdalenian. The younger date (Poz-71444: 3350±40 BP) lies calibrated in the middle of the 4th millennium BC, which corresponds to the Late Chalcolithic Boleráz/Cernavodă III Horizon in South-eastern Europe. As of yet, no finds from either period have been documented at any of the archaeological sites at Bucova Pusta.

A total of three charcoal dates are available from Early Neolithic features at Bucova Pusta IV (Poz-51356: 6890±40 BP; Poz-51355: 6920±50 BP; Poz-58612: 6940±40 BP), which are informative about the beginning of settlement at this site. Significantly, all three dates yield very high values which we would place before the beginning of settlement. This demonstrates a classic old-wood effect because the data only document the period of time during which the timbers grew. They would have been felled and used in the settlement at a later date. The three charcoal dates thus fix a terminus post quem for the beginning of settlement on Bucova Pusta IV.

The series of dates on short-lived samples reflects the Early Neolithic occupation of the site in close succession. The calibrated values range from 5800–5510 calBC, a timespan within which the lifetime of the Early Neolithic settlement can be assumed. Taking into account the terminus post quem of the wood and the oldest dates of short-lived samples, the beginning of the settlement can be narrowed down to 5750±20 calBC. In light of the almost ideal diagonal shape of the calibration curve in this range, the individual dated features can be ranked according to their ^{14}C-age. On account of the stratigraphic observations and due to fitting fragments, we assume a single-phase settlement. Within this span, Feature D19 appears to be particularly early. Charred seeds of Cornelian cherry (*Cornus mas*) were dated (Poz-88722: 6840±40 BP). A short time later, the backfilling of Pit H8 begins (Poz-88721: 6820±40 BP; Poz-58362: 6730±40 BP). The use of Ovens K12 (Poz-88719: 6790±40 BP; Poz-88720: 680±40 BP) and G/H1–G10

Nr.	features	context	labcode	^{14}C-age [BP]	STD	material	calBC 2sig.
1	B9-20/D2	Neolithic pit (dwelling)	Poz-51356	6890	40	charcoal	5880-5680
2			Poz-51354	6750	40	bone (*Bos*)	5740-5580
3			Poz-58363	6730	35	bone (*Bos*)	5710-5590
4			Poz-51355	6920	50	charcoal	5930-5690
5	D19	Neolithic feature	Poz-88722	6840	40	seeds (*Cornus mas*)	5800-5640
6	G/H1-G10	Neolithic oven	Poz-58612	6940	40	charcoal	5920-5720
7			Poz-58360	6705	35	bone (*Bos*)	5690-5530
8			Poz-88718	6740	35	seeds (*Triticum monococcum*)	5720-5600
9	G/H 6/9	Neolithic pit	Poz-88717	6770	40	chaff/seeds (*Tr. monococcum/dicoccum*)	5730-5610
10	H8	Neolithic pit	Poz-88721	6820	40	seeds (*Hordeum vulgare*)	5780-5620
11			Poz-58362	6730	40	bone (*Bos*)	5720-5560
12	K12	Neolithic oven	Poz-88719	6790	40	chaff (*Tr. monococcum/dicoccum*)	5740-5620
13			Poz-88720	6800	40	seeds (*Tr. monococcum/dicoccum*)	5750-5630
14	L11	Neolithic pit	Poz-67237	6720	40	bone (*Bos*)	5710-5550
15	S14	Neolithic child burial	Poz-77263	6700	50	Bone (*Homo sapiens*)	5710-5510
16			Poz-76963	6665	35	bone (*Ovis/Capra*)	5650-5530
17	M13	Late Chalcolithic burial	Poz-66988	4190	35	tooth (*Homo sapiens*)	2940-2620
18	Sedimentcore 21-1		Poz-71458	14000	190	charcoal	17580-16380
19	Sedimentcore 15-1		Poz-71444	3350	40	charcoal	3700-3460

Tab. 1 Data table of radiocarbon samples from the Bucova Pusta IV site. Osteological determinations: Bea de Cupere; botanical determinations: Elena Marinova.

(Poz-88718: 6740±35 BP; Poz-58360: 6705±35 BP) is roughly simultaneous. The same is the case for the backfilling of Pits B9–20/D2 (Poz-51354: 6750±40 BP; Poz-58363: 6730±35 BP) and G/H 6/9 (Poz-88717: 6770±40 BP). The end of the settlement is marked by the backfilling of Pit L11 (Poz-67237: 6720±40 BP); a cattle bone from the lowest layer of the pit fill was dated. The last event during the Early Neolithic occupation phase can be considered to be Child Burial S14, from which the skeleton itself (Poz-77263: 6700±50 BP) and the skull fragment of an ovicaprid (Poz-76963: 6665±35 BP) were dated.

The data basis is very clear and concise so far. However, if we wanted to model the data, we could first isolate the three charcoal dates, which mark a period before the beginning of the settlement in which the timbers grew. This is followed by the series of radiocarbon dates on short-lived samples from the Early Neolithic contexts. Stratigraphically, the youngest unit is the infant burial with its two dates. We have thus defined three stages for which dates can be modelled, the charcoal samples which pre-date the founding of the settlement (Phase 0), the Neolithic settlement itself (Phase 1), and the Early Neolithic Child Burial (Phase 2). Two methods were used: Gaussian Monte Carlo Wiggle Matching with the CalPal programme package (Weninger et al. 2018) (Fig. 1; Tab 2) and Bayesian sequencing with OxCal (Bronk-

