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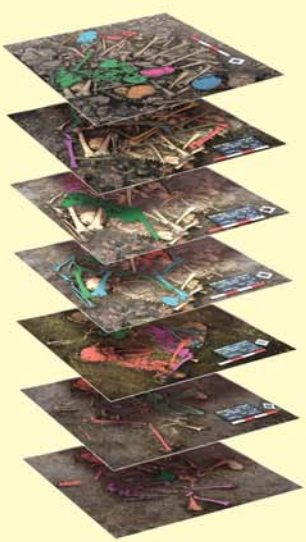

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SUMAR / *SUMMARY*

STUDII
STUDIES

The Upper Palaeolithic site of Bistricioara-*Lutărie III* (Ceahlău Basin, Northeastern Romania): raw materials and possible supply sources

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Abstract: *This paper brings to light new results regarding the petroarchaeological investigations of the lithic raw materials used at the multi-layered site of Bistricioara-*Lutărie III*. These investigations include a series of field surveys for the identification and sampling of geological deposits with archaeologically relevant siliceous rocks, but also a comparative petrographic analysis of archaeological and geological samples. Seven categories of knappable siliceous rocks, covering a diversity of geological settings and ages, were characterized based on samples collected from the study area (between Târgu Neamț, Borlești, Lacu Roșu, and Toplița). The analysis of 25 thin sections from Bistricioara-*Lutărie III *allowed distinguishing seven raw material categories. Four of them originate from geological occurrences in the study area, within a radius of 50 km from Bistricioara-*Lutărie III *(the Audia detrital siliceous rocks, Eocene chert, Hăghimaș syncline cherts, Toplița chert). Three others originate from the Prut-Dniester (the Prut-Dniester spiculite flint, Dniester Globotruncanidae flint) and Întorsura Buzăului (the Sita Buzăului chert) areas, located at >130 km NE and 155 km S.*

Rezumat: *Acest articol supune atenției noi rezultate privind investigațiile petroarheologice ale materiilor prime litice utilizate în situl pluristratificat de la Bistricioara-*Lutărie III*. Aceste investigații includ o serie de periegheze pentru identificarea și eșantionarea depozitelor geologice cu roci silicioase de importanță arheologică, dar și un studiu petrografic comparativ realizat pe probe arheologice și geologice. Șapte categorii de roci silicioase prelucrabile prin cioplire, care acoperă o diversitate de contexte și vârste geologice, au fost caracterizate pe baza eșantioanelor colectate din zona de studiu (între Târgu Neamț, Borlești, Lacu Roșu și Toplița). Analiza a 25 de secțiuni subțiri de la Bistricioara-*Lutărie III *a permis diferențierea a șapte categorii de materii prime. Patru dintre ele provin din ocurențe geologice din cadrul zonei de studiu, pe o rază de 50 km față de Bistricioara-*Lutărie III *(rocile silicioase detritice de Audia, silicolitul eocen, silicolitele din sinclinalul Hăghimaș, silicolitul de Toplița). Alte trei provin din zona Prut-Nistru (silexul spiculitic de Prut-Nistru, silexul de Nistru cu Globotruncanidae) și Întorsura Buzăului (silicolitul de Sita Buzăului), localizate la >130 km NE și 155 km S.*

Keywords: *petroarchaeology; microfacies analysis; chert; Middle Bistriţa Valley.*

Cuvinte cheie: *petroarheologie; analiza de microfacies; silicolit; Valea Bistriței mijlocii.*

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◈ 1. Introduction

Many papers dealing with the Palaeolithic archaeology start with a remark regarding *lithics* as the most abundant or the only preserved archaeological remains. In subsequent lines we find out that the *lithics* convey various amounts of information regarding the past hunter-gatherers economic organization, raw material procurement patterns, scale of mobility, social and exchange networks. Therefore, the accurate characterization and sourcing of the lithic raw materials, reliable estimates on their natural availability, size and quality, but also their frequency, mode of introduction and exploitation in the assemblage, are all vital in securing solid inferences on any of the above topics.

For reasons largely discussed elsewhere (A. Doboș 2017; M. Anghelinu 2018) and despite recent reassessments and a growing corpus of data, the Romanian Palaeolithic research is still far from reaching a coherent image on the above-mentioned issues, even on a regional basis. The limits of our current knowledge are particularly evident in the case of the dense network of Upper Palaeolithic (UP) sites found along the Middle Bistriţa Valley (in Ceahlău Basin), which has otherwise been the focus of many published papers and reports since the mid 1950's onwards (C.S. Nicolăescu-Plopşor *et alii* 1966; Al. Păunescu 1998; L. Steguweit *et alii* 2009; A. Tuffreau *et alii* 2018; M. Anghelinu *et alii* 2018, 2021a, 2021b, and references therein).

Even with some notable progress in the provenience studies recorded in the last decades (for a brief research summary, see Al. Ciornei 2015, p. 44-45; L. Moreau *et alii* 2019, p. 522), the description of the lithic raw materials used during the UP in the Eastern Carpathians still lingers on some generic categories defined more than half a century ago. Four basic raw materials were recognised in the UP assemblages from Ceahlău Basin (C.S. Nicolăescu-Plopşor *et alii* 1966, p. 20, 23-24): the "Audia black schist" and the "glauconitic siliceous sandstone" from the Lower Cretaceous Audia Beds opened on Hangu Valley; the "menilite" from the Lower Oligocene deposits found between Bicaz and Piatra Neamţ (Bisericani area); and the "Prut flint" from the Middle Prut Valley.

The Eastern Carpathians Flysch raw materials were identified based on archaeological samples (with the petrographic bulletins partially published by Al. Păunescu 1970, p. 217-219; 1998, p. 46-48) and their supposed origin was acknowledged by Th. Joja (C.S. Nicolăescu-Plopşor *et alii* 1966, p. 20, note 17). So far, except this expedient verdict, there is no published comparative petrographic and/or geochemical analysis of archaeological and geological samples confirming the supposed provenience of the Eastern Carpathians Flysch raw materials.

Beside these well-known raw materials, pointing towards local Eastern/Southeastern supply sources, the archaeological literature also referrers to other siliceous rocks less frequently used (or recognised) in the UP sites from the Middle and Lower Bistriţa Valley.

Florea Mogoșanu mentioned a hydrothermal silex (hornstein) from the Baia Mare area (Bicsad and Boinești) at Ceahlău-*Bofu* and Ceahlău-*Scaune* (Fl. Mogoșanu 1960, p. 127). Maria Bitiri-Ciortescu remarked the presence at Lespezi-*Lutărie* of (red and yellow) jaspers and (greyish, reddish, and yellowish) hydrothermal opals (presumably originating) from Oaș-Maramureș area (M. Bitiri-Ciortescu *et alii* 1989, p. 14), but also a few isolated obsidian pieces at Buda-*Dealul Viilor* (M. Bitiri-Ciortescu *et alii* 1989, p. 22). Contrary to these views, Constantin Nicolăescu-Plopşor considered the dark or light grey vitreous hydrothermal silex from Ceahlău-*Scaune* as originating, based on determinations made by the geologist Mircea Ilie, from the Harghita-Călimani volcanic mountains (C.S. Nicolăescu-Plopşor 1958, p. 10; C.S. Nicolăescu-Plopşor *et alii* 1966, p. 103). The two alternative origins of the "opals" indicate remote Western and distant Northwestern supply sources.

Another raw material observed in the UP assemblages from Ceahlău Basin, but especially in the swiderian assemblage from Ceahlău-*Scaune* (C.S. Nicolăescu-Plopşor *et alii* 1961, p. 40; 1966, p. 103; Al. Păunescu 1970, p. 84), was considered to be supplied from a place called "Polița Cremenișului", a massive reef limestone on Ceahlău Mountain located at an absolute altitude of >1500 m. Alexandru Păunescu noted the presence in all the sites from Ceahlău Basin, in small quantities, of radiolarites/jaspers, probably from the Mesozoic deposits in the Hăghimaș syncline (Al. Păunescu 1970, p. 84, 219; 1998, p. 56). Other researchers remarked the use of opal and radiolarites/jaspers, but no specific origin was attached to those materials (L. Steguweit *et alii* 2009, p. 144, 149, 150). These mentions largely point towards close-by Southwestern/Southern supply sources.

The "Prut flint" was recognised by C.S. Nicolăescu-Plopşor, based on his experience and familiarity with this raw material (C.S. Nicolăescu-Plopşor *et alii* 1966, p. 23-24). Only later, the "Prut flint" was characterized from the supposed source (the Middle Prut Valley, between Rădăuți and Liveni) and its presence in the UP sites from the Middle and Lower Bistrița Valley echoed without a direct petrographic comparison between the source materials and the archaeological ones (A. Muraru 1990, p. 151-153). The results of the most recent research cast serious doubt on its reiterated supposed provenience (L. Moreau *et alii* 2019, p. 530; Al. Ciornei, I. Mariș 2020, p. 53, tab. 4). Whatever the exact sources of the Upper Cretaceous flints bundled under the "Prut flint" label, their presence in the UP sites from Ceahlău Basin indicate a distant Northeastern supply trajectory.

The so-called "Balkan flint" is another raw material less frequently used (and/or recognised by previous research) in the UP assemblages from the Middle and Lower Bistrița Valley (Al. Ciornei 2015, p. 59, and references therein; A. Tuffreau *et alii* 2018, p. 149; L. Moreau *et alii* 2019, p. 523-526, and references therein). While a recent geochemical analysis (L. Moreau *et alii* 2019, p. 532) has partially failed in certifying its provenience, a newer study (Al. Ciornei, I. Mariș 2020, p. 52-53, tab. 4) confirmed the presence in several regional UP contexts of two Lower Danube Valley chert identical to samples from the gravels around the UP site of Giurgiu-*Malu Roşu*. The presence of the Sita Buzăului chert (from the Upper Buzău Valley) in several UP sites from the Middle and Lower Bistrița Valley (Al. Ciornei, I. Mariș 2020, p. 53, tab. 4), together with the Lower Danube Valley cherts, corroborates a Southern direction of raw materials transferred over great distances from, otherwise ignored, chronologically and presumably culturally equivalent UP sites.

From this brief and incomplete overview emerges an image of the UP procurement in the Middle Bistrița Valley in which the different raw materials originate from geologically distinct sources and transported over short and long distances from almost all cardinal points. However, this image is also overprinted by research biases and the unverified terminology used to name and label the siliceous rocks exploited during the UP in Ceahlău Basin.

As showed above, several issues regarding the raw materials characterization and provenience still need to be addressed without losing sight of the terminological inconsistencies. The ongoing archaeological research at Bistricioara-*Lutărie III* (hereafter BL III) provides an excellent opportunity to reopen the petroarchaeological investigations and take advantage of the well segregated and directly dated UP lithic assemblages. The present study focuses mostly on the Eastern Carpathians Flysch raw materials and the ones less well known or less frequently used (opals, radiolarites/jaspers). The results of the ongoing investigations on the Upper Cretaceous flint sources will be presented in detail in a subsequent paper.

◈ 2. Setting of Bistricioara-*Lutărie III*

The BL III site is located near Bistricioara village (Ceahlău commune, Neamţ County), on the right side of Bistriţa River (pl. I), at 500 m absolute altitude. The archaeological investigations (2008-2019) explored a total surface of 36 m² (trenches T0/2008, T1 and T2/2015, T3/2018, T4/2019) and identified six archaeological horizons (AH) attributed to the Late Gravettian and to Epigravettian occupations spread between ca. 27 ka cal BP and 20-15 ka BP (for an expanded discussion on the archaeological contexts, see M. Anghelinu *et alii* 2021a). The size of the lithic assemblages recovered so far at BL III varies markedly between the archaeological layers: 2 lithics (AH 3.1, Gravettian); 2217 and 3 lithics, respectively (AH 2.5 and AH 2.4, both Late Gravettian); 1402 and 5902, respectively (AH 2.3 and AH 2.2, Early Epigravettian); 2802 and 1958 lithics, respectively (AH 2.1 and AH 1.1) for the youngest Epigravettian layers (M. Anghelinu *et alii* 2021a).

In the site's wider physiographic setting the absolute altitudes range from 900-1000 m to 1200-1400 m, with Ceahlău Mountain (Toaca Peak - 1904 m; Ocolașu Mare - 1907 m) dominating this mountainous landscape. The main watercourse draining the area is Bistriţa River, with Largu, Bistricioara, Hangu, Bicaz, and Tarcău as the most important tributaries.

From south of Boroșteni to Piatra Neamţ, Bistriţa River runs through Cretaceous and Paleogene flysch deposits pertaining to Teleajen, Ceahlău, Audia, Tarcău, and Marginal Folds nappes (I. Băncilă 1955, 1958; T. Joja *et alii* 1968; Gr. Alexandrescu 1968; M. Săndulescu 1990; M. Amadori *et alii* 2012; F. Guerrera *et alii* 2012; M. Melinte-Dobrinescu, R. Roban 2011; R. Roban, M. Melinte-Dobrinescu 2012). Further to the West, Bistricioara and Bicaz rivers open, beside the flysch deposits of Teleajen and Ceahlău nappes (sandstones, shales, conglomerates), the Proterozoic-Palaeozoic metamorphic rocks, the Triassic-Jurassic sedimentary deposits, and the Lower Cretaceous wildflysch deposits (I. Băncilă 1958; L. Contescu 1968; Gr. Alexandrescu *et alii* 1968; C. Grasu 1971; M. Săndulescu 1975; I.I. Bucur *et alii* 2011). On the left side of Bistriţa River, Largu creek opens the flysch deposits of Teleajen (sandstones, shales), Audia (black shales), and Tarcău nappes (limestones, shales, sandstones), while Hangu the ones of Audia and Tarcău nappes. On the right side of Bistriţa River, Tarcău and Izvorul Muntelui cut through the Paleogene flysch deposits (sandstones, shales, marlstones, bituminous shales and dysodiles) of Tarcău Nappe, while Schitu creek exposes the Cretaceous flysch deposits of Teleajen and Ceahlău nappes.

On its middle course, Bistriţa River has narrower valley segments (between Secu and Cârnu, Izvorul Muntelui and Straja) or wider ones (between Hangu and Buhalniţa, Poiana Cârnului, Stejaru and Piatra Neamţ), influenced by the background geological composition, and up to 10 terrace levels, of which two are alluvial plain terraces (I. Donisă 1960, p. 390; 1961, p. 445-447).

The site is located in one of the widest segments of Bistriţa Valley known as Ceahlău (Răpciuni) Basin (C.S. Nicolăescu-Plopşor *et alii* 1966, p. 8), on a lower terrace (15-18 m relative altitude) composed of loess-derivate deposits, sandy and gravelly loam (5-9 m thick), and alluvial terrace gravels (O. Trandafir *et alii* 2015; M. Anghelinu *et alii* 2021a). The area immediately surrounding the site is composed of polymictic calcareous-micaceous sandstones, calcarenites, and silty micaceous shales (Piscu cu Brazi flysch, Barremian-Aptian, Ceahlău Nappe; M. Săndulescu 1990, p. 34). Slightly to the East of Schitu creek, the geology is dominated by convolute sandstones and shales (Curbicortical flysch, Lower Cretaceous, Teleajen Nappe; M. Săndulescu 1990, p. 39).

◈ 3. Materials and methods

The petroarchaeological investigation regarding the raw materials from BL III comprised several overlapping stages:

1) preliminary macroscopic analysis and sampling of the archaeological materials;

2) pre-field documentation and preparation;

3) field surveys for locating and sampling the geological deposits supposed to be the sources for the local raw materials ("Audia black schist", "glauconitic siliceous sandstone", "menilite", Hăghimaș syncline Mesozoic radiolarite/jasper);

4) petrographic analysis of the geological samples, origin control samples, and archaeological samples;

5) review regarding the geological occurrence of knappable lithic raw materials in the study area.

3.1. Field surveys for raw materials sources

The general goal of the field surveys was to locate and sample the geological deposits supposed to be the sources for the archaeological materials. A substantial part of this effort relied on the pre-field preparation and documentation: (1) the preliminary review of the petroarchaeological, archaeological, and geological bibliography regarding the raw materials used at the UP sites from Ceahlău Basin and their supposed area of provenience; (2) the correlation of the geological and topographic maps of the area with the reviewed information in order to determine physical locations to be checked during the field surveys.

The study area considered for the field surveys (pl. I), adjacent to the site and dictated by the supposed geological occurrences of the archaeological raw materials, extends between Galu, Petru Vodă, Straja, Tarcău, Dămuc, Lacu Roșu and Tulgheș localities, covering some 1300 km². The preliminary review allowed confining the survey area and delineating five research perimeters:

A) Audia - Petru Vodă (Cretaceous Flysch with "black schists" and siliceous sandstones), an area of 66 km²;

B) Ceahlău Mountain (Ceahlău conglomerates with jaspers/radiolarites and greyish cherts), an area of 58 km²;

C) Izvorul Alb - Tarcău (Paleogene Flysch with menilite), an area of 101 km²;

D1) Tulgheș - Toșorog (the Crystalline-Mesozoic area with Hăghimaș syncline Mesozoic radiolarites/jaspers), an area of 100 km²;

D2) Cheile Bicazului - Lacu Roșu (the Crystalline-Mesozoic area with Hăghimaș syncline Mesozoic radiolarites/jaspers), an area of 147 km².