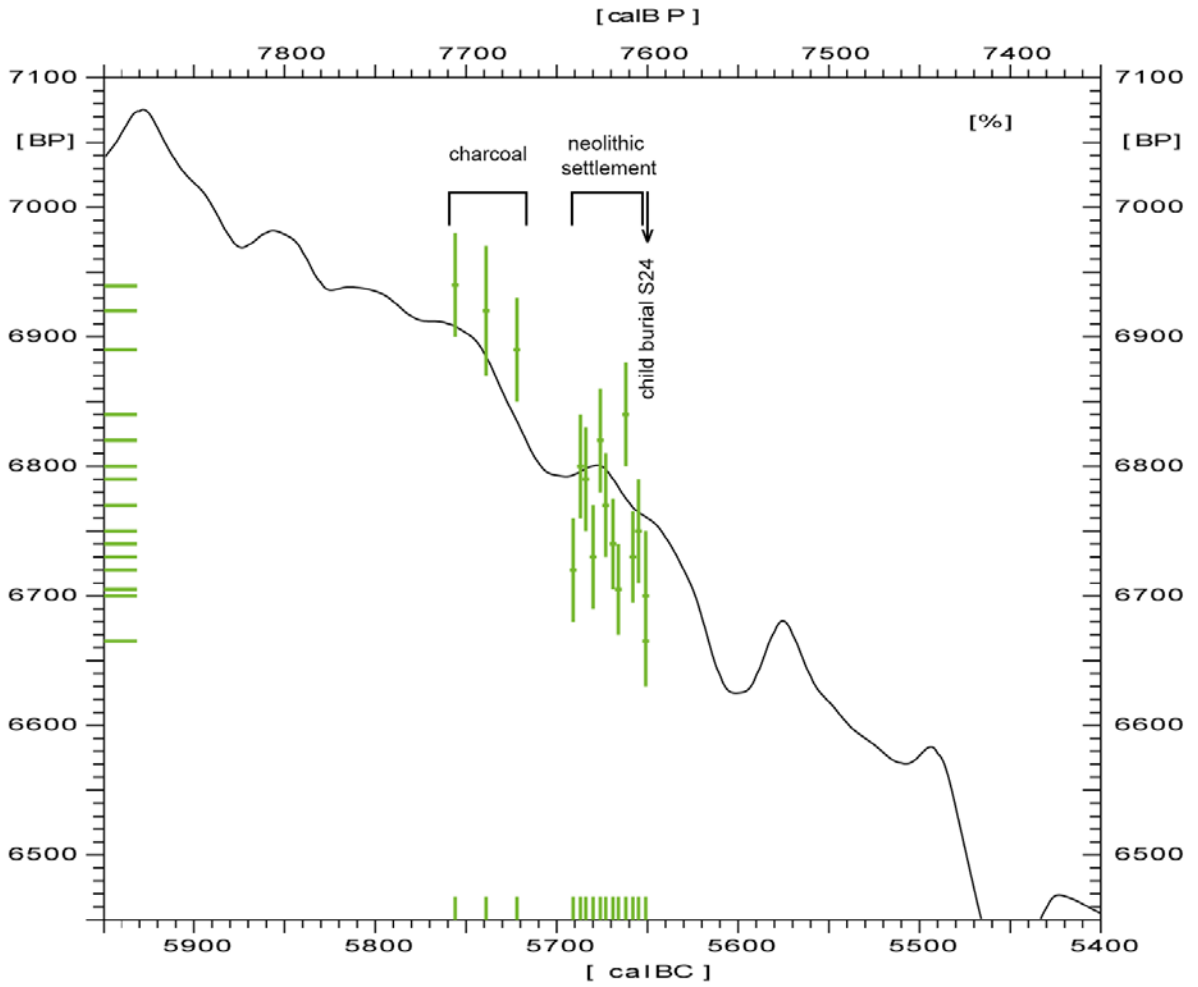


Fig. 1 Results of Age-Model for the Early Neolithic at Bucova Pusta IV, based on application of Gaussian Monte Carlo Wiggle Matching (CalPal-version 2019.5) to ^{14}C-data given in Tab. 1.

Ramsey 2009) (Fig. 2; Tab. 3). The results of the methodologically completely different approaches are very similar. The growth phase of the wood used for the construction of the settlement is between 5756–5722 calBC (CalPal) or 5968–5709 calBC (OxCal). The higher range in OxCal results from the fact that the standard deviation of the modelled data is also given there. The beginning of the Early Neolithic settlement on Bucova Pusta IV lies between 5691±40 cal BC (CalPal) and 5733–5640 calBC (OxCal). The child was buried around 5651±35 calBC (CalPal) or 5656–5574 calBC (OxCal), which also marks the end of the Early Neolithic settlement. This results in a duration of the settlement of at least 16 to a maximum of 159 years. Based on the structure of the settlements, the quantity of the find accumulation, and above all the matching fragments, we consider a duration of one to a maximum of two human generations, i.e. 50 to 70 years, to be probable.

This time period corresponds to the developed Early Neolithic in the Banat (Fig. 3). For the beginning of the Neolithic in the region, only two radiocarbon dates from Foeni-Sălaș are presently available (Biagi et al. 2005). At around 6000 calBC, one of them corresponds to archaeological expectations; the second value is somewhat too old, lying in the range of the earliest Balkan Neolithic, still during the 8.2 kcalBC event (Weninger et al. 2005; Weninger et al. 2014). Nevertheless,

	LabCode	^{14}C-Age [BP]	C14 STD	Delta	Gauss WM	Depth	Result	Context
1	Poz-77263	6700	50	0	1	0	5651	child burial
2	Poz-76963	6665	35	0	1	0	5651	
3	Poz-51354	6750	40	4	2	4	5655	Neolithic settlement
4	Poz-58363	6730	35	4	2	8	5658	
5	Poz-88722	6840	40	4	2	12	5662	
6	Poz-58360	6705	35	4	2	16	5666	
7	Poz-88718	6740	35	4	2	20	5669	
8	Poz-88717	6770	40	4	2	24	5673	
9	Poz-88721	6820	40	4	2	28	5676	
10	Poz-58362	6730	40	4	2	32	5680	
11	Poz-88719	6790	40	4	2	36	5684	
12	Poz-88720	6800	40	4	2	40	5687	
13	Poz-67237	6720	40	4	2	44	5691	
14	Poz-51356	6890	40	36	3	80	5722	charcoal
15	Poz-51355	6920	50	20	3	100	5739	
16	Poz-58612	6940	40	20	3	120	5756	

Tab. 2 Data table for model in Fig. 1.

on the basis of general considerations, it can be assumed that the Banat was reached by Early Neolithic settler groups from the Balkan region around 6000 BC. This is comparable to the earliest settlement horizon of Donja Branjevina in the Bačka or the sites of Ocna Sibiului, Gura Baciului, and Şeuşa in Transylvania. A reliable data series for the Banat is available from Movila lui Deciov (Ongoing excavations by the University of Tübingen with the National Museum of Banat). The older Early Neolithic settlement horizon begins there in the 59th century BC. An Early Neolithic date from Foeni-Gaz and the two older dates from Parţa Tell II also coincide with this (Biagi et al. 2005). The younger settlement layer at Movila lui Deciov dates to the 58th century BC, and thus overlaps in time with the beginning of settlement at Bucova Pusta IV. Based on the youngest dates from sites at the Danube Gorges (Borić 2011), it can be assumed that groups with Mesolithic subsistence coexisted in certain refugia throughout this period. The settlement on Bucova Pusta IV was built when the new way of life based on agriculture and animal husbandry had already become established in the region. The abandonment of the settlement does not mean that the area was completely deserted. Only a slight geographical relocation is to be expected, for example to the Kalscov I site, which is confirmed by a radiocarbon date (Poz-179984: 6720±40 BP, 5719-5561 calBC). This could have been due to minor changes in the region's very dynamic water network. The data series in Maroslele begins shortly after the end of the settlement on Bucova Pusta IV in the second half of the 6th millennium BC (Paluch 2011, 59). We are therefore dealing here with a developed phase of the Early Neolithic in Banat. The settlement in Giulvăz could be placed approximately at the same time. The following time horizon is determined by the local Vinča variety Szakálhát, represented at Parţa I and Uivar, on the one hand (Lazarovici et al. 2001; Drașovean/Schier 2020, 549–565), and the Turdaş variant, represented