The field surveys (2018-2019, 2021) were carried out as walks with broadly predetermined paths and objectives based on the pre-field documentation. All stops (observation and/or sampling locations) and field survey routes were recorded with a handheld GPS (Garmin eTrex 35, accuracy of 3 m). Due to logistical reasons, the last research perimeter (D2) was not surveyed.

3.2. Lithic raw materials characterization

The method employed for the lithic raw material characterization and sourcing is the petrographic analysis: a) the macroscopic examination (naked eye, hand lens) of all geological hand samples collected during the field surveys and of the artefacts from BL III; b) the microscopic analysis (thin sections) of representative geological and archaeological samples.

A batch of 350 artefacts from BL III were macroscopically analysed and sampled for thin sections in 2018. The analysed samples came from three excavation campaigns (2008, 2015 and 2018) and from three archaeological layers framed as Early Epigravettian (AH 2.2 and AH 2.3) and Late Gravettian (AH 2.5).

Beside the ones from the field survey, this study also includes geological samples of Paleogene cherts from the gravels of Nechit Valley (right-hand tributary of Bistrița River, lower course) and Secu creek (right-hand tributary of Neamț River). The samples from Nechit Valley were collected during the field surveys conducted in 2013 (unpublished data) as part of the archaeological research at Buda-*Dealu Viilor* and Lespezi-*Lutărie* sites (Al. Ciornei 2015, p. 61, and references therein). The samples from Secu creek were collected in February 2021 during the archaeological diagnostic research on the feature path of A8-Unification Freeway (Târgu Neamț-Tulgheș sector).

The archaeological raw materials were identified through comparison with the geological samples from this study and with other materials available in the lithoteque at the "Vasile Pârvan" Institute of Archaeology (Petroarchaeology Laboratory). The lithoteque is still in the phase of gathering samples from various geological deposits and lacks archaeologically relevant rocks from many areas. To compensate for the gaps in the lithoteque, the supposed non-local (or outside of the surveyed area) and long-distance raw materials from BL III were confirmed by comparison with control samples from representative UP sites:

a) Toplița-*Pârâul Baicăului* (Harghita County) for the "Toplița chert" on the Upper Mureș Valley (M. Anghelinu *et alii* 2012, p. 272; 2013, p. 187; this is the closest known UP use of "opal" from local sources);

b) Cremenea-*Malu Dinu Buzea*, Gîlma-*Roate*, and Costanda-*Lădăuți* (Covasna County) for the Sita Buzăului chert on the Upper Buzău Valley (C.S. Nicolăescu-Plopşor, I. Pop 1959, p. 33; Al. Păunescu 1966, p. 324; Al. Păunescu, I. Pop 1961, p. 33; M. Cosac *et alii* 2014; 2015);

c) Ripiceni-*La Izvor* (Botoșani County, Romania; Al. Păunescu 1999, p. 45-46) and Oselivka-*Chisla Nedjimova* (Chernivtsi oblast, Ukraine)[1] for the "Prut-Dniester flint" (Middle Prut-Dniester area).

Throughout the paper, these sites will be called origin sites and the samples used for comparison will be called origin control samples (Al. Ciornei, I. Mariș 2020, p. 43). Though unorthodox, this methodological approach relies on a few prerequisites:

1) the sites exploiting the respective raw materials are culturally similar and more or less chronologically synchronous to BL III;

2) the sites are located very close or on top of the raw material source they exploit;

3) the raw material used for comparison is predominant in the assemblage and shows all reduction stages (from cortex removal to exhausted cores and tools).

The origin sites are not assumed to be the actual source of the compared raw materials, but rather a proxy (a general location) for their possible provenience when confirmed for a given site (such as BL III).

[1] The site was discovered by Ceslav Ambrojevici in 1925 (N.N. Moroşan 1933, p. 16-17; 1938, p. 106). The samples for thin sections were taken from the lithic collection curated at "Vasile Pârvan" Institute of Archaeology. The lithics, representing all reduction stages (with abundant cortical pieces and various tools), are knapped from several varieties of Prut-Dniester flint and Dniester Globotruncanidae flint (Al. Ciornei, I. Mariș 2020, p. 47, tab. 3). The lithic industry was considered (Al. Păunescu 1999, p. 43) as near identical to the Epigravettian one from Dorohoi-*Stracova* (Botoșani County).

A bibliographic review regarding the geological occurrences of knappable siliceous rocks was conducted to supplement the area covered by the field surveys. This was focused on the rock types similar to the ones sampled from geological deposits during the field surveys or similar to the raw materials described from BL III.

The macroscopic examination of the geological samples (collected during the field surveys), the additional geological samples, the origin control samples, and the artefacts from BL III provided general-propose characterizations and a basis for the thin section sampling. The macroscopic examination (naked eye, hand lens) was focused on recording the external (colour, type and consistency of cortex/rind, and naked eye visible fossils) and the internal features (type of fracture/break, light transmittance, lustre, colour and play of colours, absence or presence and distribution of inclusions, visible fossils or their absence).

The microscopic analysis was conducted at the Faculty of Geology and Geophysics (University of Bucharest) on an Olympus BX-40 petrographic microscope (at magnifications of 4×/0.10 P, 10/0.25 P, 20×/0.40 P, and 40×/0.65 P). Photomicrographs were taken with a DSLR camera attached on a Nikon Eclipse E200 Pol microscope at magnifications of 4× and 10×, 20×. Additionally, thin section photographs (at magnifications of 0.5× and 1×) were captured using a macro photography rig composed of a DSLR camera, a macro lens, a copystand, and a lightbox (for a detailed description of this technique, see M. Haaland *et alii* 2019, p. 105, and references therein). Images in plane polarized light (PPL) and cross-polarized light (XPL) were obtained using a sheet of polarizing film under the thin section and a circular polarizing filter on the macro lens.

The chert samples were classified according to microfacies criteria (primary constituents, such as the amounts and types of grains, matrix, and cement; mineralogy; depositional fabrics and associated environments; diagenetic fabrics; for details, see Al. Ciornei *et alii* 2014, p. 139; Al. Ciornei 2015, p. 46-49, and references therein). The amounts of primary constituents were estimated against visual comparison charts using the 1× photographs and directly in thin sections under the microscope with the 4× and 10× objectives.

The mudstones and sandstones were characterized according to the systematic petrography of siliciclastic rocks (F. Pettijohn *et alii* 1987; P. Potter *et alii* 2005; S. Boggs 2009). For the sandstone samples, the 15% matrix (normalized from the estimated amount at thin section surface) was used as threshold to distinguish between arenites and greywackes (F. Pettijohn *et alii* 1987, p. 144-146). The amount of quartz, feldspar and lithoclasts (plotted in the QFL ternary plot) were used to distinguish between quartz, arkose, and lithic arenite/greywacke. Throughout this paper, the term mudstone will be used generically for all fine-grained massive (non-fissile) indurated argillaceous rocks with at least 50% silt- and clay-sized particles in subequal amounts (P. Potter *et alii* 2005, p. 256-258).

No.	Date	Field survey	Walked distance (km)	Area (km²)	Stops (Observation and sampling points)	No. of samples		Objectives
						Collected	Thin sections	
01	19.06.2018	Audia - Audia creek - Obcina Hangului creek	14.6	0.13	8	76	16	Identify the occurrences and take samples of siliceous glauconitic sandstones and "Audia black schist" (Gr. Alexandrescu 1968, p. 140)
02	08.08.2019	Curmătura la Scaune - Cabana Dochia - Jgheabul cu Hotar - Durău	17.3	9.24	8	8	4	Identify the occurrences and take samples of siliceous rocks from the Ceahlău conglomerates (M. Săndulescu 1990, p. 36)
03	10.08.2019	Tarcău - Crasna Creek - Potoci creek	19.8	0.79	14	3	0	Verify and take samples of Oligocene menilites mentioned on Potoci creek (T. Filimon, A. Damian 1965, p. 43)
04	11.08.2019	Poiana Largului - Țiganului creek	7.3	0.03	14	49	11	Identify the occurrences and take samples of siliceous glauconitic sandstones and "Audia black schist" (Gr. Alexandrescu 1968, p. 141)
05	12.08.2019	Durău - Cabana Fântânele - Cabana Dochia - Piatra cu Apă	21	0.02	11	18	8	Identify the occurrences and take samples of siliceous rocks from the Ceahlău conglomerates; take samples from the siliceous rocks found in the limestone blocks (C. Grasu 1965, p. 73-74) contained by these conglomerates
06	13.09.2019	Hangu - Obcina Hangului creek - Grozăvești - Hangu	9.8	0.40	13	16	13	Identify the occurrences and take samples of siliceous glauconitic sandstones and "Audia black schist" (Gr. Alexandrescu 1968, p. 140)
07	14.08.2019	Izvorul Muntelui - Izvorul Muntelui creek	13.9	0.11	10	5	2	Identify the occurrences and take samples of siliceous rocks
08	15.08.2019	Tulgheș - Bălai creek	13	0.83	13	19	7	Identify the occurrences and take samples of Triassic and/or Jurassic radiolarites (M. Săndulescu 1975, p. 47-50)
09	16.08.2019	Pintec - Pârâul cu Pești creek	21.6	2.10	8	13	4	
10	03.08.2021	Curmătura la Scaune - Bistra Mică - Piatra Sură	17.7	9.70	10	24	0	Identify the occurrences and take samples of siliceous rocks from the Ceahlău conglomerates (P. Șoigan, Gr. Alexandrescu 1976, p. 226-229)
11	08.08.2021	Durău - Toaca - Cabana Dochia - Piatra Lată din Ghedeon	17.9	0.03	11	16	0	Take samples of siliceous rocks from the Ceahlău conglomerates (M. Săndulescu 1990, p. 36)
			173.9	**23.38**	**120**	**252**	**65**	

Tab. 1. General data regarding the field surveys conducted in the Middle Bistrița and Bistricioara basins (northeastern Romania). Informații generale privind cercetările de teren realizate în bazinele Bistriței mijlocii și Bistricioarei (nord-estul României).

◈ 4. Results

4.1. Lithic raw materials from the study area

The field surveys are equally spread between the four research perimeters mentioned above, and cover 14 km² (pl. I, tab. 1). The geological samples collected from the four research perimeters, together with the additional geological samples from Nechit and Secu creeks and the origin control samples from Toplița define an extended study area between Târgu Neamț, Borlești (South of Piatra Neamț), Lacu Roșu, and Toplița.

The samples collected during the field surveys (pl. II-IV), those from additional geological locations, and the ones from the origin site were macroscopically classified and grouped in four rock categories (tab. 2; pl. V). The focus of the subsequent lines are the samples in categories 1-3 (tab. 3, pl. VI-XII). Our presentation will focus on those petrotypes that are for the first time described in a petroarchaeological work and are relevant for the archaeological materials (tab. 4, pl. XIII-XIV). The thin sections analysed from the fourth category are not the subject of this study (their main role was to provide supporting information when collected together with samples from categories 1-3).

Sampling areas	Geological context	Samples			(1)		(2)		(3)		(4)	
		Stops	Macroscopic analysis (MA)	Thin sections (TS)	Chert		Black mudstone		Sand-stone		Lime-stone, dolostone, marlstone	
					MA	TS	MA	TS	MA	TS	MA	TS
Secu	creek gravels	1	10	0	9	0	0	0	1	0	0	0
Nechit	creek gravels, Paleogene deposits	7	37	6	6	5	0	0	15	0	16	1
Potoci	Paleogene deposits, creek gravels	14	3	0	0	0	0	0	1	0	2	0
Izvorul Muntelui	Paleogene deposits, creek gravel	10	5	2	3	1	1	1	1	0	0	0
Hangu-Audia	Audia Fm, Hangu Fm, creek gravels	20	92	29	4	2	15	12	47	13	26	2
Țiganului	Audia Fm, Cârnu-Șiclău Fm, Hangu Fm	14	49	11	1	1	2	1	23	5	23	4
Ceahlău	Ceahlău cg, Neagra Mică Sst, Poiana Macilor Sst	40	71	12	59	11	0	0	2	0	10	1
Bălai-Pintec	creek gravels, Triassic dolostones and limestones, Wildflysh Fm	21	32	11	10	6	1	1	0	0	21	4
Toplița-Pârâul Baicăului	-	-	10	10	10	10	0	0	0	0	0	0
		127	**309**	**81**	**102**	**36**	**19**	**15**	**90**	**18**	**98**	**12**

Fm – Formation; Sst – Sandstone; cg – conglomerates.

Tab. 2. Rock samples from geological deposits and origin sites in the extended study area.
Probe de roci din depozite geologice și situri de origine din zona extinsă de studiu.

4.1.1. Paleogene cherts

The field surveys in Tarcău-Izvorul Muntelui area failed to locate any occurrences of Paleogene cherts as presumed from the available geological information and settings. Although not excluded, the possibility that the primary geological deposit might have been missed is very slim, as the presence of such cherts was not observed in the gravels of any of the surveyed creeks (Crasna, Potoci, and Izvorul Muntelui).

The samples of menilite (from the gravels of Secu and Nechit valleys) are dark brown to blackish, have greasy to glassy lustre, with whitish laminae at regular intervals and fractures oblique or perpendicular to the lamination (pl. V/1). The shape of the samples indicates this is a bedded chert from 3-5 to 8 cm thick, though some of the Secu samples reached a maximum thickness of 12-15 cm. No thin sections were prepared from this material, but previous petrographic descriptions indicate this is a chemical siliceous rock composed of crypto- to microcrystalline quartz groundmass enclosing radial concretions (chalcedony), subangular silt-sized detrital quartz (low content), pyrite, laminar or ocellar yellowish to brown organic bituminous matter, with no identifiable fossils and fine fractures filled by secondary quartz or iron oxide-hydroxides (see tab. 5; also M.G. Filipescu 1936, p. 611-612; C. Grasu *et alii* 1988, p. 142-144; D. Puglisi *et alii* 2006, p. 114-115)[2]. When struck, this chert breaks in uneven chunks (splintery break), more or less determined by the lamination and the oblique fractures and veins. The menilite can be found in both the Oligocene and Miocene deposits of the Tarcău and Marginal Folds nappes, which have a wide occurrence in the extended study area (tab. 5/33-37, pl. XV). The menilite outcrops are located at distances of 25-46 km ESE, E, and SE from BL III. They are also mentioned on Tarcău Valley, south of Schitu Tarcău, some 41 km SSE.

The Eocene chert, previously described from Lespezi-*Lutărie* archaeological samples as variety 4b (Al. Ciornei 2015, p. 50-51), was also identified in thin sections from Nechit valley. The Nechit samples have a medium greyish-brown colour, sometimes beige or dark greyish-brown, with yellowish-whitish cortex, translucent to semi-opaque, greasy to dull, smooth surface (pl. V/1). The quartz clasts are conspicuous in both hand samples (sparkling in the light) and in thin sections (coarse silt to fine sand, subangular to subrounded, 10-15%), and represent one of the main traits of this chert type. Based on the abundance of the various microfossils, two microfacies were distinguished (tab. 3): one dominated by the carbonaceous bioclasts (pl. VI/1-4), and one by sponge spicules and radiolarians (pl. VI/5-8). Planktonic and benthic foraminifera are abundant (pl. VI/8). Burrowing of the sediment is evidenced as irregular shaped areas with very fragmented and jumbled bioclasts (pl. VI/7). These observations are suggestive for a deep shelf depositional setting. This chert has suffered a late episode of siderite/ankerite replacement by calcite, resulting in a particular appearance that leaves the impression of the chert being poorly silicified.

[2] In thin sections, the Oligocene menilite from Valea Morii Fm. (Valea Morii, Vișeu de Jos, Maramureș County) exhibits two microfacies: one is composed of a microcrystalline quartz groundmass with disseminated amorphous iron oxy-hydroxides and organic matter (dark brownish-yellowish) oriented parallel to the stratification plane, poorly preserved microfossils (?) (passed through a mould stage and filled with chalcedony), rare silty quartz and phyllosilicate clasts, opaque minerals, and abundant rhombohedral siderite/ankerite crystals; the second one has a similar composition, but shows clear evidence of a calcitization process (with variable amount of calcite pseudomorphs after rhombohedral siderite/ankerite crystals). The Oligocene menilites from Maramureș exhibit signs of brittle deformation: systematic and overprinting fractures, oblique and perpendicular to the stratification plane, but also breccia fabric (unpublished data, Ciornei *et alii*, in preparation).

Based on the microfauna contained, the supposed primary geological deposit of this chert is the Doamna limestone Fm. that outcrops on Nechit Valley (pl. XV/1), not reached during the field surveys from 2013. The Doamna limestones are known to contain chaille-type cherts. The petrographic traits of the samples from Nechit Valley are in accordance with the petrographic description of the Doamna limestone and of the siliceous accidents found in them (tab. 5). In the extended study area, these deposits outcrop in the Marginal Folds Nappe, from S of Nechit Valley and up to N of Cracău Valley (tab. 5/28-32, pl. XV), stretching 40-45 km on a NNW-SSE direction.