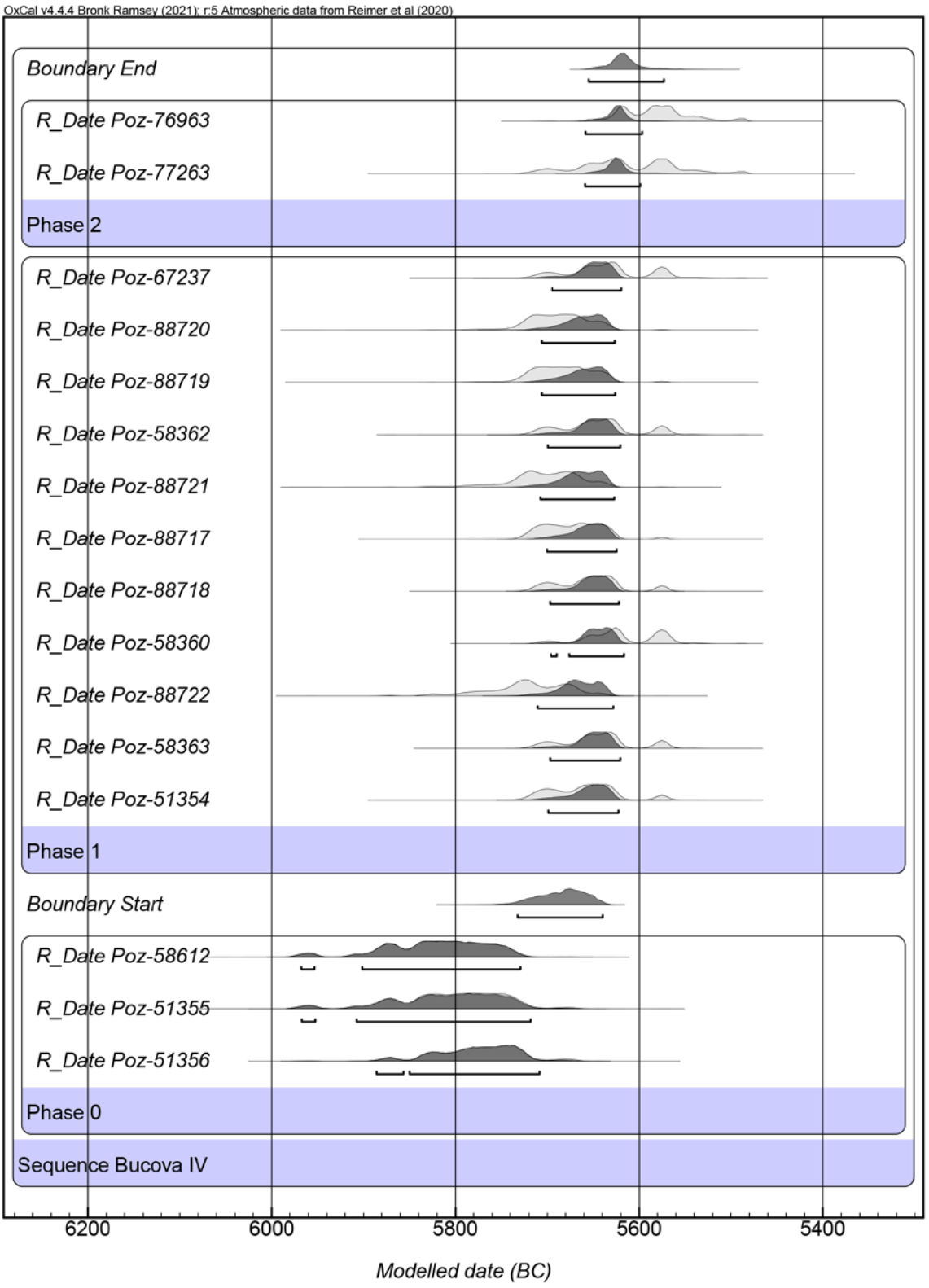


Fig. 2 Results of Age-Model for the Early Neolithic at Bucova Pusta IV, based on application of Bayesian Sequencing (OxCal-Version 4.3) to ^{14}C-data given in Tab. 1.

	Unmod. (BC)		Mod. (BC)		Indices Amodel=122.4 Aoverall=119.1	
	from	to	from	to	Acomb A	C
Phase 0						
Poz-51356	-5884	-5671	-5886	-5709	101,8	99,5
Poz-51355	-5971	-5717	-5968	-5719	101,2	99,5
Poz-58612	-5968	-5729	-5968	-5730	100,3	99,7
Boundary Start			-5733	-5640	98,9	
Phase 1						
Poz-51354	-5723	-5571	-5700	-5623	120	99,8
Poz-58363	-5717	-5566	-5698	-5621	123,3	99,8
Poz-88722	-5827	-5636	-5711	-5629	71,2	99,7
Poz-58360	-5714	-5556	-5697	-5617	98,2	99,9
Poz-88718	-5718	-5570	-5698	-5623	122,8	99,8
Poz-88717	-5731	-5622	-5701	-5625	108,7	99,8
Poz-88721	-5776	-5631	-5708	-5628	83,4	99,7
Poz-58362	-5720	-5564	-5700	-5621	124,8	99,8
Poz-88719	-5736	-5626	-5707	-5627	96,8	99,8
Poz-88720	-5743	-5626	-5707	-5627	92	99,6
Poz-67237	-5719	-5561	-5695	-5620	121,4	99,8
Phase 2						
Poz-77263	-5718	-5527	-5660	-5599	138,1	99,5
Poz-76963	-5655	-5484	-5659	-5597	90,7	99,5
Boundary End			-5656	-5574	97,7	

Tab. 3 Data table for model in Fig. 2.

in the Cauce cave (Luca et al. 2004, 68–70), on the other. The Alföld LBK then develops in the neighbouring Great Hungarian Plain to the north. In absolute terms, we are talking about the last three centuries of the 6th millennium (Fig. 4). Szakálhát merges smoothly into the Banat culture and Turdaş develops into the Petreşti facies. In the Alföld, this is the time of the Bükk culture, which starts after 5000 BC. Dominant in the region in the first half of the 5th millennium is the Tisza culture. The most recent Neolithic settlement on the Movila lui Deciov should be seen in this context. This developed into the Early Chalcolithic Tiszapolgár culture. Numerous cemeteries from this period are documented in the region. The same applies to the subsequent Bodrogkeresztúr and Hunyadihalom time horizons of the Late Chalcolithic. The development in the further course of the 4th millennium is somewhat unclear. In any case, the Boleráz group developed in the second half of the millennium, and became part of the supra-regional phenomenon of the so-called "Scheibenhenkel" (knobbed handles, "toarte pastilate" in Romanian). In the area of the Lower Danube and the Balkan region, it is the time of Cernavodă III. The transition to the 3rd millennium BC is marked by the Coţofeni culture, which corresponds to the Baden (Péceler) culture within the Carpathian Basin.