4.1.2. Cretaceous detrital-rich siliceous rocks and sandstones

The Cretaceous deposits of the Audia and Tarcău nappes exposed on Hangu and Țiganului valleys yielded three categories of knappable siliceous rocks: the Audia detrital siliceous rocks, the Audia glauconitic sandstones, and the Cârnu-Șiclău radiolarian chert.

The analysed thin sections of Audia detrital siliceous rocks come mainly from the outcrop on Hangu Valley (GPS point Au 00, Middle Mb. of Audia Fm., Audia Nappe). Just one sample (detrital-rich spiculite) was analysed from the Middle Mb. of Audia Fm. (Tarcău Nappe, GPS point Tig 01) outcropping on Țiganului Valley. On Hangu Valley, the grey and black shales are interlayered with apparently massive blackish and greyish mudstone, limestone, and sandstone layers (pl. II), which exhibit partings (5, 10 or 15 cm thick) along the bedding plane. The thin sections (11) continuously prepared from an apparently massive (45 cm thick) rusty weathered blackish mudstone layer (Au 00-7, pl. II/2-3) reveal a fining-upward depositional sequence (tab. 3): a medium-dark greyish laminated layer (7 cm thick) with detrital-rich spiculite (Au [00-7J-A.1]) and calcareous glauconitic sublithic arenite (Au [00-7J-A.2]); a dark greyish-blackish layer (15 cm thick) with glauconitic lithic greywacke (Au [00-7J-B], Au [00-7J-C]); a dark greyish-blackish layer (10 cm thick) with glauconitic lithic greywacke (Au [00-7J-D.1]), detrital-rich spiculite (Au [00-7J-D.2]), and glauconitic lithic greywacke (Au [00-7J-E]); a medium-dark greyish laminated layer (3 cm thick) containing a detrital-rich spiculite packstone/radiolarian wackestone (Au [00-7J-F]); a dark greyish-blackish layer (10 cm thick) of carbonaceous mudstone (Au [00-7J-G], Au [00-7J-H], Au [00-7J-I]). This sequence (detrital-rich spiculite-lithic greywacke-mudstone) repeats itself in layers Au 00-13 (laminated detrital-rich spiculite, Au [00-13.1], and glauconitic lithic greywacke, Au [00-13.2]) and Au 00-10 (carbonaceous mudstone, Au [00-10]) found 3-4 metres SW from layer 7 (pl. II/4-5).

Macroscopically, the detrital-rich spiculite and the sublithic arenite have a medium-dark greyish laminated appearance, dull and rough surface (pl. V/2). The detrital-rich spiculite contains abundant siliceous sponge spicules, radiolarians, quartz clasts, benthic and planktonic foraminifera, organic matter, and opaque minerals (pl. VIII/1-2). The particles are well-sorted medium to fine sand with a strong orientation parallel to the bedding plane. The laminated calcareous glauconitic sublithic arenite is composed of quartz clasts, lithoclasts, benthic and planktonic foraminifera, fragments of various fossils (echinoderms, algae), and glauconite. In both petrotypes, the predominant interparticle cement is crypto- to microcrystalline calcite, with overgrowths on bioclasts and pseudomorphs after rhombohedral crystals of siderite/ankerite.

The glauconitic lithic greywacke is blackish, dull, opaque, with thin discontinuous laminae, oval, or lens-shaped whitish inclusions arranged parallel to the bedding plane and describing a lineation fabric (pl. V/2). It is composed of medium sand sized detrital quartz, mica, carbonaceous bioclasts, coarse sand sized siliceous and argillaceous oval-shaped rock fragments, carbonate intraclasts (similar to sample Au [00-8], which is a bioclastic ferruginous

cryptocrystalline limestone), all encompassed in a mixed mud and cryptocrystalline silica groundmass. The particles have parallel orientation to the bedding plane, which is outlined by thin dark brownish anastomosing dissolution seams, discontinuous laminae with quartz grains, but also accumulations of organic matter, flattened siliceous and argillaceous rip-up clasts (pl. VII/3-4). Both the oval and the flattened shaped ones are composed of cryptocrystalline silica with radiolarians (conserved in cryptocrystalline silica, sometime calcitized), silty quartz clasts, and very fine-grained phyllosilicates. The ones with a flattened shape have one straight lateral outline and the other shredded (or both shredded). Further in the sequence, the carbonaceous mudstone (sample Au [00-7J-G]) contains similar siliceous rip-up clasts, only they are smaller.

Sample Au [00-7J-F] has a dull medium-dark greyish laminated appearance (pl. V/2) which corresponds to a compositional lamination. The lower half of the thin section, towards sample Au [00-7J-E], is composed of alternating thick laminae of detrital-rich spiculite packstone (sponge spicules, radiolarians, detrital quartz, phyllosilicates, carbonaceous bioclasts, intraclasts) and very thin laminae of mudstone with organic matter accumulations. The upper half of the thin section, towards sample Au [00-7J-G], is composed of alternating thicker laminae of radiolarian wackestone (with radiolarians, sponge spicules, detrital quartz, phyllosilicates) and thin laminae of mudstone with organic matter accumulations (pl. VII/5-6). The particles are well-sorted very fine sand (to coarse silt) and show a strong orientation parallel to the bedding plane. The overall groundmass is a mix of mud and cryptocrystalline silica (as matrix) and crypto- to microcrystalline calcite cement, calcite pseudomorphs after siderite/ankerite, and syntaxial overgrowth calcite cement.

The carbonaceous mudstone, previously designated as Audia "black schist" MF 2 (Al. Ciornei, I. Mariș 2020, p. 47, tab. 3), is blackish to dark greyish, dull, opaque, very fine-grained, with a smooth surface and conchoidal break (pl. V/2). It is composed of a mixed siliceous and mud groundmass invaded by calcite (mostly pseudomorphs after siderite/ankerite), with radiolarians, sponge spicules, fragmented carbonate bioclasts, silty quartz clasts and phyllosilicates. The silt-sized particles are well sorted and fixed in a mud and cryptocrystalline silica groundmass invaded by calcite pseudomorphs after siderite/ankerite (pl. VII/7-8, VIII/3-4). The phyllosilicates are very fine-grained mica (sericite) forming a continuous foliation. The presence of calcite pseudomorphs after siderite/ankerite, the radiolarians filled with calcite, the cryptocrystalline calcite cement, and the syntaxial overgrowth calcite cement on carbonate bioclasts point out to a later episode of calcitization. By comparison, sample Le-Lu [07] (variety 2b) from Lespezi-*Lutărie* is similar to the samples from Au 00, but is even more carbonaceous.

The sample of "black schist" found in the gravels of Izvorul Muntelui creek (IzMu [02.3]) was determined as a laminated detrital-rich radiolarian chert (tab. 3, pl. VIII/5-6). The groundmass is a mix of cryptocrystalline silica and organic matter. Beside radiolarians, this petrotype also contains sponge spicules (siliceous), planktonic foraminifera, carbonate bioclasts, opaque minerals, siderite/ankerite, pseudomorphs after siderite/ankerite, silty quartz clasts, and very fine-grained mica (sericite) forming a continuous foliation. This petrotype is partially relatable to sample Au [00-7J-F].

Most of the Audia sandstone samples analysed in this study were collected from the poorly exposed outcrops on Hangu Valley (GPS points Au 11-15, Upper Mb. of Audia Fm., Audia Nappe, pl. III/1-2), but also from the better exposed outcrops on Țiganului Valley (GPS points Tig 02-02d, Upper Mb. of Audia Fm., Tarcău Nappe, pl. III/3-4). In fresh break, the sandstones are medium to dark grey or slightly grey-greenish, with greasy or glassy lustre and

smooth surface or with dull and rough surface (pl. V/3). They are composed of angular/subangular to subrounded quartz clasts (with undulose extinction or subgrain boundaries), lithoclasts, bioclasts (fragments of echinoderms, algae, bivalve and mollusc shells, sponge spicules), phyllosilicates (mostly white mica), and feldspars. The content of heavy minerals is around 0.5%, with a notable amount of 1% in sample Au [09.1]. The average content of glauconite peloids is around 5% (up to 7-8% in some samples). Based on their matrix to cement content, the samples can be described as sublithic arenites and lithic greywackes (tab. 3, pl. IX). Further differentiation is given by grain size, samples ranging from very fine sand (pl. IX/1-2), fine sand (pl. IX/5-8) to medium sand (pl. IX/3-4). All samples are poorly (sometimes moderately) sorted with larger subrounded/rounded quartz clasts and smaller angular/subangular quartz clasts in-between the larger ones. The predominant cement type holding the particles together is either siliceous (pl. IX/1-6) or calcareous (pl. IX/7-8). All samples contain various amounts of dispersed rhombohedral crystals of siderite/ankerite, most of them replaced by calcite (giving the false appearance of a fine-grained "carbonate matrix"). The calcareous and siliceous sublithic arenite petrotypes are very similar with varieties 1c (Le-Lu [03], [05]) and 1d (Le-Lu [04]) from Lespezi-*Lutărie*, which were described as quartzarenites (Al. Ciornei 2015, p. 49). After reanalysis and comparison with the ones from this study, they were reclassified as sublithic arenites.

Some different types of sandstones were collected from other geological deposits, but most of them were deemed (macroscopically) not compatible with the archaeological materials or not suitable for knapping. Of these, one sandstone sample from Audia Valley (GPS point Au 01, Hangu Fm., Late Campanian-Maastrichtian, Tarcău Nappe) caught our attention. It has a medium grey-greenish dull and rough surface and conchoidal break (pl. V/3). This is a calcareous glauconitic sublithic arenite (very fine sand) composed of quartz clasts, lithoclasts (metamorphic and sedimentary rocks), bioclasts, feldspars, glauconite peloids (10%), and phyllosilicates held in a calcite cement, but without the siderite/ankerite pseudomorphs very conspicuous in the Audia sandstones.

On Țiganului Valley, a greenish fine-grained bedded chert (4-5 cm thick) is intercalated within the greenish and reddish shales of the Cârnu-Șiclău Fm. (Tarcău Nappe, GPS point Tig 03, pl. III/5-6). This chert is composed of radiolarians and subangular silty quartz clasts held together in a cryptocrystalline silica, organic matter and fine chlorite groundmass (tab. 3, pl. V/2, VIII/7-8). The peculiarity of this chert is the overprint of the groundmass by sericite forming a continuous foliation subparallel to the orientation of the radiolarians.

The Audia detrital siliceous rocks, the Audia glauconitic sandstones, and the Cârnu-Șiclău radiolarian chert are derived from geological formations that outcrop together in the Audia (as a narrow E-W strip, but continuous on the N-S direction) and Tarcău (as anticlines) nappes (tab. 5/41-42, pl. XV). Similar siliceous rocks are mentioned in the Sărata and Upper Tisaru formations (chronostratigraphic equivalents of the Audia and Cârnu-Șiclău formations) outcropping in the Marginal Folds Nappe, around Piatra Neamț (tab. 5/38-40, pl. XV).

4.1.3. Ceahlău cherts

The field surveys in the Ceahlău Mountain documented the presence of siliceous rocks at several locations in the Ceahlău conglomerates (Ceahlău Nappe, pl. IV/1-8), the Urgonian limestones block at Piatra cu Apă (GPS point Chl 14, pl. IV/9), and creek gravels (pl. IV/10). These siliceous rocks exhibit similar petrographic traits ranging from chert to silicified limestone. The chert has a medium greyish or greyish-brownish to dark greyish colour, greasy lustre, translucent to semi-translucent. The silicified limestone is medium grained, grey-

brownish to dark grey, dull and rough surface, opaque, with abundant detrital quartz. The chert gradually transitions outwards or contains within a medium-grained, dull, beige or grey carbonaceous material. The silicified limestone contains mm-sized cherty patches, sometimes becoming extensive cm-sized areas. Some of the samples have a laminated appearance, with brownish or dark greyish chert laminae alternating with greyish or beige silicified limestone ones. Other samples represent a laminated chert composed of a thicker chert layer with thin laminae of silicified limestone, transitioning outwards to a beige or grey-whitish carbonaceous material. The chert and the silicified limestone occur in the conglomerates as subangular fragments of pebble-cobble size with a morphology suggesting a tabular (lens-like) initial shape. At Piatra cu Apă, the silicified limestone occurs in primary position as small nodules (<10 cm), but C. Grasu (1965, p. 74) mentioned ellipsoidal silicified areas longer than 30 cm.

Thin sections of these materials show benthic and planktonic microfauna and small intraclasts/peloids held together in a microcrystalline silica cement. Very conspicuous is the presence in several samples of involutinid foraminifera with monocrystalline test (in the centre of pl. X/4). The abundance and association of various fossils and non-skeletal particles allows separating three microfacies: (1) dominated by sponge spicules and radiolarians (MF 1); (2) with abundant echinoderm fragments (MF 2); (3) dominated by carbonaceous small intraclasts/peloids with subordinated sponge spicules and radiolarians (MF 3). These so-called small intraclasts/peloids are composed of micrite, have uniform size (40-250 μm), spherical or ovoid shaped (rarely rod-like), no internal structure, and are most probably faecal pellets. Hence, MF 3 might represent a poorly silicified pelletal limestone. The combination of these microfacies results into two main petrotypes composed of MF 1, respectively MF 2, with laminae or irregular areas of MF 3 (tab. 3, pl. X/1-4). A third petrotype is represented by the laminated chert, which is composed of alternating laminae of MF 3, MF 2 and MF 1 (pl. X/7-8)[3]. The silicified limestone from Piatra cu Apă has a near identical petrographic composition to MF 1, but represents a patchy silicified limestone showing ample evidence of a later calcitization episode affecting the particles (partially or totally infilling the sponge spicules and radiolarians, and with syntaxial overgrowth cement on carbonaceous bioclasts and non-skeletal particles) and the siliceous groundmass (tab. 3, pl. V/4, X/5-6).

All samples contain rhombohedral crystals with slightly curved outlines, dispersed in the groundmass, as interparticle cement, and as intraparticle cement (partially infilling the interior of sponge spicules or other bioclasts), most probably representing dolomite. The dolomitization is later then the silicification process. The syntaxial overgrowth calcite cement on carbonate bioclasts bordering the rhombohedral crystals, or several crystals bounded by a syntaxial calcite cement, together with the dark coloured coatings on the rhombohedral crystals indicate a dedolomitization process (replacement of dolomite by calcite). Many of the chert samples display evidence of pressure solution (stylolites) and tensile fracturing (systematic fractures filled with opaque minerals and amorphous iron oxide-hydroxides or with sparry calcite). All evidence points towards a dolomitized chert later affected by an episode of calcitization. This process seems stronger in the silicified limestone samples from Piatra cu Apă and in MF 3, both of which seem less affected by the dolomitization process.

On one hand, the Ceahlău chert petrotypes exhibit broad petrographic similarity with the descriptions for the Callovian-Oxfordian silicified pelletal limestones, the Kimmeridgian-Tithonian silicified limestones, and the Jurassic-Lower Cretaceous cherts mentioned in the Ceahlău conglomerates (tab. 5/43, pl. XV/4). On the other hand, the samples of Ceahlău cherts

[3] After re-examination, sample Le-Lu [06] from Lespezi-*Lutărie* was found to fit within this description.

and silicified limestone from this study have similar petrographic traits. Hence, it is very possible that the Ceahlău conglomerates comprise several different materials (of which only a few were sampled and described in this study) originally derived from distinct geological deposits. The sampling points are located at a distance of 7-16 km S, SSW, and SE from BL III, but such materials might be present in the creeks descending from Ceahlău Mt. towards Bistriţa Valley (such as Schitu creek).

4.1.4. Hăghimaș syncline cherts

Under this heading, we include those siliceous rocks generally called by Romanian archaeologist radiolarites/jaspers derived from the Mesozoic deposits in the Hăghimaș syncline. Such cherts were identified in the gravels of Bălai and Pintec creeks and their tributaries (GPS points Bal 01-04, 07, Chi 01, Pin 01-02). They are very fine-grained and have various shades of green, red, or show bicoloured lamination. Similar siliceous rocks were also identified on Ceahlău Mountain in the conglomerates (GPS points Chl 10, 22, and 23b). The primary geological deposits with such rocks have not been located during the field surveys.

The analysed thin sections were prepared only from the samples collected from the gravels of Bălai creek. Based on their petrographic traits, two groups were differentiated: radiolarian-bearing siliceous rocks and mollusc shells chert (pl. V/5, XI). The sample (Bal [07.1]) determined as mollusc shells chert is composed of a reddish, translucent, greasy siliceous part which transitions outwards to a greyish-beige limestone. In thin section, the reddish part is characterized by densely packed mollusc shells (packstone) held in a microcrystalline silica cement with voids filled by botryoidal chalcedony and megaquartz cements (tab. 3, pl. XI/1-2). The limestone part of the sample has the same petrographic composition, only it retains the original mineralogy (calcite).