The Ochre Grave phenomenon also manifested itself during this period. Grave M13 from the Bucova Pusta IV tumulus should be seen in

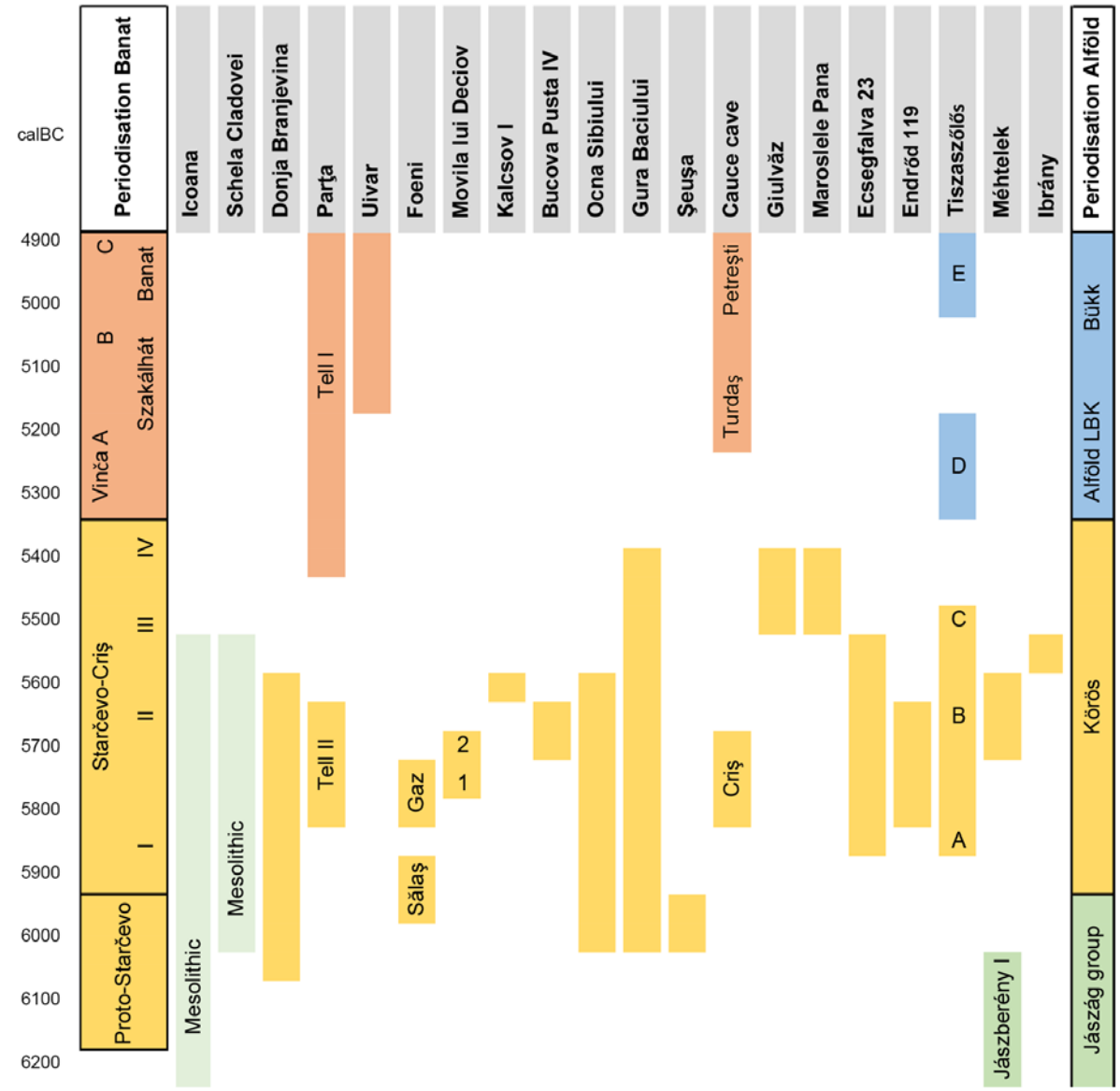


Fig. 3 *Chronological overview of Neolithic settlements in Banat, Bačka, Transylvania, and Alföld.*

this context. For the dating of the Chalcolithic burial, a tooth from the woman was dated. The date (Poz-66988: 4190±35 BP) lies with its calibrated time interval in the first half of the 3rd millennium BC, which corresponds to our archaeological expectation. The dates of a Kostolac house from Foeni-Gaz tend to be only slightly younger (Krauß/Ciobotaru 2013). This burial mound thus joins a whole series of Chalcolithic tumuli in northern Banat. The Ochre Graves are part of a larger cultural-historical context with the spread of this phenomenon from the northern Pontic steppes along the Lower Danube to the Carpathian Basin and beyond to eastern Central Europe (Heyd 2011; Frînculeasa et al. 2015; Heyd 2016).

The find horizon of the Early Bronze Age begins with the widespread Makó-Kosihy-Čaka complex, around the middle of the 3rd millennium BC, followed by Somogyvár-Vinkovci, which dates slightly after 2300 BC. Nyirség in the Great Hungarian Plain should still overlap in time with Vinkovci. The Bronze Age tell settlements in the Carpathian Basin then begin with the time horizon of Nagyrév and the subsequent Hatvan. In the

Banat, extensive Nagyrév material from a well filling was documented in Foeni-Gaz (Krauß/ Ciobotaru 2013).

No radiocarbon dates could be obtained from the Late Bronze/Early Iron Age occupation on account of the lack of datable material from the excavation trenches. The time horizon to be expected on the basis of the finds (see Chapter 19) is likely to fall largely on the Hallstatt plateau of the calibration curve, which means that it is impossible to make detailed statements on the absolute chronology during this time of occupation without additional stratigraphic information. Dating the Medieval graves using the radiocarbon method is just as pointless, as determining the age using the grave finds allows for much greater precision (see Chapter 19).

Situated in the middle of a prehistoric river landscape, the slightly elevated area provided the basis for a comparatively short period of settlement during the Early Neolithic. The construction of the Chalcolithic burial mound further elevated the site, and thus provided a landmark in the flat landscape, which was also a favoured settlement location during the Late Bronze Age and Early Iron Age. In Medieval times, i.e. specifically in the 6th-9th and then again in the 10th-11th centuries AD, this elevation in the landscape provided the basis for the construction of further graves by the largely nomadic equestrian population. The drainage of the area due to the silting up of river meanders and, at the latest, the hydrogeographical interventions during Austrian rule meant that this was no longer a favoured settlement location.

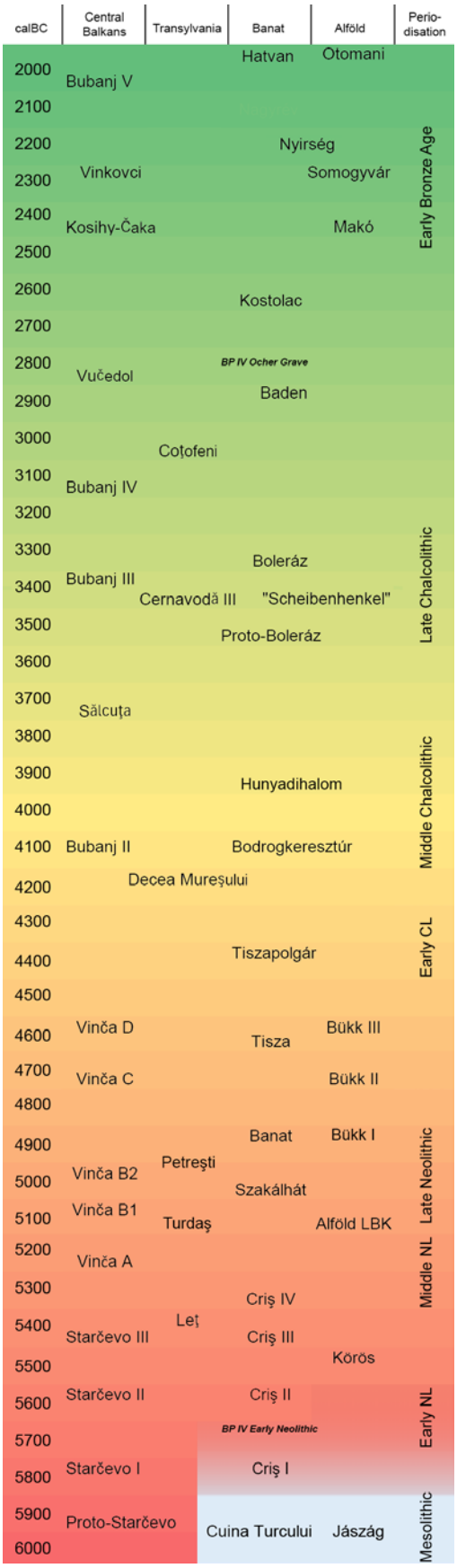


Fig. 4 Overview of the most important Neolithic to Early Bronze Age cultural groups in the study area.

Tradition and Adaptation

Raiko Krauß, Dan Ciobotaru

The aim of the Bucova Pusta IV excavation project was to investigate the Early Neolithic settlement in the northernmost part of the Banat. In ancient times, this landscape was characterised by numerous watercourses and marshlands; this stands in stark contrast to the drained landscape of today, which is the regulatory interventions in the water system since the Baroque period. In the settlement on Bucova Pusta IV, we can recognise a special settlement location which was deliberately chosen to exploit the local resources, and which demonstrates a marked adaptation to the natural environment. Nevertheless, the settlement evidences its inhabitants' clear ties with their southern regions of origin within the Balkans, and agriculture and animal husbandry were undoubtedly the most important economic basis. These aspects have been clearly outlined in the previous chapters by the respective specialists for the individual find categories and research methods. This chapter will now summarise the main results of the previous chapters, and seek to present the settlement in its cultural-historical context.

Neolithic package versus aquatic resources

The hamlet-like settlement on Bucova Pusta IV existed at the transition from the 57th to the 56th century BC, over a period of less than one hundred years, and sheds light on a period within the Early Neolithic in which the region's agrarian population had already considerably adapted to the natural conditions. This phenomenon has already been described for the northern Alföld region (Whittle 2007), and apparently began here in the northern Banat. Some of the pioneer settlements of the initial Neolithic in the region are known: Timişoara-Fratelia, Foeni-Sălaş, and Movila lui Deciov were founded in the first two centuries of the 6th millennium BC. Hence, these were sites at which the farmers from the southern Balkans first settled. We are currently investigating the site of Movila lui Deciov, and it is clear that settlement activity continued there until the time of the colonisation of Bucova Pusta IV. This means that the later Early Neolithic settlement on Movila lui Deciov might have existed at the same time as the example on Bucova Pusta IV. During this period, a strong utilisation of aquatic resources is evident at both sites. In satellite images, a LiDAR scan, and above all in the geomagnetic mapping, old watercourses are clearly recognisable in the fields of Bucova Pusta. The geomorphological evaluation (see Chapter 2) concludes that all these watercourses must have emerged before the Early Neolithic settlement was founded.

Today they are all dry, and only the northern channel is still seasonally boggy in places. Based on the archaeological observations, we assume that only the channel to the south and certainly the watercourse to the north of the site could have carried water at the time of the Early Neolithic settlement. The channel running right through the settlement which we transected with our Excavation Trench R was usually dry during the existence of the Early Neolithic settlement. Early Neolithic and Early Iron Age find concentrations were found at the bottom of this depression, proving that this channel must have been predominantly dry in prehistory. A flood event after the Iron Age then contributed to the filling in of this channel. Nevertheless, the entire area surrounding the settlement site was strongly characterised by existing watercourses. On Bucova Pusta IV, the shells of freshwater snails and mussels make up a third of the taxonomically identifiable zoological food waste. In addition, 6 % are terrestrial gastropods, and 5 % fish remains (see Chapter 15); to this might be added the consumption of aquatic plants, such as the water caltrop (*Trapa natans*) (see Chapter 16). This is all quite astonishing when one considers that the cultivation of plants and the breeding of domestic animals formed the essential basis of the Neolithic period. On archaeological observations alone, the impression might thus be gained that this was a local Mesolithic population which had adopted some elements of the Neolithic from the farmers and stock breeders who had migrated from the south, but otherwise largely adhered to their traditional nutrition. Yet, the results of the genetic analysis of the Early Neolithic child burial from Bucova Pusta IV demonstrate the complete opposite (see Chapter 9). Three centuries after the immigration of settlers from the Aegean via the Balkan region into the Carpathian Basin, the child's genome still does not present any admixture with the local Mesolithic population! Nevertheless, unlike in the western part of the Carpathian Basin with the Transdanubian LBK, the early farmers in the Banat adapted very quickly to the local conditions.

What did the buildings look like?

The excavations at Bucova Pusta IV alone can contribute only little to the long-running discussion about Early Neolithic house building. The thorough analysis of the construction clay fragments by Ciocani demonstrated that we can expect above-ground buildings built using the wattle-and-daub technique (see Chapter 8). However, our excavations only revealed some very complex pit-structures. Within the excavation team, we discussed the question of how to interpret the empty areas between these pits. It is possible that the houses stood there, but this cannot be proven with absolute certainty. Interestingly, the vast majority of the earthen ovens were certainly located outside possible house structures. However, the large feature in Excavation Trenches S and T consists of two sunken (house) structures, of which two ovens in the west were accessible from inside these sunken areas. The findings of regular foundation trenches with postholes from the oldest settlement phase of our current excavations on the Movila lui Deciov prove that these must have been post-structures employing wattle and daub. The house walls are well preserved there because they were covered by the later construction phases. The settlement structures of Bucova Pusta IV, which was inhabited for a comparatively short time, may have been so severely altered by soil erosion that only the deeper settlement structures have survived. In any case, the vast majority of the pit structures which we uncovered are far too small and irregular to be pit houses. Instead, we believe that they were above-ground buildings, the masonry of which consisted of wooden posts, wattle, and daub.

find category	total amount	weight in kg	percent
pottery	24955	~600	47,62%
construction clay	20795	~500	39,68%
ceramic small finds	68		0,13%
clay weights	121		0,23%
zoological remains	6308		12,04%
bone and antler tools	54		0,10%
chipped stone tools	21		0,04%
polished stone tools	32		0,06%
grinding stones	53		0,10%
	52407		100,00%

Tab. 1 List of the processed find categories. It can be assumed that all the worked stone artefacts were recorded, whereas the ceramic finds and in particular the burnt clay make up only a part, albeit a representative part, of the total finds.

A Stone Age (almost) without stones

That we have presented 100% of our lithic finds here in no way disguises the fact that there was a serious problem with the supply of stone raw materials in this region. A total of 61 flint artefacts were recovered from the Bucova Pusta IV site, of which only 21 can be assigned with certainty to an Early Neolithic context (see Chapter 12). The situation is not much better for the polished stone artefacts either, with a count of just 32 specimens (see Chapter 13). In view of the very high number of finds in all other find categories the proportion of all stone artefacts makes up just 2 per thousand of all finds (Tab. 1). Also in comparison to other Early Neolithic sites in south-eastern Europe, this is a negligible number. In addition, both the chipped and the polished stone tools display a very high degree of wear, and secondary use in many cases. The scarce few stone tools were thus used until they were completely worn out. Also striking is the diverse origin of the raw materials used, the sources of which are all located far distant. The farthest away are the sources for the obsidian, hailing from the northern Carpathian Arc, and for the caramel-coloured "Balkan Flint", originating from areas south of the Lower Danube. Wherever possible, people needed to make do with other materials. So, we find cutting tools made of bone and antler, and the clay weights so typical of the sites in the region. These weights have a wide variety of shapes, and were evidently made to meet specific needs for different purposes. This finding is unusual, and should provide food for thought for future research, as the question as to how a pre-Neolithic settlement in this region can be methodically proven must also be seriously considered. In terms of natural resources, the northern Banat certainly offers very favourable conditions for a hunter-gatherer population. Yet, how can this be demonstrated without the evidence of characteristic stone tools?