The radiolarian-bearing siliceous rocks have various amounts of radiolarians with different mineralogy and fabrics (tab. 3). From a mineralogical point of view, the samples can be classified as chert (Bal [03.1], [02.2]), carbonaceous chert (Bal [01.3]), mixed siliceous-carbonaceous (Bal [04.1]) or siliceous-ferruginous-carbonaceous (Bal [04.2]) rocks. The mixed types are dull and opaque in hand samples, while the cherts are semi-translucent and have greasy lustre. The amount of radiolarians (J. Halamić, S. Klindžić 2009, p. 19-20) gives the basic division between radiolarian cherts (<50%) and radiolarites (>50%). Further differentiation is provided by the groundmass composition (crypto- or microcrystalline silica with chlorite or amorphous iron oxides-hydroxides), the content of detrital quartz and phyllosilicates, or the presence of calcite cement replacing the groundmass and the radiolarians (pl. XI/3-8). Specific radiolarian genus associations allowed discriminating between Triassic (dominated by *Liosphaera* and *Cenosphaera*) and Jurassic (dominated by *Heliodiscus*, *Rhopalastrum*, *Hagiastrum*, *Cenosphaera*) radiolarian-bearing siliceous rocks (tab. 3; pl. XI/4, XI/6, XI/8). Two petrotypes (the medium greenish, Bal [03.1], and the light greenish, Bal [02.2]) have a low detrital content and no carbonate cement. The intense greenish radiolarian chert (Bal [01.3]) has a high content of detrital quartz and phyllosilicates, shows ample evidence of calcite replacing the silica (in the groundmass and radiolarians), but also areas with chlorite disseminated in the groundmass and infilling the radiolarians (pl. XI/6). The mixed petrotypes (reddish, Bal [04.2], and bicoloured laminated, Bal [04.1]) have a low content of silica (for the most part replaced by calcite) and a high content of detrital quartz and phyllosilicates. The radiolarian-bearing siliceous rocks exhibit deformational fabric elements such as systematic conjugate fractures (crackle breccia fabric), microfolds, stylolites, and sericite disjunctive spaced foliation. When struck, some of them break along these fabric elements, resulting in irregular chunks.

The petrographic composition of the radiolarian-bearing siliceous rocks is in general agreement with the descriptions of similar rocks encountered in the Triassic, Jurassic and Lower Cretaceous deposits from Hăghieș-Criminiș area (tab. 5/44-47, pl. XV), but also from Chicera Mt., Stânei Valley, and Lacu Roșu-Valea Rece area (tab. 5/48-51, pl. XV). Such rocks are also mentioned in the Ceahlău conglomerates (tab. 5/43, pl. XV/4).

4.1.5. Toplița chert

The analysed samples come from the origin site of Toplița-*Pârâul Baicăului* near Toplița town (Harghita County), in the Upper Mureș Valley (between Călimani and Gurghiu Mts.). The geological context of the origin site is represented by the Neogene Fâncel-Lăpușna Volcaniclastic Fm. (D. Rădulescu *et alii* 1973, p. 21-22; T. Bandrabur, V. Codarcea 1974, p. 34, 36-38): pyroclastic breccias and microbreccias with intercalations of tuffs, epiclastic rocks, and flows of basaltic andesites; lacustrine deposits (conglomerates, microconglomerates, sands, sandstones, clays) alternating with coarse and fine pyroclastic rocks (Andreneasa, Lunca Bradului, Neagra, and Toplița lacustrine basins). The epiclastic deposits contain incarbonized or silicified ligneous and herbaceous remains.

The samples of Toplița chert have an attractive gem-like appearance as they are variably and intensely multi-coloured, with very fine-grained and smooth surfaces (sometimes medium-grained and a rough surface), from dull and opaque to greasy and translucent (pl. V/6). Some of the samples have a whitish very fine-grained "tuff-like" cortex. The petrographic composition allows discriminating between two types of chert: one devoid of fossils and one fossiliferous (tab. 3).

Eight out of the ten samples analysed depict a very well silicified material with a variety of non-sedimentary fabrics which can be abridged as follows: massive fabric with microcrystalline silica groundmass containing disseminated opaque minerals and amorphous iron oxide-hydroxides, irregular veins and voids filled with chalcedony or amorphous iron oxide-hydroxides (pl. XII/1-2); breccia fabric with irregular shaped clasts (microcrystalline quartz, chalcedony, amorphous iron oxide-hydroxides/opaque minerals) vaguely outlined either by surrounding crypto- to microcrystalline silica groundmass/amorphous iron oxide-hydroxides or by irregular voids filled with chalcedony and/or iron oxide-hydroxides (pl. XII/3-4); flow-banding fabric with microcrystalline silica or amorphous iron oxide-hydroxides bands wrapping around oval or rectangular shaped silicified clasts (pl. XII/5-6). These fabrics together with the notable absence of fossils and the texture of the silica polymorphs (well-developed microcrystalline quartz and chalcedony) indicate a hydrothermal related silicification in volcaniclastic deposits.

Two of the analysed samples contain fossils: one is composed of algae, charophyta gyrogonites, and mollusc shells fixed in a microcrystalline silica groundmass impregnated with amorphous iron oxide-hydroxides and organic matter (tab. 3, pl. XII/7-8); the other sample shows laminae of whole algae or algal fragments/detritus alternating with laminae of microcrystalline silica, amorphous iron oxide-hydroxides, and organic matter. The fossils indicate a lacustrine/lagoon depositional environment. The silicification is less strong, but displays the same well-developed microcrystalline quartz and chalcedony. The fossiliferous samples indicate a hydrothermally related silicification of lacustrine deposits.

The petrographic traits of Toplița chert (i.e., hydrothermally silicified volcaniclastic rocks and lake sediments, in stark contrast to all materials presented above) confirms a handful of mentions (missing a petrographic description) from Toplița area, which trace a recurrent occurrence of siliceous rocks in a specific volcanic setting (tab. 5/52-56, pl. XV/6).

Rock category and petrotype		Geological context	Particles	Matrix	Cement	Fabric
Eocene chert	detrital-rich bioclastic chert	Nechit creek gravels (derived from the Doamna Limestone Fm., Eocene)	CarbBio, SpoSpi, Radio, Qd (coarse silt-fine arenite)	RS	Qcc, RhoPse	detrital-rich bioclastic cementstone (MF 1)
	detrital-rich bioclastic (spiculitic) chert		SpoSpi, Radio, PlaFo, BenFo, CarbBio, Qd (coarse silt-fine arenite)	RS	Qcc, RhoPse	detrital-rich bioclastic wackestone (MF 2)
Audia detrital siliceous rocks	detrital-rich spiculite	Audia Fm., Middle Mb. (Late Barremian-Early Albian)	SpoSpi, Radio, BenFo, PlaFo, rip-up clasts, CarbBio, Qd, Phyl, Gla, Opq	mud	Cal, SyntCal, Rho, RhoPse	detrital-rich packstone or packed wackestone spiculite
	laminated calcareous glauconitic sublithic arenite (very fine sand)		Qd, CarbBio, SpoSpi, BenFo, PlaFo, Gla, Phyl, rip-up clasts, Opq	mud	Cal, Rho, RhoPse	calcareous sublithic arenite
	glauconitic lithic greywacke (medium sand)		Qd, CarbBio, SpoSpi, rip-up clasts, Phyl, PlaFo, BenFo, Gla, Opq, Feldspars	mud+Qcc	Sid, RhoPse	lithic greywacke
	laminated detrital-rich spiculite/radiolarian wackestone		SpoSpi/Radio, PlaFo, CarbBio, rip-up clasts, Phyl+Qd, Gla, Opq	mud	Cal, Rho, RhoPse	laminated detrital-rich spiculite/radiolarian wackestone
	carbonaceous black mudstone		Radio, SpoSpi, PlaFo, CarbBio (?), rip-up clasts, Phyl+Qd, Gla, Opq	mud+Qcc	Rho, RhoPse	carbonaceous siliceous mudstone
	laminated carbonaceous black radiolarian chert	Izvorul Muntelui creek gravels	Radio, SpoSpi, PlaFo, CarbBio (?), InCl, Phyl+Qd, Gla, Opq	mud+Qcc	Rho, RhoPse	laminated carbonaceous radiolarian wackestone
Audia glauconitic sandstones	calcareous glauconitic sublithic arenite (fine sand)	Audia Fm., Upper Mb. (Early-Late Albian)	Qd, lithoclasts (metamorphic, radiolarian and micaceous chert, argillaceous, carbonate), Gla, CarbBio, SpiSpo, Phyl, Feldspars, Opq	mud	Cal, SyntCal, Rho, RhoPse, Qcc	calcareous sublithic arenite
	siliceous glauconitic sublithic arenite (medium to fine sand)				Qcc, Rho, RhoPse, SyntCal	siliceous sublithic arenite
	siliceous glauconitic lithic greywacke (medium to fine sand)				Qcc, Rho, RhoPse, SyntCal	siliceous lithic greywacke
	siliceous-calcareous glauconitic lithic greywacke (very fine sand)				Qcc, RhoPse, SyntCal, Rho	siliceous-calcareous lithic greywacke
Cârnu-Șiclău radiolarian chert		Cârnu-Șiclău Fm. (Upper Cretaceous)	Radio, SpoSpi, Phyl, Qd	Qcc+RS +chlorite	-	sericite-rich radiolarian wackestone

BenFo – benthic foraminifera; PlaFo – planktonic foraminifera; InvoFo – involutinid foraminifera; CarbBio – carbonaceous bioclasts (echinoderms, algae, sponge spicules, mollusc, bivalves); InCl – intraclasts; SpoSpi – siliceous sponge spicules; Radio – radiolarians.
Qd – detrital quartz clasts; Phyl – phyllosilicate clasts; Phyl+Qd – silty fraction of detrital quartz and phyllosilicate clasts; RS – residue; OM – organic matter.
Qcc – cryptocrystalline quartz (1-4 μm); Qm – microcrystalline quartz (4-20 μm); Qf – chalcedony; MQ – drusy megaquartz (> 20 μm, subhedral to euhedral crystals); Cal – crypto- or microcrystalline calcite cement; SyntCal – syntaxial overgrowth calcite cement; Rho – rhombohedral siderite/ankerite/dolomite crystals; RhoPse – calcite pseudomorphs after siderite/ankerite/dolomite; Fe ox-hy – amorphous iron oxide-hydroxides; Opq - opaque minerals; Gla – glauconite peloids; MF – microfacies; Mb. – Member; Fm. – Formation.

Tab. 3. Petrographic characteristics of the samples from geological deposits and origin sites.
Caracteristicile petrografice ale probelor din depozite geologice și situri de origine.

Rock category and petrotype		Geological context	Particles	Matrix	Cement	Fabric
Ceahlău cherts	spiculitic-intraclastic chert	Ceahlău conglomerates (Albian)	SpoSpi, Radio, CarbBio, small InCl/peloids, InvoFo, Qd, Phyl	RS	Qm, RhoPse, SyntCal, Cal	dedolomitized spiculitic-intraclastic wackestone (MF 1) + dedolomitized intraclastic/peloidal packed wackestone (MF 3)
	bioclastic-intraclastic chert		CarbBio, SpoSpi, Radio, small InCl/peloids, InvoFo, Qd, Phyl	RS	Qm, Qf, RhoPse, SyntCal, Cal	dedolomitized bioclastic-intraclastic wackestone (MF 2) + MF 3
	laminated chert		small InCl/peloids, CarbBio, SpoSpi, Radio, Qd, Phyl	RS	Qm, RhoPse, SyntCal, Cal	alternating laminae of MF 3, MF 2, MF 1
	spiculitic-intraclastic calcareous chert	Urgonian limestone	SpoSpi, CarbBio, Radio, small InCl/peloids, InvoFo, Qd, Phyl	RS	Cal, RhoPse, Qm	dedolomitized spiculitic-intraclastic wackestone
Hăghimaș syncline cherts	greenish radiolarite (Bal [03.1])	Jurassic, Bucovinian Nappe	Radio (60%), SpoSpi, Qd, Phyl	Qm+RS	-	packed wackestone radiolarite
	light greenish radiolarian chert (Bal [02.2])		Radio (40%), SpoSpi, Qd, Phyl	Qcc+RS +chlorite	-	sericite-rich radiolarian wackestone
	intense greenish carbonaceous radiolarian chert (Bal [01.3])		Radio (40%), PlaFo, InvoFo, Qd, Phyl, Gla	Qcc+RS +chlorite	Rho, RhoPse, SyntCal	carbonaceous radiolarian wackestone
	bicoloured laminated radiolaritic siliceous-carbonaceous rock (Bal [04.1])		Radio, InvoFo, Qd, Phyl	RS+Qm	SyntCal	laminae with detrital-rich carbonaceous radiolarian packed wackestone; laminae with detrital-rich carbonaceous packed wackestone radiolarite
	reddish radiolaritic siliceous-ferruginous-carbonaceous rock (Bal [04.2])		Radio, SpoSpi, PlaFo, Phyl, Qd, Feldspars	Fe ox-hy+Qcc+ RS	SyntCal	laminae with detrital-rich ferruginous radiolarian mudstone; laminae with detrital-rich carbonaceous radiolarian packed wackestone; laminae with detrital-rich wackestone radiolarite
	mollusc shells chert (Bal [07.1])	(?)	mollusc shells (70-75%)	RS	Qm, Qf+MQ	mollusc shells packstone
Topliță chert	non-fossiliferous chert	Fâncel-Lăpușna Volcaniclastic Fm. (Neogene)	-	-	Qm+Opq+Fe ox-hy	massive, breccia, and flow banding
	fossiliferous chert		algae, charophyta gyrogonites, mollusc shells	Fe ox-hy+Opq+OM	Qm	bioclastic packed wackestone; laminated wackestone

Tab. 3. *Continued.*
Continuare.

Sample ID	Archaeological horizon	Cultural framework	Macroscopic appearance		Petrotype and raw material category	
BL III [729]	AH 2.2	Early Epigravettian	"Menilite"	medium grey-brownish	Eocene chert - MF 1	Eocene chert
BL III [404]	AH 2.2			beige	Eocene chert - MF 3 – detrital-rich bioclastic chert with planktonic foraminifera	
BL III [316]	AH 2.3			beige		
BL III [360]	AH 2.2			dark and light grey-brownish laminae	Eocene chert – laminated detrital-rich bioclastic chert (with laminae of Qd, MF 1, MF 2 or MF 3)	
BL III [463]	AH 2.2			beige and grey-brownish laminae		
BL III [331]	AH 2.3			grey-brownish with whitish dots, beige partial patina		
BL III [1117]	AH 2.3		"Audia black schist"	blackish	Audia siliceous black mudstone	Audia detrital siliceous rocks
BL III [453]	AH 2.2			blackish, medium grey-greenish patina		
BL III [803]	AH 2.2			blackish		
BL III [575]	AH 2.3			blackish with light grey-whitish laminae	Audia laminated black radiolarian chert	
BL III [684]	AH 2.2		"Siliceous sandstone"	grey-brownish	Audia detrital-rich spiculite chert	
BL III [560]	AH 2.2			dark grey-greenish		
BL III [731]	AH 2.2			dark and light grey laminae	Audia laminated siliceous glauconitic sublithic arenite (very fine sand)	
BL III [452]	AH 2.2		"Opal"	grey-blackish and whitish-rosy patina	Topliţa non-fossiliferous chert with breccia fabric	Topliţa chert
BL III [626]	AH 2.2			whitish-rusty patina		
BL III [640]	AH 2.2			whitish-rusty patina		
BL III [632]	AH 2.2			whitish patina with a rusty-brown undulating lamination	Topliţa non-fossiliferous chert with flow banding	
BL III [366]	AH 2.2		"Radiolarites"	reddish and grey-greenish	Detrital-rich bicoloured radiolarite	Hăghimaş syncline cherts
BL III [590]	AH 2.2			greenish	Detrital-rich greenish radiolarian chert	
BL III [666]	AH 2.2			medium grey-bluish	**Sita Buzăului radiolarian chert**	
BL III [367]	AH 2.2		"Prut-Dniester flint"	grey-brownish, whitish patina	**Prut-Dniester spiculite flint**	
BL III [513]	AH 2.2			medium grey, whitish-bluish patina		
BL III [389]	AH 2.3			dark grey, bluish patina	**Dniester Globotruncanidae flint**	
BL III [SI-A3-02]	AH 2.5	Late Gravettian		grey-bluish and whitish patina		
BL III [SIII-Pas-04]	AH 2.5			whitish-bluish patina		

Qd – detrital quartz; MF – microfacies; AH – archaeological horizon

Tab. 4. Petrographic characteristics of the samples from Bistricioara-*Lutărie III*.
Caracteristicile petrografice ale probelor de la Bistricioara-*Lutărie III*.