Relations with the neighbouring areas

The Early Neolithic finds from Bucova Pusta IV stand in a clear tradition of the Balkan Early Neolithic (Fig. 1). The form spectrum of the pottery as a whole, as well as individual forms and decorative elements, can be directly derived from the southern areas. The transition from vessel painting to predominantly plastic types of vessel decoration, as is characteristic in Bucova Pusta IV, is attested in many regions

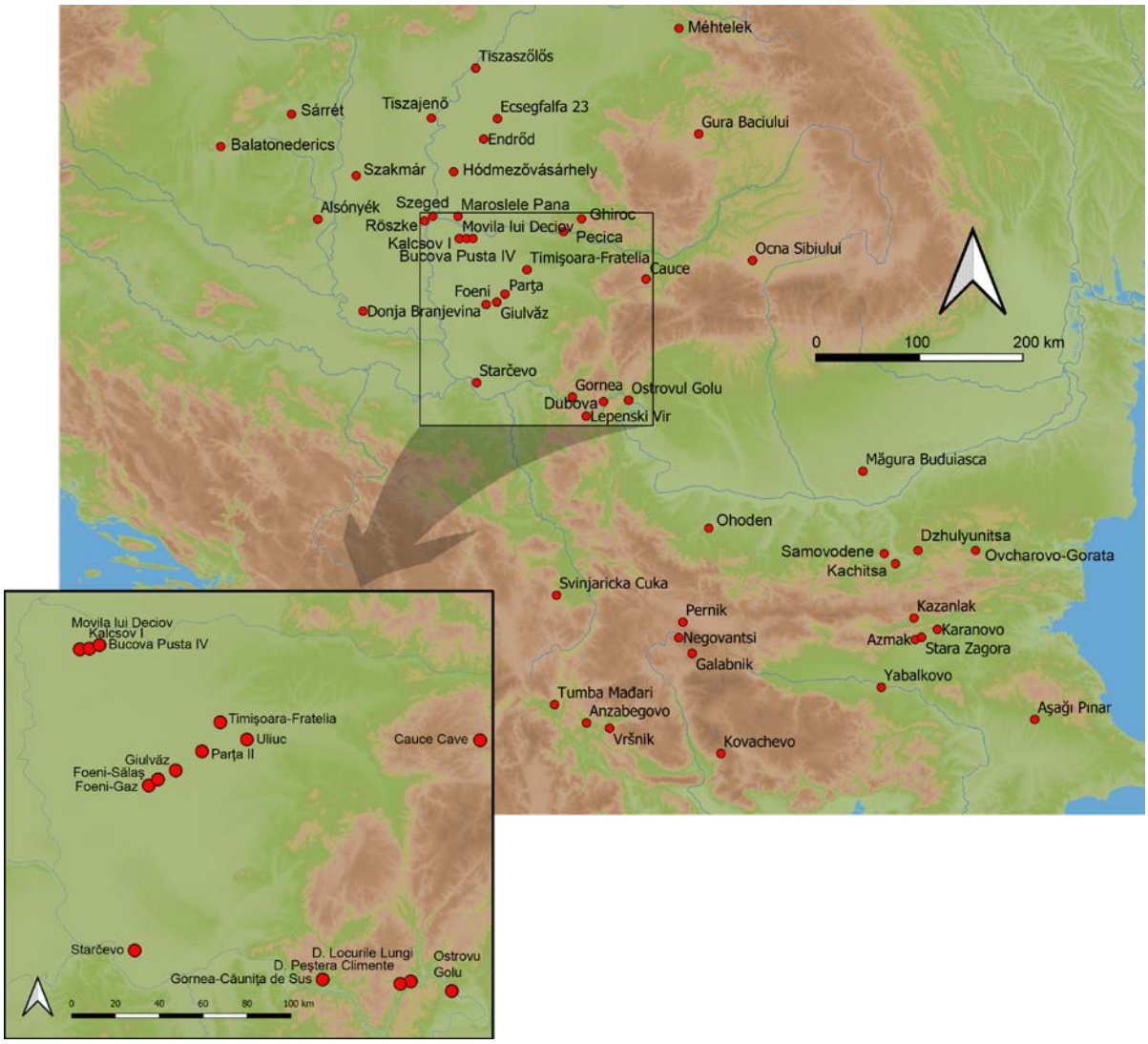


Fig. 1 Early Neolithic sites in Banat and neighbouring regions mentioned in the text.

of the Balkan area. However, notched rims or dimples in the lip rim are characteristic only for the initial phase of the Early Neolithic in the more southern Balkan region. It seems as if a certain repertoire of forms reached the north with the Neolithisation process, and was further developed there in a very conservative manner. Conspicuous in our material is the widespread absence of fine pottery, which can also be interpreted as an indication of the absence of further impulses from the south. Once established, this pottery tradition was continued for a very long time and became increasingly simplified due to the lack of new inspiration from the Neolithic centres in the Balkan region. At the same time, we see a clear regionalisation, which ultimately leads to the development of the Körös culture. Unlike in the rest of the Balkan Carpathian region, there are no natural stone deposits, which was of great influence on the manufacturing techniques, but also on the material culture of the Early Neolithic settlers. Stones were not readily available for smoothing pottery or other technological steps in pottery production as well. Fired clay also fulfilled the function here of compensating for the lack of stones, which is evident in numerous massive objects made of this material. The variety of clay weights is striking, and remarkable

compared to other areas of the South-Eastern European Early Neolithic.

Within Banat and Bačka

The finds from Bucova Pusta IV can be satisfactorily situated within the Early Neolithic development of the Banat. A long settlement sequence is evidenced at Donja Branjevina, located to the east, in the Bačka (Karmanski 2005). Our finds correspond roughly to the end of the sequence found there. The plastic motifs on large storage vessels and the shape of the four-footed tables, which appear at the close of Donja Branjevina (Karmanski 2005, Pl. CLXXXVII-CCIX), are easily comparable. However, let us start with the beginning of the Early Neolithic development, so that the chronological position of the finds from Bucova Pusta IV can be better understood.

Early Neolithic development in the Banat begins with clearly recognisable influence from the Central Balkan region in the form of white-on-red painted pottery, which has also been demonstrated at Foeni-Sălaş (Draşovean 2007, Fig. 5). In the system developed by Gheorghe Lazarovici (1979), this would be his phase I. We do not want to go into the quibbles here as to why his phase IA is purely hypothetical, or on the basis of which criteria the phases IB and IC can be distinguished from each other; rather, let it here be noted that the earliest horizon of painted pottery (white-on-red) is already represented at several sites in the Banat. Small idols in the form of stylised cattle heads are also characteristic of this earliest Neolithic find horizon, the so-called bucrania idols, also known as labrets in earlier research (Krauß 2016). Two bucrania idols from Timişoara-Fratelia are known from the Banat (Draşovean 2001, Pl. 4,4–5).