No. in Pl. XV	Occurrence area	Siliceous rock type and petrographic traits		Geological context	References
28	left side of Cracău (Țiganului and Șerpelui creeks)	silicified areas (chaille-type siliceous accidents, small lens-like, 10 cm in thickness) in fine-grained limestones (10-25 m thick) [greyish, greenish or beige, whitish on alteration surfaces, as 5-30 cm thick beds; micrites with 25-30% sponge spicules, calcareous foraminifera, coccolithophorids, glauconite, detrital quartz]		Doamna Limestone Fm. (Eocene), Marginal Folds Nappe	T. Joja 1959, p. 92; C. Olteanu 1952, p. 45-46; 1953, p. 17; O. Mirăuță 1962, p. 48; O. Mirăuță, E. Mirăuță 1964, p. 140; M. Micu 1976, p. 56
29	right side of Cracău (Pocivnicu and Porcăroaia creeks)				
30	between Cuejdiu and Horăița valleys (Gherman, Recea, Țiganca creeks)				
31	left side of Bistrița valley (Runcu, Sărata, and Plopușoru creeks)				
32	Doamna Valley basin (Bighirea, Gliguța, and Jgheabul Mare creeks),	whitish-greenish limestones with dark coloured inhomogeneous siliceous accidents (chaille-type) in discontinuous beds parallel to the stratification	siliceous sponge spicules, echinoderm and bryozoan fragments, foraminifera (nummulites, globigerines), detrital angular quartz grains		M. Frollo 1937, p. 78-79
-	Picioarele Hill, near Târgu Ocna				
33	between Cuejdiu and Agapia valleys	blackish menilite in 1-7 cm thick beds with millimetre thick intercalations of dysodile shales and quarzitic sandstones (3-8 m thickness)		Lower Menilites Fm. (Oligocene), Marginal Folds Nappe	O. Mirăuță, E. Mirăuță 1964, p. 141-142; M. Micu 1976, p. 58; T. Joja 1959, p. 92; C. Olteanu 1952, p. 46; 1953, p. 18;
34					
35	between middle Pângărăcior and Cuejdiu creeks (Răchitiș, Stirigoești, Bisericani, and Valea Mare)				
36	Doamna Valley basin (Jgheabul Mare)				
37	near the confluence of Horăița and Lingurarului creeks (Poiana village)	brownish menilite (3-4 m thick), banded, in 1-2 cm thick beds		Upper Dysodilic Shales and Menilites Fm. (Miocene), Marginal Folds Nappe	M. Micu 1976, p. 58; O. Mirăuță, E. Mirăuță 1964, p. 142
-	Bîtca Răchiței-Întărcătoarea-Picioru Făgețelu syncline (Merișor, Tărcuța, and Tarcău creeks)	brownish-blackish menilite as 1-4 cm thick beds (with compact an hard areas passing laterally to a slightly clayish material and splits along the stratification planes) interlayered with rusty silicified marls (4-5 intercalations at the base of the brownish bituminous marls)	lighter and darker coloured laminae/stripes composed of cryptocrystalline silica impregnated with a yellowish-brown substance (more concentrated in the darker stripes), pyrite and magnetite	Lower Menilites Fm. (Oligocene), Tarcău Nappe	L. Ionesi 1957, p. 381; 1962, p. 194
-	Ardele-Tarcăul Mare anticline	menilite intercalations, lens-like shape (10 cm thick)			
-	Potoci creek (left side tributary of Tarcău, Tarcău village)	calcareous bituminous brownish marls and dysodile shales with 4 intercalations of menilite (0.3-0.85 m thick)			T. Filimon, A. Damian 1965, p. 43

Tab. 5. Occurrences of siliceous rocks in the extended study area.
Ocurența rocilor silicioase în zona extinsă de studiu.

No. in Pl. XV	Occurrence area	Siliceous rock type and petrographic traits			Geological context	References
38	Cuejdiu-Horăița valleys	small chaille in very fine-grained limestones (with globigerina, *Inoceramus* fragments, *Globotruncanae*, sponge spicules)			Lepșa Fm. (K2), Marginal Folds Nappe	O. Mirăuță, E. Mirăuță 1964, p. 135-136
		blackish, reddish and greenish shales (20 m thick), in 2-6 m beds, with greenish radiolarites (sometimes banded) in 2-5 cm thick beds	cryptocrystalline silica and chloritized clay groundmass (greenish) with radiolarians (*Spumellaria*, *Nasselaria*) conserved in chalcedony, detrital clasts (5% - quartz-chlorite schist, quartz, biotite), and glauconite		Tisaru Fm. (K2), Marginal Folds Nappe	O. Mirăuță, E. Mirăuță 1964, p. 134-135
		medium to coarse grained greyish limestones (60-100 m thick) in 10-100 cm thick beds with greyish-blackish or whitish spongolithic siliceous accidents (chaille, 2-6 cm in thickness)		chalcedony groundmass with numerous sponge spicules (chalcedony), radiolarians, and detrital quartz	Upper Mb., Sărata Fm. (K1), Marginal Folds Nappe	Mirăuță 1962, p. 48; O. Mirăuță, E. Mirăuță 1964, p. 133-134
39	Cuejdiu-Horăița valleys between Sărata, Valea Mică, and Tisei creeks	lydite horizon (60-100 m thick) with dark grey or black shales and jasper-like blackish siliceous rocks (lydite) in 2-20 cm thick beds (very hard, banded, with conchoidal break)	mix of chalcedony and clay, detrital quartz, glauconite, organic matter and pyrite; transition from rocks with small foraminifera to rocks with radiolarians (*Spumellaria*) and sponge spicules (chalcedony) in an isotropic brownish-blackish groundmass		Middle Mb., Sărata Fm. (K1), Marginal Folds Nappe	O. Mirăuță, E. Mirăuță 1964, p. 132-133; T. Joja 1959, p. 89; C. Olteanu 1952, p. 44; 1953, p. 15; Mirăuță 1962, p. 48
40	Doamna Valley basin (Gliguța and Jgheabul Mare creeks)					
41	Cârnu-Izvorul Muntelui-Straja area	siliceous rock (lydite/ spongolite) in 5-10 cm beds, hard and compact, black with tar-like lustre, conchoidal break	siliceous groundmass (chalcedony, 80%) with sponge spicules and radiolarians; the clay-carbonate mix (20%) appears as sporadic clusters in interstitial spaces, with calcite rhombohedral crystals in the groundmass and the sponge spicules		Audia Fm. (K1), Tarcău Nappe	I. Băncilă 1955, p. 1205; I. Băncilă, V.C. Papiu 1962a, p. 21
42	Ața, Izvorul, Secul, and Bulătăul creeks	spongolite			Audia Fm., Audia Nappe (K1)	J. Gherman, M. Solcanu 1969, p. 182
		siliceous glauconitic sandstones, hard, with conchoidal fracture				
-	Ceahlău Mt.	blocks and fragments of radiolarites			Ceahlău conglomerates (Albian), Ceahlău Nappe	M. Săndulescu 1990, p. 36
		Urgonian limestone blocks (found at the same level as the sandstone intercalations) with ellipsoidal silicified areas (30 cm long)				C. Grasu 1965, p. 74; M. Săndulescu 1990, p. 37
43	between the Bistra Mare and Bistra Mică basins (Piatra Sură Peak, Ceahlău Mt.)	polymictic conglomerates with elements of: limestones and metamorphic rocks; Callovian-Oxfordian dark coloured cherts (with radiolarians and sponge spicules); Callovian-Oxfordian silicified pelletal limestones (alternating laminae of silica and biomicrite, with sponge spicules and radiolarians); Kimmeridgian-Tithonian silicified limestones (with sponge spicules calcitized or with calcite rhombohedral crystals); Jurassic-Lower Cretaceous cherts (with calcitized radiolarians)				P. Șoigan, Gr. Alexandrescu 1976, p. 226-229; M. Săndulescu 1990, p. 36

Tab. 5. *Continued.*
Continuare.

No. in Pl. XV	Occurrence area	Siliceous rock type and petrographic traits		Geological context	References
44	the northern extremity of Hăghieș Mt.	greenish and reddish radiolarites intercalated in quarzitic sandstones	cryptocrystalline silica groundmass (sometimes with microcrystalline silica agglomerations) with disseminated chlorite; the reddish varieties contain haematitic pigment uniformly disseminated or as parallel areas; the radiolarians (*Liosphaera*, *Cenosphaera*, rarely *Heliodiscus*) are uniformly disseminated or concentrated in parallel stripes; rare uniseriate foraminifera (silicified); detrital quartz is found in various amounts up to arenaceous radiolarites	Radiolarite facies (Seisian, Triassic), Bucovinian Nappe	M. Săndulescu 1975, p. 47-48
45	West of Cupașu Mt.				
	near the springs of Suhardu creek				
46	on the norther slope of Păltiniș Mt. (South of Toșorog-Tulgheș road)	light green and yellowish radiolarites in quarzitic sandstones			
-	Bălai creek basin, on the right side tributaries (North of Toșorog-Tulgheș road)	radiolarites intercalated in massive dolostones		Radiolarite facies (Campilian-Anisian, Triassic), Bucovinian Nappe	M. Săndulescu 1975, p. 49-50
			silicified areas in dolostones composed of a microcrystalline dolomite groundmass with partially silicified radiolarians		
			carbonaceous radiolarites with untransformed areas of microcrystalline dolomite		
47	Eastern side of Criminiș Mt.	calcareous dolostones and silicified limestones with reddish and greenish radiolarites		Triassic klippe in the Wildflysch Fm. (Lower Cretaceous)	M. Săndulescu 1975, p. 55
-	Piatra Crăpată Peak	dolostones with radiolarites		Triassic klippe at the base of Hăghimaș Nappe	M. Săndulescu 1975, p. 52
-	Western bank of Lacu Roșu	circular and elliptic silicified areas (chaille) in blueish-grey sandy limestones		Aalenian-Bathonian, Bucovinian Nappe	M. Săndulescu 1975, p. 67
-	Bicaz Valley				
48	Chicera Mt.	reddish and greenish radiolarites in 4-7 cm beds (intercalated with reddish and greenish siliceous shales), compact, greasy lustre, conchoidal fracture (sometimes rectangular chunks)	cryptocrystalline silica groundmass pigmented with chlorite (or haematite for the reddish ferruginous ones), containing radiolarians (*Heliodiscus*, *Rhopalastrum*, *Hagiastrum*, *Cenosphaera*) and variable amounts of detrital material and calcite	Callovian-Oxfordian, Bucovinian Nappe	M. Săndulescu 1975, p. 68; I. Preda, M. Pelin 1963, p. 213-214
49	West of Lacu Roșu				
-	between Cheile Bicazului and Telecu Peak				
-	on the northern side of Muntele Fagului creek				

Tab. 5. *Continued.*
Continuare.

-	Fagului ridge	greyish and greenish cherts with abundant radiolarians (radiolarites) and a high content of chlorite		Lunca Beds (Tithonian-Valanginian), Bucovinian Nappe	M. Săndulescu 1975, p. 76-77
50	Western flank of the Hăghimaș syncline (Lapoș Valley, Ciofronca creek, North of Piatra Unică, Fagul Oltului creek)	reddish, greenish or blackish-grey radiolarites in 2-5 cm beds (with thin intercalations of radiolarian clays or greenish tuffites or cinerites	siliceous groundmass (chloritic pigment for the greenish jaspers, chloritic-haematitic for the reddish ones) with numerous radiolarians	Wildflysch Fm. (Lower Cretaceous), Bucovinian Nappe	M. Săndulescu 1975, p. 100-101, 103
-	Ghiciminișului Hill				
	Stânei Valley				
51	Stânei creek (tributary of Toșorog creek	siliceous rocks (reddish-brown to greenish, greyish or blackish jaspers) and reddish-brown argillite (as 30-60 cm thick beds) in agglomerates and diabase tuff (5 m thick)	the greenish-grey or blackish jaspers are composed of hydrothermal opal and a dark grey isotropic vitroclastic material (some contain rhombohedral dolomite); for the bicolored jasper, the reddish area is composed of 60-80% radiolarians and sponge spicules (fine-grained chalcedonic groundmass pigmented with haematite, low amount of detrital material), while the grey-greenish area is composed of cryptocrystalline silica pigmented with chlorite with vague radiolarian shapes; the two areas are sharply marked by a sinuous line of haematite concentration randomly cutting through the organisms	volcanoclastic complex, Lower Cretaceous (Wildflysch Fm.), Bucovinian Nappe	I. Băncilă, V.C. Papiu 1962b, p. 28-32
-	Valea Rece (Poiana Fagului ridge)	reddish and greenish silicified area intercalated in blackish detrital-pyroclastic schist	silica (chalcedony) groundmass pigmented with haematite (reddish areas) or chlorite (greenish areas), detrital material (quartz, muscovite, zircon), radiolarians (barely recognisable)	Sinaia Fm. (*Aptychus* Beds), Lower Cretaceous, Ceahlău Nappe	I. Băncilă, V.C. Papiu 1962b, p. 37-40
52	Ciobotani (unknown location)	waxy opal		Fâncel-Lăpușna volcaniclastic Fm., Neogene	V. Ghiurcă 1996, p. 20; 1999, p. 33; Gh. Lazarovici *et alii* 2011, p. 58; C.-M. Lazarovici *et alii* 2018, p. 28
53	Călimănel (unknown location)	opal			
54	Pârâul Baicăului (Toplița)	opal			
-	Toplița (unknown location)	jasper, opal, silicified wood			
-	Pârâul Sec (Toplița)	opal			
55	Cisc Valley (Gălăuțaș)	reddish and yellowish opal			
56	Sărmaș-Hodoșa (behind the train station)	amber-coloured opal			
-	Sărmaș	opal, silicified wood			

Tab. 5. *Continued.*
Continuare.

4.2. Lithic raw materials from Bistricioara-*Lutărie III*

The macroscopic analysis of the BL III raw materials established six groups of raw materials, here labelled under the glorified archaeological terminology (in brackets) for the sake of continuity with previous accounts (pl. V/8). The microfacies analysis carried on 25 thin sections (from three archaeological layers framed as Late Gravettian and Early Epigravettian) has discriminated 14 petrotypes, grouped in seven raw material categories (tab. 4).

4.2.1. Eocene chert

The samples of archaeological "menilite" show significant macroscopic variation, from simple greasy medium grey-brownish (BL III [729]) or dull beige (BL III [316], [404]) to laminated beige-brownish (BL III [463], [331]) or dark-medium grey (BL III [360], which is macroscopically similar to samples of variety 3 from Lespezi-*Lutărie*). This macroscopic variation is underlined by a petrographic diversity corresponding to several microfacies of the Eocene chert. One sample was matched to MF 1 defined in this study (pl. XIII/1). Two samples represent a microfacies compositionally similar to MF 1 or MF 2, but in which the predominant microfossils are planktonic foraminifera, henceforth described as MF 3 of the Eocene chert (pl. XIII/2). Three samples exhibit compositional lamination represented by alternating laminae of MF 1/MF 2/MF 3 and detrital quartz (pl. XIII/3-4), henceforth described as laminated Eocene chert, which is very similar to variety 3 from Lespezi-*Lutărie* (Al. Ciornei 2015, p. 50). This was dubbed "menilite" despite the acknowledged discrepancy with the geological descriptions of the Oligocene menilite, but also disregarding the petrographic similarities with the Eocene chert samples from the same study. In light of the current petrographic analysis, variety 3 from Lespezi-*Lutărie* should be considered as a laminated version of the Eocene chert. The Eocene chert outcrops (the Doamna limestone Fm.) are located at distances of 25-51 km NE to SE from BL III (tab. 6).

4.2.2. Audia detrital siliceous rocks

Two samples of "Audia black schist" (pl. XIII/5) were identified as Audia siliceous black mudstone, previously described in origin samples from Ceahlău-*Dârţu* as Audia "black schist" MF 1 (Al. Ciornei, I. Mariș 2020, p. 47, tab. 3). Sample Chl-Dâr [06] contains two areas, which show the transition from the carbonaceous (see the description in previous section) to siliceous mudstone. This is composed of a mixed siliceous and mud groundmass with radiolarians, sponge spicules, silty detrital quartz, rhombohedral siderite/ankerite crystals, and very fine-grained phyllosilicates. The siliceous mudstone (pl. XIII/5) is different from the carbonaceous one (pl. VII/7-8, VIII/3-4) in several ways: (1) it lacks the calcite pseudomorphs after the rhombohedral crystals of siderite/ankerite; (2) has a higher percentage of rhombohedral crystals of siderite/ankerite; (3) it does not contain planktonic foraminifera or they are extremely rare (hence they have a low visibility in thin sections); (4) it has a low amount of carbonate bioclasts. These observations indicate slightly different depositional conditions for the two types of mudstones, which might have spatially distinct occurrences within the sedimentary basin.

One sample (BL III [575]) is a laminated detrital-rich radiolarian chert with a cryptocrystalline silica and mud groundmass, radiolarians, sponge spicules, planktonic foraminifera, bioclasts, organic matter, opaque minerals, and rhombohedral siderite/ankerite crystals. This material also contains a small area where the primary constituents suffered a calcitization process, giving it a carbonaceous composition. This petrotype, henceforth

described as Audia laminated radiolarian chert (pl. XIII/6), is similar with the more carbonaceous one from Izvorul Muntelui creek (IzMu [02.3], pl. VIII/5-6), both of which have a broad resemblance (but a mineralogical mismatch) with the upper half of sample Au [00-7J-F] (pl. VII/5-6). In comparison, sample Le-Lu [08], variety 2c from Lespezi-*Lutărie* (Al. Ciornei 2015, p. 50; Al. Ciornei, I. Mariș 2020, p. 47, tab. 3), is a laminated radiolarian carbonaceous mudstone with radiolarians, sponge spicules, planktonic foraminifera, bioclasts, and abundant rhombohedral siderite/ankerite crystals held together by a siliceous groundmass. This sample is partially similar to BL III [575], but is more carbonaceous overall and has a lower content of radiolarians.

Two of the three samples macroscopically designated as siliceous sandstones were identified as detrital-rich spiculite chert (pl. XIII/7), a petrotype which corresponds to variety 1a (Le-Lu [01]) from Lespezi-*Lutărie* (Al. Ciornei 2015, p. 49). The detrital-rich spiculite chert has a similar particle content and packing to the detrital-rich spiculite from Audia Fm., the difference being represented by the cryptocrystalline silica cement (instead of the cryptocrystalline calcite) encompassing the particles. The particles (sponge spicules, radiolarians, subangular-subrounded quartz, glauconite peloids) are moderately sorted fine-medium sand. Hence its macroscopic appearance similar to a siliceous sandstone. The other sample was identified as a laminated siliceous glauconitic sublithic arenite (pl. XIII/8), and has a similar composition to sample Au [00-7J-A.2], but with a cryptocrystalline silica groundmass. Towards one of the thin section's margins, there is a small area of detrital-rich spiculite chert. The sample shows substantial evidence of calcitization (pseudomorphs after rhombohedral siderite/ankerite crystals).

The detrital-rich spiculite chert and the laminated siliceous glauconitic sublithic arenite, considered together with the laminated radiolarian chert and the siliceous mudstone, suggest the same fining-upward depositional sequence as the samples from Au 00 (layer 7, see above), but they are siliceous and less affected by calcitization.

The sampling locations from Hangu and Țiganului valleys are located at 7 km E, and 8 km NE respectively from BL III (tab. 6), but these materials might also be found in the gravels from Țiganului, Poiana Largului, Hangu, and Bistriţa valleys. The mismatch between the archaeological and geological samples of Audia detrital siliceous rocks and the resemblance between the laminated radiolarian chert samples from Izvorul Muntelui and BL III opens the possibility to consider the outcrops from Izvorul Muntelui-Cârnu-Straja (at 16-22 km SSE) and Piatra Neamț (30-33 km ESE) areas as potential sources for the archaeological materials (tab. 6).

4.2.3. Topliţa chert

The analysed "opal" samples have whitish-rusty to dark grey alteration surface (sometimes with a laminated appearance) which impedes other macroscopic observations. In thin sections, the "opal" samples exhibit similar petrographic traits to the Topliţa non-fossiliferous chert described in this study: three samples have breccia fabrics, one of which contains a fragment of silicified wood (pl. XIV/1); one sample has a flow banding fabric (pl. XIV/2). Variety 5b (Le-Lu [16]) from Lespezi-*Lutărie* was previously described as a blackish translucent cementstone chert and, despite its lack of clearly identifiable microfossils, included in the "Prut flint" type (Al. Ciornei 2015, p. 51). Reanalysed, sample Le-Lu [16] can be reclassified as a non-fossiliferous Topliţa chert, further confirmed by another two samples recently made and analysed (Le-Lu [32], [33]). The geological occurrences of siliceous rocks from Topliţa area are located at a distance of 44-47 km WSW from BL III (tab. 6).

4.2.4. "Radiolarites"

Three samples were macroscopically recognized under this heading. The first one (BL III [366]) is a bicoloured detrital-rich radiolarite with two areas petrographically different: the reddish area is composed of an amorphous iron oxide-hydroxide and cryptocrystalline silica groundmass enclosing radiolarians (55%), sponge spicules, planktonic foraminifera, detrital quartz clasts, phyllosilicates, siliceous-argillaceous and radiolarian chert lithoclasts; the grey-greenish area is composed of radiolarians (55%), sponge spicules, planktonic foraminifera, detrital quartz clasts, and phyllosilicates, fixed in a microcrystalline silica and fine chlorite groundmass (pl. XIV/3). The second sample (BL III [590]) is composed of a microcrystalline silica and fine chlorite groundmass with rare radiolarians, detrital quartz clasts, phyllosilicates, and syntaxial overgrowth calcite cement on rhombohedral crystals and carbonate bioclasts (pl. XIV/4). These samples show a petrographic composition similar to the Hăghimaș syncline radiolarites (tab. 5/39-46, pl. XV). The radiolarians (*Liosphaera*, *Cenosphaera*), the notable amounts of detrital quartz and phyllosilicates, and the syntaxial overgrowth calcite cement indicate a broad likeness to the Triassic radiolarites and radiolarian cherts from Hăghimaș syncline. The outcrops of Mesozoic radiolarites are found at distances ranging between 21 km SW (Bălai) and 32 km SSW (Lacu Roșu-Valea Rece), and as close as 8-11 km S from BL III (Ceahlău Mt., in Ceahlău conglomerates; tab. 6).

Another sample (BL III [666]) matches the Sita Buzăului radiolarian chert petrotype previously described in origin samples from Sita Buzăului area (Al. Ciornei, I. Mariș 2020, p. 45). This is composed of a cryptocrystalline quartz groundmass with dispersed larger rhombohedral and very small anhedral to euhedral dolomite crystals, radiolarians, sponge spicules and carbonate bioclasts. It also contains the specific involutinid foraminifera (in the centre of pl. XIV/5). Such involutinid foraminifera are also present in the Ceahlău chert. Unlike the Bălai radiolarian cherts/radiolarites and the Ceahlău chert, the Sita Buzăului radiolarian chert contains almost no detrital quartz and shows no signs of dedolomitization. This is a true long-distance raw material, as the origin sites from Sita Buzăului lie 155 km to the S from BL III (tab. 6).

4.2.5. "Prut-Dniester flint"

Most of the "Prut-Dniester flint" samples have whitish, whitish-bluish or greyish-bluish alteration surfaces (highly specific for this raw material), with small areas (rarely one entire surface) that maintain their true colour (such as sample BL III [389], very translucent dark grey-blackish). Out of the five analysed thin sections of "Prut-Dniester flint", two were recognised as Prut-Dniester spiculite flint, and three as Dniester Globotruncanidae flint. The Prut-Dniester spiculite flint is composed of a crypto- to microcrystalline quartz groundmass with fragmented sponge spicules (microcrystalline quartz, chalcedony) and silicified fragments of echinoderms, but also planktonic and benthic foraminifera (pl. XIV/6). This is described from Ripiceni-*La Izvor* origin samples (mostly grey-light brownish, translucent, with spotty carbonate remains), derived from the Cenomanian deposits in the Prut-Dniester interfluve (Al. Ciornei, I. Mariș 2020, p. 47). This is the same as variety 5cd (Le-Lu [19]) from Lespezi-*Lutărie* (Al. Ciornei 2015, p. 51, pl. 14/4-6). The Dniester Globotruncanidae flint is composed of a cryptocrystalline quartz groundmass with silicified bioclasts (echinoderms, algae, bivalves, ostracods, sponge spicules). The characteristic note is given by the presence of planktonic foraminifera (from which the *Globotruncana* stands out) and Phitonella (Pl. XIV/7-8). This is described only from Oselivka-*Chisla Nedjimova* origin samples, and probably derived from chalks similar to those near Dubivtsi village, Western Ukraine

(Al. Ciornei, I. Mariș 2020, p. 47, and references therein). This is the same as variety 5bc (Le-Lu [19]) from Lespezi-*Lutărie* (Al. Ciornei 2015, p. 51, pl. 13/1-3). Both petrotypes are very well silicified and have a particular trait in thin sections (seen in PPL), namely the siliceous groundmass it is very clean (low amount of residuals, micrite, opaque minerals, and amorphous iron oxide-hydroxides), hence in hand specimens it is very translucent (even in thicker flakes). The origin sites from the Prut-Dniester interfluve are located at 135-162 km NE from BL III (tab. 6).

Raw material	**Location**	**Distance* to**	**Direction**	**Distance**
Eocene chert	Neamț-Doamna-Nechit valleys	Sec 01	NE	27 km
		Cracău	ENE	25 km
		E of Doamna	ESE	33 km
		Nec 03b	SE	51 km
Audia detrital siliceous rocks	Hangu Valley	Au 00	E	7 km
	Țiganului Valley	Tig 01	NNE	9 km
	Izvorul Muntelui	IzMu 02	SSE	16 km
	Cârnu-Straja	NW of Straja	SE	22 km
	Cuejdiu-Horăița valleys	Cuejdiu	ESE	30 km
	Doamna Valley basin	E of Doamna	ESE	33 km
Ceahlău cherts	Ceahlău Mountain	Chl 08	S	7 km
		Chl 14	S	10 km
		Chl 19	SSW	15 km
		IzMu 01b	SE	16 km
Hăghimaș syncline cherts	Ceahlău Mountain	Chl 10	S	8 km
		Chl 23b	S	11 km
	Bălai-Pintec	Bal 03, 04	SW	21 km
	Lacu Roșu-Valea Rece	Lacu Roșu	SSW	32 km
Toplița chert	Toplița area	Toplița-*Pârâul Baicăului*	WSW	47 km
		Hodoșa	WSW	44 km
Sita Buzăului chert	Upper Buzău Valley	Sita Buzăului	S	155 km
"Prut-Dniester flint"	Prut Valley	Ripiceni	NE	135 km
	Dniester Valley	Oselivka	NNE	162 km

* The distance is calculated in a straight line from BL III to a locality (town, village), origin site or a GPS point.

Tab. 6. Distances between Bistricioara-*Lutărie III* and possible supply sources.
Distanțe între Bistricioara-*Lutărie III* și surse posibile de aprovizionare.

◈ 5. Discussion

5.1. Bistricioara-*Lutărie III*: possible supply sources

In this study, seven categories of knappable siliceous rocks (each of them with several petrotypes) were characterized from geological and origin samples in the extended study area. Their petrographic characteristics suggest a diversity of geological settings and ages (tab. 3, pl. XV). Seven raw material categories were differentiated for BL III (tab. 4, pl. XV), four of them matched to geological occurrences in the extended study area, and three to origin samples from the Prut-Dniester and Sita Buzăului areas.

The petrographic description of the Eocene chert relies on the samples collected from the gravels of Nechit Valley, which confirm the characteristics outlined in thin sections from Lespezi-*Lutărie*. The samples from BL III fit well in this description and augment its compositional variability. This petrographic variability might be linked to sedimentary and

diagenetic traits specific for physiographically distinct outcrops of this material and/or to vertical variations within such outcrops. All the samples from BL III recognised macroscopically as archaeological "menilite" proved to be Eocene chert. The importance of this outcome resides in the slightly distinct geological occurrences for the Eocene chert and menilite, but especially in their suitability for knapping. The Doamna limestones are restricted to the exterior of the Eastern Carpathians Flysch (the Doamna Lithofacies of the Tarcău and Marginal Folds nappes), while the menilite can also be found more to the interior (such as Tarcău Valley, S of Schitu Tarcău). More so, its mode of occurrence, i.e. as thin beds and lenses (frequently 1-4 cm thick, rarely 7 or 10 cm thick), coupled with its splintery break (resulting in uneven chunks) make the menilite mostly unsuitable for knapping. On the other hand, the Eocene chert occurs as 5/10 to 30 cm thick lens-like nodules and beds and breaks conchoidally.

None of the BL III samples matches the description of the Audia glauconitic sandstones (Upper Mb. of Audia Fm.). The Cârnu-Șiclău radiolarian chert from Țiganului Valley has unique petrographic traits and bears no resemblance to any of the other radiolarian-dominated samples from this study. This does not mean that these raw materials are absent from the BL III assemblages, but either were missed during sampling or the batch macroscopically analysed did not contained any.

The Audia detrital siliceous rocks described in this study represent a fining-upward depositional sequence repeating itself within multiple black mudstone beds in the Middle Mb. of Audia Fm. The geological samples show ample evidence of diagenetic calcite replacing the silica and other mineral phases, which is the opposite of the BL III samples. The difference between the carbonaceous and the siliceous mudstone may suggest a provenience from physiographically and/or stratigraphically distinct occurrences. Altogether, the facts presented above (sections 4.1.2 and 4.2.2) can be interpreted in at least two ways: as evidence of sampling misfortune and lateral variation within the sampled beds (also locally and diversely affected by the diagenetic precipitation of calcite); or as evidence that the black mudstone beds sampled on Hangu Valley (GPS point Au 00) do not represent the actual geological source for the archaeological materials, most probably derived from a similar fining-upward sequence found somewhere else in the Audia Fm. or its chronostratigraphic equivalent from the Marginal Folds Nappe.

Given the mismatch between the archaeological samples and those from Hangu, the above-mentioned outcrops (sections 4.1.2 and 4.2.2) widen the initially presumed source area eastwards up to Piatra Neamț. The outcropping areas of the Audia and Sărata formations generate a more extensive possible supply area and, more importantly, describe different transport directions and distances than initially presumed.

Although none of the samples from BL III was identified as Ceahlău cherts and silicified limestone, their abundance and occurrence area confirm the existence of a raw material source on Ceahlău Mt. (i.e., not "Polița Cremenișului" per se, as put forward by previous research, but the whole area covered by the Ceahlău conglomerates with the Urgonian limestones). The Ceahlău cherts and silicified limestone, either considering their widespread abundance in the Ceahlău conglomerates, or their existence, yet to be proved, in the gravels of the creeks descending towards Bistrița valley, were one of the few true local raw materials available to the UP hunter-gatherers from Ceahlău Basin. Some archaeologists working here have identified this material (by word-of-mouth) as "menilite" (i.e., the Eocene chert), to which it shows a certain degree of macroscopic resemblance (colour, lamination). Thus, confirming its presence in the UP assemblages from Ceahlău Basin is just a matter of time.

The presence of Mesozoic radiolarites in the BL III lithic assemblage is undoubtable and confirms prior archaeological suppositions. The petrographic overlap recognized for the Triassic and the Jurassic radiolarites can be bypassed by carefully identifying and differentiating between the specific radiolarian genus associations (M. Săndulescu 1975, p. 68). Even so, the extension of the possible supply area is considerably larger than previously thought. Since there are Hăghimaș syncline cherts present in the Ceahlău conglomerates (and hence in the creeks descending towards Bistrița valley?), tracing the exact provenience of such materials found in the UP assemblages becomes more difficult. The radiolarite and radiolarian chert from BL III are most probably derived from the Triassic deposits of the Hăghimaș syncline, but pinpointing the area from which they were sourced requires more work, not only in terms of occurrences, but also in terms of their abundance and availability.

Four samples from BL III were identified as Toplița chert, thus confirming C.S. Nicolăescu-Plopşor's view on the origin of the "opal" used at the UP sites from Ceahlău Basin. The possible provenience from Toplița area for the "opal" recognised in the BL III lithic assemblage also relies on the physiographic proximity and a few connecting facts that indicate a mutual raw material transfer between the two areas. On one hand, there is a significant and very little-known concentration of Late Upper Palaeolithic (Epigravettian) sites (Hodoșa-*Dealul Hodoșa*, Gălăuțaș-*Dealul Cisc*, Toplița-*Pârâul Baicăului*; Al. Păunescu 2001, p. 395-396; Gh. Lazarovici *et alii* 2011, p. 58; M. Anghelinu *et alii* 2012, p. 272) exploiting the local sources of "opal" from Toplița area (pl. XV/6). On the other hand, two raw materials frequently found in the Ceahlău Basin are present in some of these sites: a retouched blade on "Audia black schist" at Toplița-*Pârâul Baicăului* (M. Anghelinu *et alii* 2013, p. 187); a burin on Prut-Dniester flint (with greyish-dark bluish patina) at Hodoșa-*Dealul Hodoșa*[4].

The presence of the Sita Buzăului radiolarian chert at BL III is no surprise as this raw material was hitherto confirmed in several UP assemblages from Ceahlău Basin (Al. Ciornei, I. Mariș 2020, p. 49, tab. 4). The broad spectrum of siliceous rocks found in the Eastern Carpathians (sampled from a limited number of field surveys and analysed in this study alone, not counting the various mentions in the geological literature), some of which bear petrographic resemblance with the material here called Sita Buzăului chert (see above, section 4.2.4), warrants a prudent approach and closer sources should not be yet excluded.