Should the criterion of painted pottery be applied, then the subsequent stage corresponds to the Starčevo "Linear" phase (cf. Garašanin 1998). The corresponding painting style is documented at Gornea-Căuniţa de Sus, Dubova Locurile Lungi, Dubova Peştera Climente, and Ostrovu Golu (Lazarovici 1979, Pl. V–VII). In Lazarovici's system, these would be his phases II and III. The mass of unpainted material is more difficult to assign on the basis of the published finds alone. A criterion for an early date would be the absence of high bases and of plastic types of vessel decoration (apart from simple impressions, which are attested everywhere in South-eastern Europe since the earliest Neolithic). The Early Neolithic material from Foeni-Gaz should belong here, even though no painted pottery has yet been found there. Finally, of relative chronological relevance is the sequence at Parţa Tell II and on the Movila lui Deciov, where the stage with linear painted pottery is still before that with material with plastic decoration, which is characteristic of Bucova Pusta IV. The key to understanding this lies in the sequence of the two Early Neolithic layers at Movila lui Deciov (Iosza 2013). The lower find level contains painted pottery in linear style, and also anthropomorphic idols of Balkan character. The upper Early Neolithic level is characterised by sculpturally decorated pottery, and head idols of the Körös type.

Consequently, the finds from Parţa Tell II and the upper Early Neolithic find layer from Movila lui Deciov would be contemporary with Bucova Pusta IV in the Banat. Due to numerous typological similarities, the new material from Ghioroc "Balastiera Vest" (Sava 2015, Pl. 4–20) would also fit in well. In terms of structure, this settlement can also be compared with Bucova Pusta IV (cf. Sava 2015, 93–102).

However, this does not mark the end of the Early Neolithic development. Somewhat younger chronologically would be the find material of the newly discovered site Kalcsov I (see Chapter 4), which lies about halfway

between Movila lui Deciov and Bucova Pusta IV near the present-day village of Dudeştii Vechi. The new finds from Pecica "Est/Smart Disel" (Sava 2015, Pl. 25–71) could be of a similar date. This material can be paralleled with the latest sequence at Ocna Sibiului "Triguri" (Ciută 2005, Pl. 45–46), and Gura Baciului (Lazarovici/Maxim 1995, Fig. 44–45).

At the end of the Early Neolithic development are the finds from Maroslele Pana (Paluch 2011, Fig. 42–124), which has its equivalent in Banat in the finds from Giulvăz (Lazarovici 1979, Pl. VII,E,1–2).

Thrace

In Thrace, the change from predominantly painted to plastically decorated pottery from Karanovo I to II (Hiller/Nikolov 1997, Pl. 63– 67 and Pl. 59) and from Aşağı Pınar 7 to 6 (Özdoğan 2011, 1–4; 10) is easily recognisable. The older find horizon at both sites is dominated by white-on-red painted pottery, the younger by various types of plastic decoration. However, the spectrum of ceramic forms changes only slightly. We also see this change in vessel decoration in the lowest layers of the tell settlements of Azmak, Stara Zagora, and Kazanlak (Николов 1998). Chronologically, this change falls into the period around 5700 calBC (Krauß 2023, 107-132), which corresponds to the date of the Early Neolithic settlement at Bucova Pusta IV. The youngest find horizon of Yabalkovo (Leshtakov 2014) should be contemporaneous. There, too, we see the advent of plastically decorated pottery, even if the decline of painted pottery is not clearly discernible, because the settlement there ends at this time.

That there were direct relations to this geographically more distant region is indicated not least by the numerous so-called Karanovo blades in the flint material. These apparently reached the northern Banat as finished products via exchange networks. In turn, obsidian from the northern Carpathian arc seems to have reached as far south as this.

Thrace is indeed a decisive source of impulses for Early Neolithic pottery production in south-eastern Europe. However, a direct influence as far as the Carpathian Basin is no longer noticeable on the basis of the ceramic forms. Rather, these impulses were indirectly transmitted to the north via the neighbouring areas.

Lower Danube

In the area along the lower course of the Danube, the transition from initially painted pottery to then relief-decorated pottery is clearly recognisable. For example, in Dzhulyunitsa III to IV (Krauß et al. 2014) or in Măgura Buduiasca from the oldest find layer to the second (Thiessen 2012). This horizon marks the beginning of the development of the multi-phase site at Samovodene (Phase A1) (Stanev 2002). Apart from the criterion of plastic decoration, a marker is the high vessel bases which only appear in the Eastern Balkan region in the course of the developed Early Neolithic, and then represent a leading form. This is also clearly visible in the material from Ohoden (Ганецовски 2009), which should be parallel in its more recent development to Bucova Pusta IV.

The site of Ovcharovo-Gorata offers the most extensive material for the developed Early Neolithic in the Eastern Balkans (Krauß 2014). At its outset, this settlement existed at about the same time as Bucova Pusta IV, which is why a direct comparison of the forms is useful. Very similar at both sites are the large pots and many of the bowl shapes (Krauß 2014, Taf. 6–16; 21– 35). The so-called tulip-shaped beakers from Ovcharovo-Gorata are forms specific to the Eastern Balkan region (Krauß 2014, Taf. 1–5). Comparable are

the mugs from Bucova Pusta IV, which are, however, lower. The jugs from both sites are less comparable. There, the references to the Central Balkan region are clearer. Overall, the spectrum of decorative forms in Ovcharovo-Gorata is more diverse. Bucova Pusta IV, for example, lacks all types of fluted decoration, and the repertoire of plastically applied decorative motifs is somewhat less extensive.

At least, the areas along the lower course of the Danube are an important source of lithic raw material, which reached the northern Banat in the form of finished tools. In terms of transport geography, there are two possible routes to the northern Banat: firstly, the direct route via the southern Carpathians along the valley of the Olt River to Transylvania, and secondly, via the Central Balkan region.

Central Balkans

In the Central Balkan area, the beginning of Anzabegovo/Vršnik III should roughly fall into the period of settlement on Bucova Pusta IV. However, there is no such clear change between vessel painting and plastic decoration of the vessels. Rather, the type of vessel painting changes, which was described in the classical sequence by Garašanin as a change between Starčevo „Linear" to Starčevo „Spiraloid" (Гарашанин 1984; Garašanin 1998). The different painting styles in Kovačevo were very well documented. The settlement of Bucova Pusta IV, however, falls exactly into the interruption of settlement between Kovačevo Id and II (Lichardus-Itten et al. 2002). This concerns the uppermost find layers of the settlement mounds of Galabnik (Horizon X) (Pavúk/Bakamska 2021) and Pernik (Layers II and III) (Чохаджиев 2007, Pl. 7,6–7), as well as the short settlement sequence of Negovantsi (Чохаджиев 2007, Pl. 18–19). According to the information in the final publication of the Galabnik excavation, the transition from Starčevo "Linear" to "Spiraloid" proves to be somewhat more complex than Garašanin outlined at the time (Pavúk/Bakamska 2021, 152–176). It is the horizon of the so-called "claw spirals" that can be found as far north as Transdanubia. The narrow-mouthed jars from Bucova Pusta IV with vertical corded eyelets seem to be directly derived from the Central Balkan area. Two asymmetrically shaped vessels hail from the Tumba Mađari (Здравковски et al. 2009, cat. no. 16; 17), which may have served as models for our jars. The fact that the vessels there are somewhat older is of little relevance, because this is a very long-lived, possibly functionally based form which still occurs in Central Europe in connection with the oldest LBK. It has been known for some time that Lepenski Vir IIIb also belongs to this period (Borić 2002). The Early Neolithic material of this horizon also fits very well into the Starčevo sequence. New finds from Svinjarička čuka have been added in recent years (Horejs et al. 2019). This material is very close to the finds from the above mentioned sites in Northern Macedonia and South-western Bulgaria.