The Prut-Dniester spiculite flint and the Dniester Globotruncanidae flint recognised in the lithic assemblage from BL III reiterates an already confirmed presence in other UP sites from Ceahlău Basin (Al. Ciornei, I. Mariș 2020, tab. 4) and from further downstream (Lespezi-*Lutărie*). The "Prut flint" is one of the initial "exotic" raw materials recognised in the Ceahlău Basin UP assemblages, which facilitated a straightforward connection with the UP sites from the Middle Prut Valley. The presence of two materials (one of which has several petrotypes) derived from different geological deposits seems to provide a more down-to-earth explanation for the geochemical mismatch (L. Moreau *et alii* 2019, p. 530) between the "Prut flint" samples from BL III and the black and grey flint from the Cenomanian chalky limestone in the Middle Prut Valley (Cotul Mic and Cotu Miculinți). The Dniester Globotruncanidae flint makes the connect with the UP sites from the Middle Dniester Valley and casts a new light on the technological and typological similarities recognised by some archaeologists (Al. Păunescu 1999, p. 43; M. Bitiri-Ciortescu *et alii* 1989, p. 21; M. Bitiri 1981, p. 337-338).

[4] Based on the macroscopic analysis of 36 lithics curated at "Vasile Pârvan" Institute of Archaeology.

5.2. Bistricioara-*Lutărie III*: transport distances and directions

Four raw material categories (Audia detrital siliceous rocks, Eocene chert, Hăghimaș syncline cherts, and Toplița chert) were supplied from sources found within a radius of 50 km from BL III. This distance is generally considered as a threshold between local and non-local raw materials in the reconstruction of the UP procurement territories (L. Kaminska *et alii* 2000, p. 66; J. Féblot-Augustins 2009, p. 38). The long-distance raw materials were supplied from sources situated at 155 km S (Sita Buzăului chert) and >130 km NE (Prut-Dniester spiculite flint, Dniester Globotruncanidae flint), in line with transfer distances often described from Gravettian and Epigravettian sites (J. Féblot-Augustins 2009, tab. 3.2 to 3.4).

Nevertheless, we stress out that BL III (and the other UP sites from Ceahlău Basin) should not be blindly bent to this line of thinking. The distinction between local and non-local sources has to be refined using shorter transport distances combined with other criteria, such as the physiographic characteristics of the landscape. In this particular case, the mountainous landscape with periglacial conditions should not be underestimated as a factor influencing the transport distances: short straight-line distances, such as 10-20 km, are not short at all.

The transfer directions for the raw materials found within the 50 km radius point to almost all cardinal directions. The long-distance raw materials represent two opposite transfer directions: one from NE/NNE, and the other from S. These transport directions might reflect multiple pathways and arrivals from different directions towards Ceahlău Basin.

In a diachronic perspective (tab. 7), the cultural layers outline a major change in raw material use, from predominantly NE distant provisioning and minor local input (Late Gravettian) to less consistent, but more nuanced NE and S distant provisioning and major local input (Epigravettian). Contrasting to the Late Gravettian layer (with an assemblage made on „Prut-Dniester flint"), the Epigravettian assemblages exhibit a melange of raw materials with variable quantities throughout time.

Raw material*		menilite, black schist, sandstone		"radiolarite/…" + opal		Others		Undetermi-ned		Long-distance raw materials	
AH 2.5	Lithics	60	2.17%	11	0.50%	44	1.98%	43	1.94%	2059	92.87%
(Late Gravettian)	Tools	0	0.00%	2	1.15%	0	0.00%	0	0.00%	172	98.85%
AH 2.3	Lithics	860	61.34%	164	11.70%	4	0.29%	24	1.71%	350	24.96%
(Early Epigravettian)	Tools	52	61.90%	8	9.52%	0	0.00%	0	0.00%	24	28.57%
AH 2.2	Lithics	3059	51.83%	1707	28.92%	70	1.19%	858	14.54%	208	3.52%
(Early Epigravettian)	Tools	130	54.85%	70	29.54%	0	0.00%	25	10.55%	12	5.06%
AH 2.1	Lithics	1189	42.43%	355	12.67%	41	1.46%	49	1.75%	1168	41.68%
(Late Epigravettian)	Tools	7	16.67%	18	42.86%	0	0.00%	0	0.00%	17	40.48%
AH 1.1	Lithics	948	48.17%	311	15.80%	14	0.71%	45	2.29%	650	33.03%
(Late Epigravettian)	Tools	32	50.00%	7	10.94%	0	0.00%	1	1.56%	24	37.50%

*Table compiled with data from M. Anghelinu *et alii* 2021a, p. 218-224.

Tab. 7. Raw material quantities from Bistricioara-*Lutărie III*.
Cantitățile de materii prime de la Bistricioara-*Lutărie III*.

However, an informed discussion on any synchronic/diachronic raw materials exploitation, acquisition patterns, procurement territories, and scale of mobility cannot be discussed based on the preliminary results obtained in this study. This high-range objective needs a more comprehensive petrographic analysis (artefact-by-artefact raw material identification) and a detailed techno-economic analysis of the BL III lithic assemblages (for an example and references therein, see A. Ciornei *et alii* 2021).

◈ 6. Conclusions

In line with some other recent contributions, the present study attempted at setting the characterization of the lithic raw materials used during the UP in Ceahlău Basin on a solid petrographic basis, corroborated by direct field identification of actual geological occurrences. The petrographic diversity and inner variability of the lithic raw materials exceeds by far the rough categories used in the archaeological literature. Moreover, one of the common such categories, the "menilite" from BL III proved to be in fact Eocene chert derived from the Doamna limestones. Although this requires confirmation through a more comprehensive examination of the lithic collections, it is an important discovery that might be replicated in other (all?) UP sites from the Middle and Lower Bistriţa Valley.

The current analysis has fallen short from decisively settling the provenience problem of the Eastern Carpathians Flysch raw materials or the Hăghimaș syncline radiolarites/jaspers (Tulgheș-Lacu Roșu area). Both the geological occurrence of these rocks and their actual knapping potential has to be verified in the upcoming field research.

We have provided a thicker description and discussion for the siliceous rocks derived from the Audia Fm. because their provenience has been taken for granted for a long time now, despite the paucity of petrographic (or geochemical) analyses comparing the archaeological materials with samples from geological occurrences. As those before us, we assumed the same provenience and went to the outcrops exposed on Hangu Valley to collect samples and make a formal confirmation. However, the results need to be clarified by further research.

This study has also brought to attention, for the first time, the presence of Toplița chert in the Early Epigravettian assemblages at BL III, confirming the long held archaeological suppositions regarding the use of "opals" in various UP assemblages in the area. In this study, the Toplița chert is described based on samples from an origin site, not a geological source. The Sita Buzăului chert, the Prut-Dniester spiculite flint, and the Dniester Globotruncanidae flint are in the same situation as the Toplița chert. Thus, forthcoming research needs to identify and fully characterize their petrographic nature and geological contexts. This is especially important as these raw materials widen the procurement territories in three distinct directions, each with different implications for the past mobility patterns.

Although somehow outbalanced between petrographic description and archaeological inferences and deliberately careful in terms of conclusions, this petroarchaeological analysis ultimately serves the archaeologically driven goals, such as the lithic raw material economy, procurement territories, scale of mobility, cultural contacts, and so forth. An accurate petrographic description of the raw materials and a better understanding of the transport directions and procurement territories, by identifying the outcrops of the above-mentioned siliceous rocks that supplied the archaeological materials, can provide a window into the mobility scale of the UP foragers from the Bistriţa Valley.

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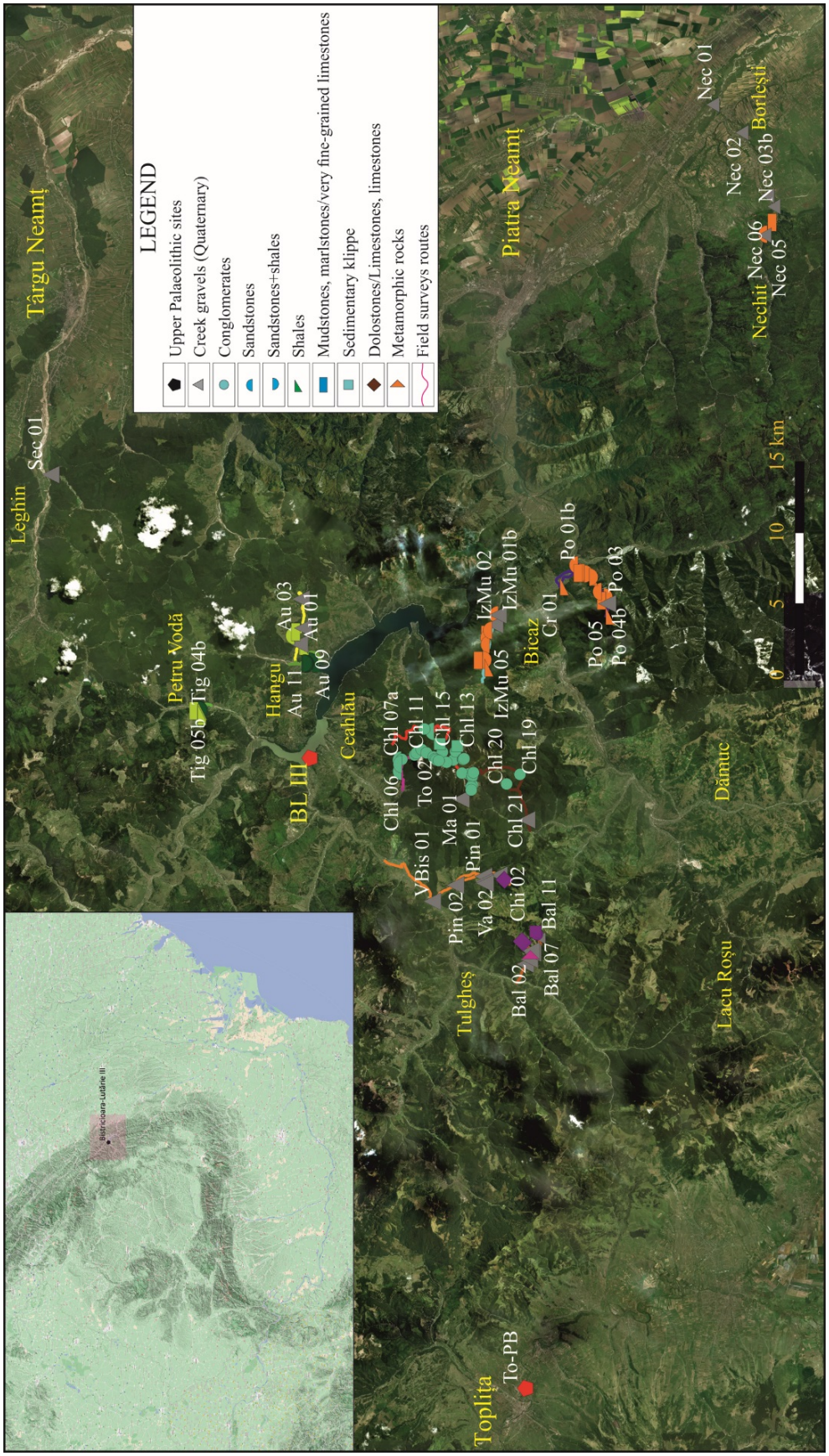
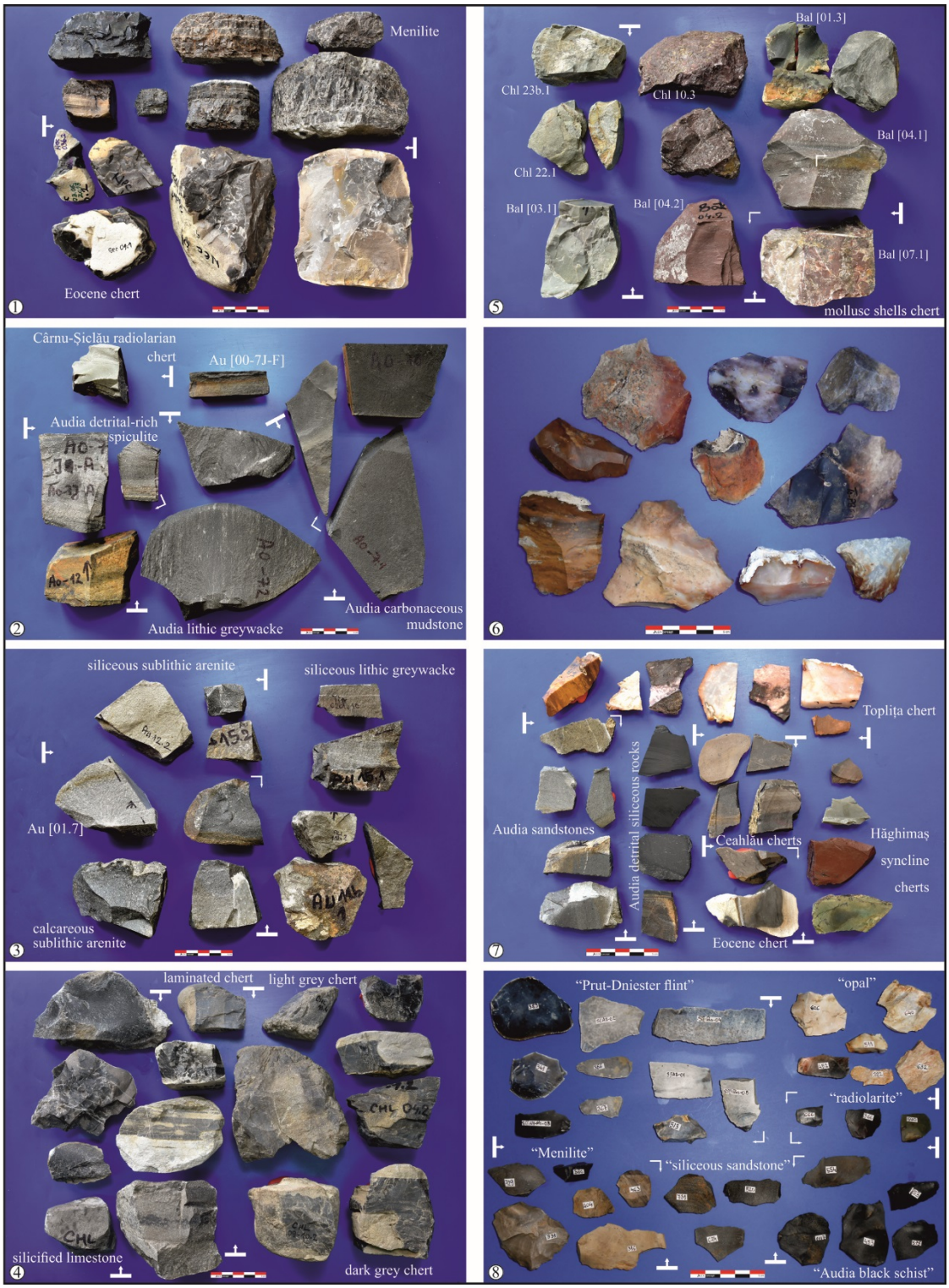


Pl. I. Map of the sampling locations (Annexes 1-7) in the extended study area (To-PB - Toplița-*Pârâul Baicăului*; BL III - Bistricioara-*Lutărie III*; map created in QGIS, projection is latitude-longitude WGS-84).
Hartă a locațiilor de eșantionare din zona extinsă de studiu.