Transylvania

In the sequence of finds represented at the site of Gura Baciului (Lazarovici/Maxim 1995), the finds from Bucova Pusta IV stand approximately in the middle of the development. In Transylvania, too, the beginning of the Neolithic is marked by painted pottery on a red background. This development is then completed. At Ocna Sibiului (Paul 1995), the end of the site should be parallel with our material, as also at the cave of Cauce (Luca et al. 2004). In light of the early occurrence of painted pottery in Transylvania, and the good correspondences from the areas south of the Carpathians, it can be assumed that these areas were neolithised directly from the south. The Olt valley suggests itself as a transport route. A later expansion via the Bega, Timiş, and Mureş river systems

draining to the west into the Banat is possible, and even very probable.

However, Transylvania does not seem to play a role in the initial spread of the Neolithic into the Banat. Rather, the impulse there also initially originated directly from the south, namely from the Central Balkan region (Krauß 2023, 221f.). It cannot be denied that important impulses for the neolithisation of Transylvania came directly from the south, for example from northern Bulgaria and Oltenia. However, the further influence to the west is hardly noticeable, because the Early Neolithic pottery production of the Banat is rather related to that of the Central Balkan region.

Alföld

Were one to name the cultural environment of Bucova Pusta IV, it would undoubtedly be the Körös culture in the narrower sense, as defined by Ida Kutzián (1947). Within its development, the following relative chronological cornerstones can be established. We see our material parallel to the end of Endrőd 119 (Makkay 2007, 127–189) and the beginning of Méhtelek (Kalicz 2012). At Ecsegfalva 23 (Oross 2007), it should lie approximately in the middle of the sequence occupied there. The same is the case at Tiszaszőlős, where it corresponds to its Phase B (Domboróczki 2010). The character of these settlements with their clear relation to water and their ephemeral buildings also correspond to our observations for Bucova Pusta IV. The use of aquatic resources is also evident there, and the use of obsidian from the known sources in the northern Carpathian arc plays a major role because of the generally poor availability of stone raw material. Besides this, contact with the latest Mesolithic communities in the northern Alföld is evident.

A unifying feature of all of these settlements is the production of large and varied clay weights, which can be linked to the lack of stones. In the case of figural representations, it is plug idols and figural scenes on large storage vessels which bear witness to the uniformity of spiritual ideas in this geographical area. Moreover, the economy of the Early Neolithic settlements in the Alföld seems to correspond to that of the northern Banat. Aquatic resources play a major role both here and there. If we consider the vessel pottery as tableware for preparation, serving, and storage of food, it is understandable that comparable vessel forms appear in both regions.

Transdanubia

The northernmost distribution of the Balkan Neolithic reaches as far as the western part of the Carpathian Basin. In Alsónyék, a dark-on-red painted vessel with a "claw spiral" is attested (Oross et al. 2013, Fig. 4,12), which is likely to date from around the time of the settlement on Bucova Pusta IV. It stands in the middle of the Starčevo development documented there. At the same time, the latest offshoots of the local Mesolithic period have been identified, for example in Balatonederics (Sümegi et al. 2008). According to the radiocarbon dates, however, the Mesolithic settlement in Sárrét should have ended shortly before (Eichmann et al. 2010).

Compared to Transdanubia, the eastern part of the Carpathian Basin, namely the Banat and the Alföld, presents a different picture of neolithisation. While in Transdanubia it looks as if the new way of life based on agriculture and animal husbandry has been passed on, a strong adaptation to the natural conditions is noticeable in the eastern part. This is also expressed in the production of ceramics, which clearly continues in the west in the Starčevo tradition until the LBK develops from this substrate. A connecting element between the eastern and western parts of the

Carpathian Basin seems to be the figurines. In both areas, representations of cattle play a greater role and also in the anthropomorphic figures, numerous parallels between the two areas can be pointed out.

In conclusion, however, it can be said that Transdanubia was shaped for much longer and more sustainably by impulses from the ancient Neolithic areas in the Balkan region, until it finally itself became the catalyst for the neolithisation of Central Europe. In a sense, the neolithisation process was more successful there, or at least the idea of the new way of life was better transmitted. In the northern Banat and in the Alföld, on the other hand, after the initial phase of neolithisation, a strong adaptation to the natural conditions can be observed (Krauß 2023, 224f.), which also had an influence on ceramic production.

The end of the Early Neolithic settlement and its legacy

The Early Neolithic settlement at Bucova Pusta IV was abandoned after only a short period of habitation. The occupation of the site Kalcsov I, located only 3 kilometres to the southwest, can be classified as somewhat more recent in date. In general, a high degree of mobility of the population can be expected, who were able to change these smaller settlement sites frequently due to the dynamic changes in the water system.

In the early 3rd millennium, the large burial mound was erected on the site of the abandoned Early Neolithic settlement. Further stray finds suggest that this may also have been associated with some settlement activity during the Late Copper Age, although there is no additional evidence of this. Substantial settlement of the site did not take place again until the transition from the Late Bronze Age to the Early Iron Age. After that, the site was once again used as a burial ground by an early medieval nomadic equestrian population. This was apparently due to the Copper Age tumulus, which served as a landmark. The present-day impression of an extremely flat and steppe-like landscape only resulted from the land being drained and used for agriculture from the period of Austrian rule onwards.

This period was also culturally formative for the local population until recent times. However, the various ethnic groups living in the region today can be traced back either to the late Avar period in line with the famous gold hoard of Sânnicolau Mare (Nagyszentmiklós), the time of the Hungarian Landnahme, or the settlement of the Pechenegs. With our excavations, we have contributed to publicising the very beginnings of the peasant way of life in this region. Our research at Bucova Pusta IV has enabled us to document a number of historical periods, rendering it a living heritage site.

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Stone Age without Stones. The Early Neolithic site of Bucova Pusta IV in northwestern Banat (Romania)

This volume deals with the results of the excavations from 2010 to 2015 at the Early Neolithic settlement of Bucova Pusta IV near Sânnicolau Mare, in northern Banat. After the end of the Early Neolithic settlement, a large burial mound was erected at this site in the early 3rd millennium BC, the main burial of which was also documented during the excavations. The site was subsequently inhabited once again during the transition from the Late Bronze Age to the Early Iron Age. In medieval times, the site served as a burial ground for a nomadic equestrian population. The flat landscape of northern Banat is characterised by numerous watercourses. This is why the utilisation of aquatic resources played an important role in the Neolithic period. Another special feature is the lack of natural stones, which is reflected in the special character of the Early Neolithic finds.

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