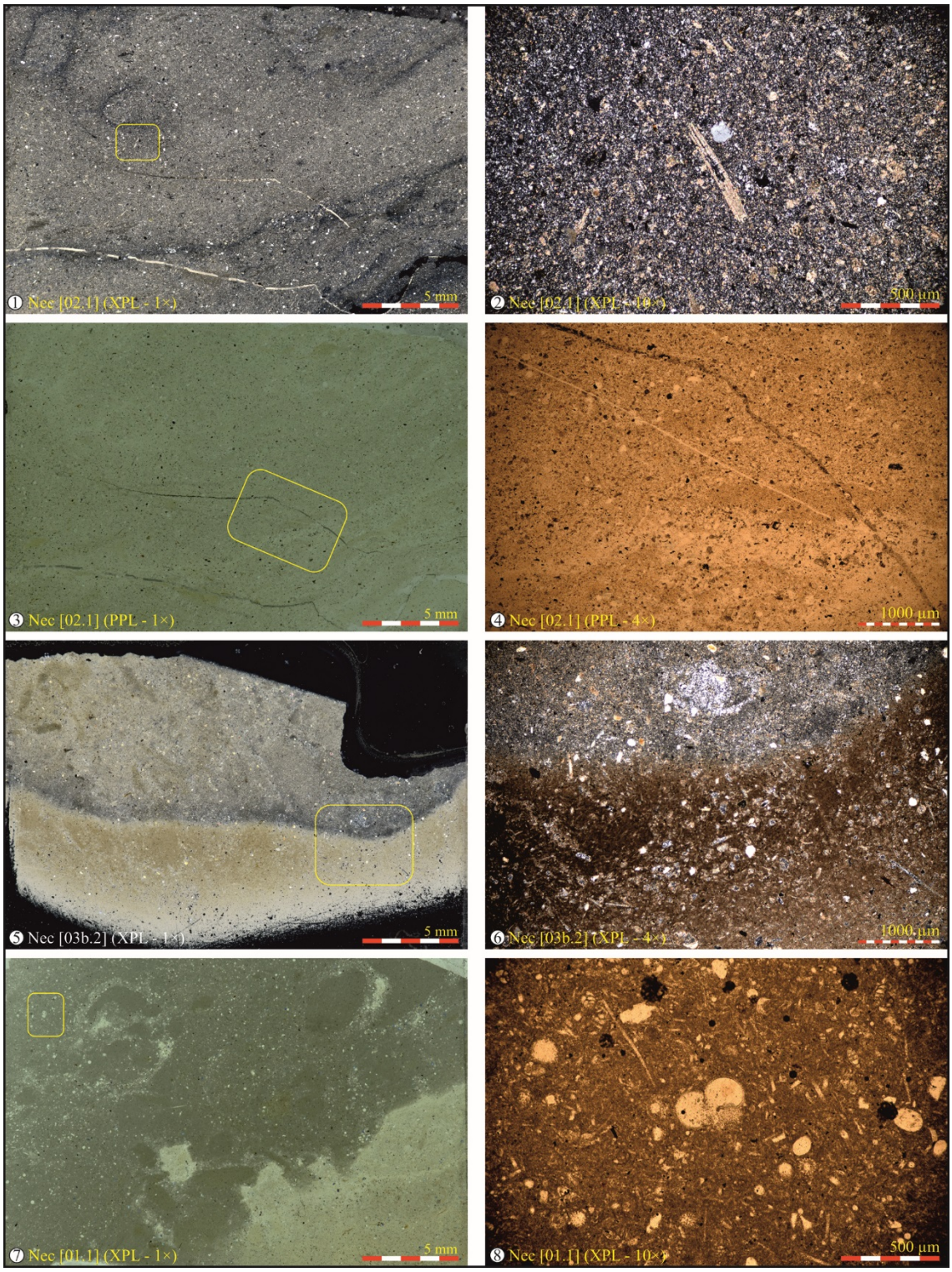
Pl. II. Outcrop of Audia Formation (Middle Member, Audia Nappe) on Hangu creek (GPS point Au 00, Hangu village, Neamț County): 1. General view of the outcrop with black and grey shales alternating with blackish and greyish mudstones and limestones (10-40 cm thick), and greyish micaceous/calcareous sandstones (in layers of 10-20 cm thick); 2-3. Detail of the blackish mudstone with the position of samples Au [00-7J] and the thin sections (11) continuously prepared (perpendicularly to the bedding plane) from the top (left side) to the bottom (right side) of the layer; 4. Detail of layer 13 (laminated detrital-rich spiculite and blackish lithic greywacke); 5. Detail of layer 10 (black mudstone); layers 1-11 were sampled in 2018, while layers 12 and 13 were sampled in 2019 (right above layer 10); hammer is 32 cm long (photographs by Al. Ciornei 2018-2019).
Afloriment al Formațiunii de Audia (Membrul Mijlociu, Pânza de Audia) pe pârâul Hangu.

Pl. III. Outcrops of Audia (1-4) and Cârnu-Șiclău formations (5-6): 1-2. General view and details of massive sandstones with greyish shale intercalations in an outcrop on the left bank of Hangu creek (GPS location Au 15, Hangu village, Neamț County, Upper Member of Audia Formation, Audia Nappe); 3-4. General view and detail of massive sandstone layers with blackish or greyish shale intercalations in an outcrop along the right bank of Țiganului creek (GPS point Tig 02, Petru Vodă village, Neamț County, Upper Member of Audia Formation, Tarcău Nappe); 5-6. General view and detail of variegated shales with radiolarian cherts in an outcrop on the left side of Țiganului valley (GPS point Țig 03, Petru Vodă village, Neamț County, Cârnu-Șiclău Formation, Tarcău Nappe); hammer is 32 cm long (photographs by Al. Ciornei 2019).
Aflorimente ale formațiunilor de Audia și Cârnu-Șiclău.

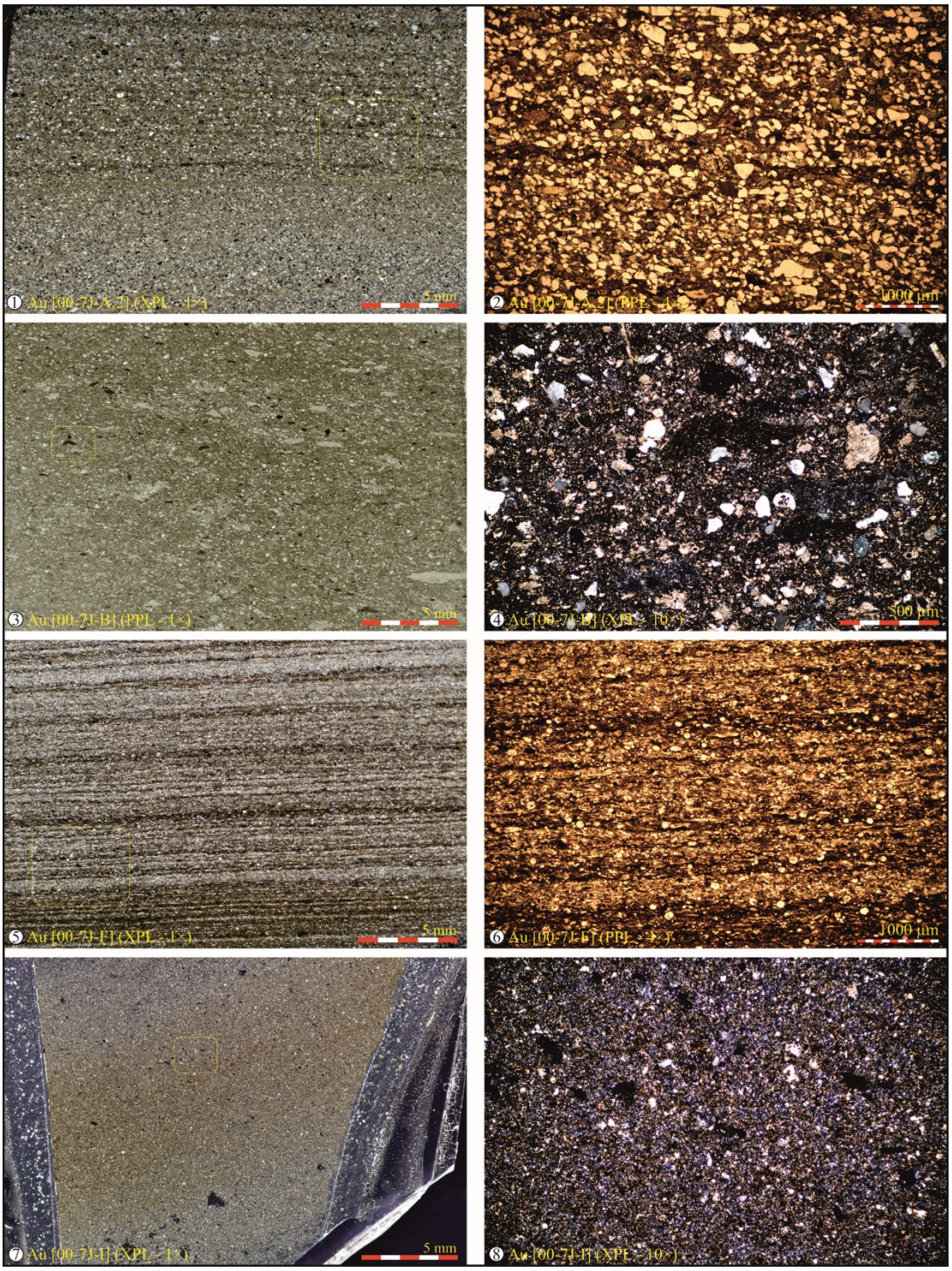
Pl. IV. Chert and silicified limestone in the Ceahlău conglomerates (1-8), Urgonian limestones (9, Piatra cu Apă), and creek gravels (10, Martin creek) on Ceahlău Mountain (Ceahlău Nappe); hammer is 32 cm long (photographs by Al. Ciornei 2019, 2021).
Silicolit și calcar silicifiat în Conglomeratele de Ceahlău, în calcarele urgoniene și în piterișurile pâraielor de pe muntele Ceahlău.



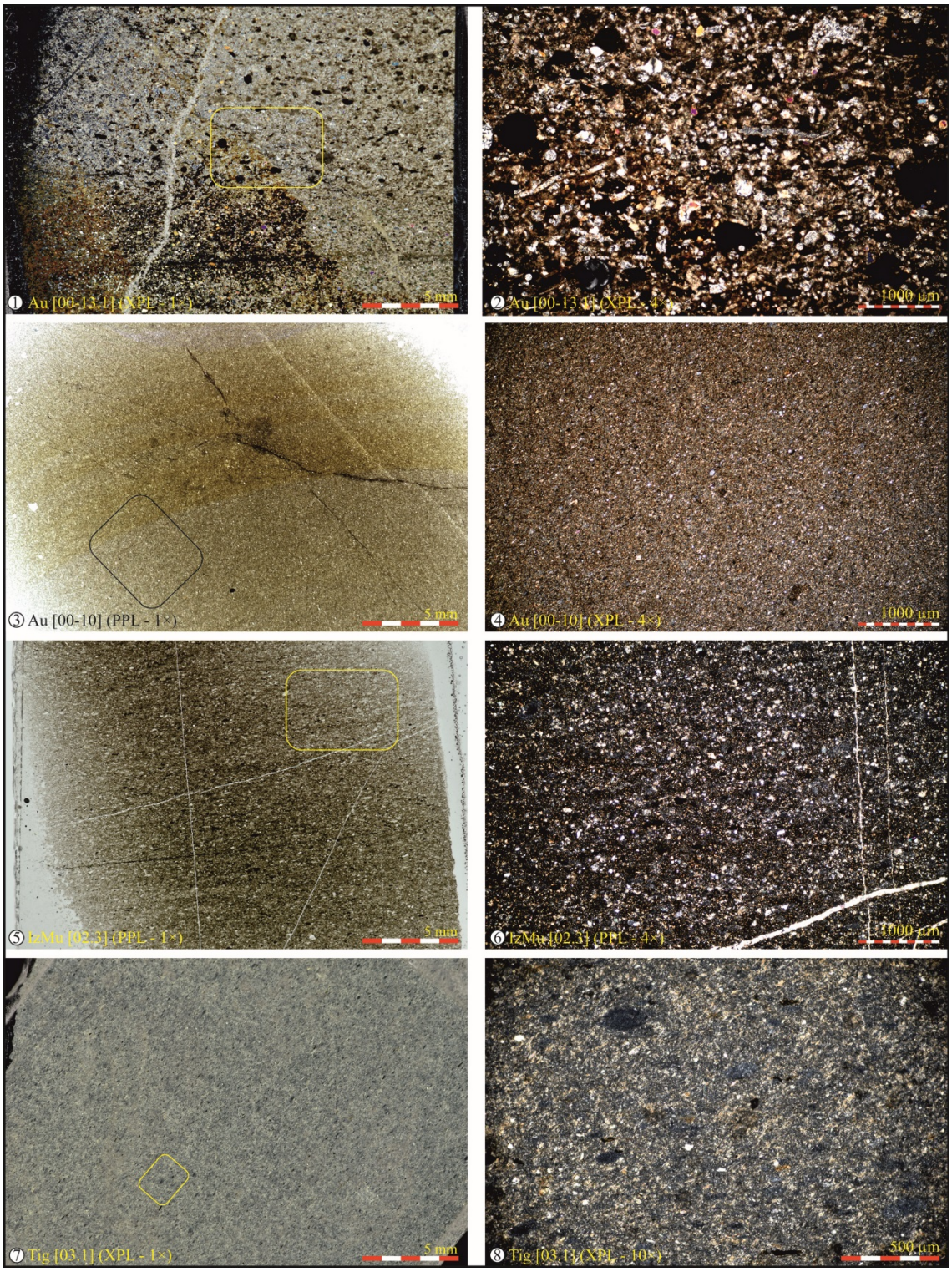
Pl. V. Rock categories from geological deposits (1-5), origin sites (6), and Bistricioara-*Lutărie III* (8): 1. Eocene chert and Menilite; 2. Audia detrital siliceous rocks and Cârnu-Șiclău radiolarian chert; 3. Sandstones; 4. Ceahlău cherts and silicified limestone; 5. Hăghimaș syncline cherts; 6. Topliţa chert; 7. Rock slices (from the preparation of thin sections) showing the main rock categories; 8. Raw material categories from Bistricioara-*Lutărie III*; all scales are 5 cm (photographs by Al. Ciornei 2019-2021).
Categorii de roci din depozite geologice, situri de origine și de la Bistricioara-*Lutărie III*.



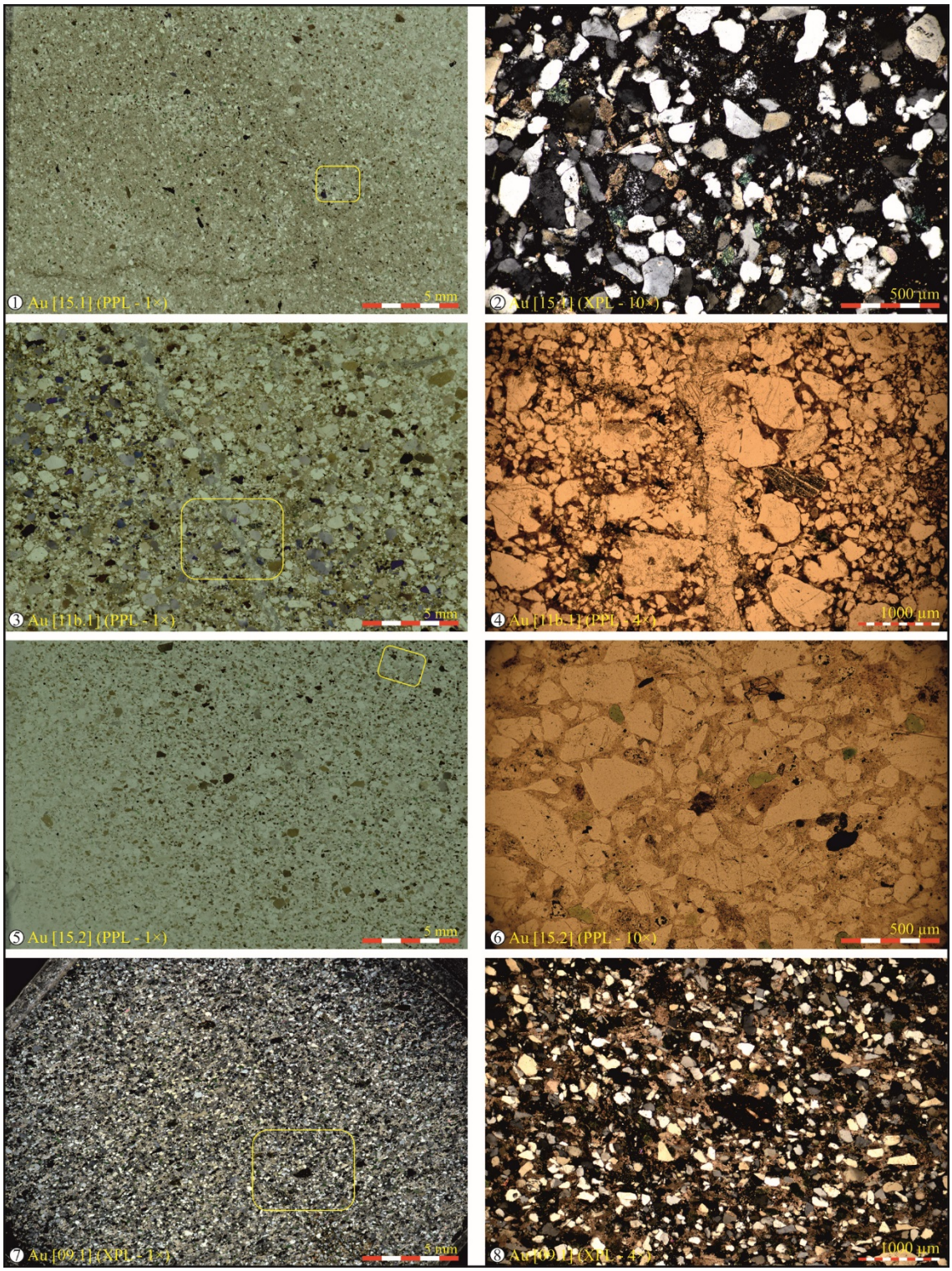
Pl. VI. Photomicrographs of cherts from Nechit Valley (Neamț County): 1-4. Eocene chert (MF 1), detrital-rich bioclastic wackestone (with echinoderms, algae, sponge spicules, radiolarians, planktonic foraminifera); 5-8. Eocene chert (MF 2), detrital-rich bioclastic wackestone (sponge spicules, radiolarians, planktonic foraminifera); PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii de silicolite de pe valea Nechit (jud. Neamț).



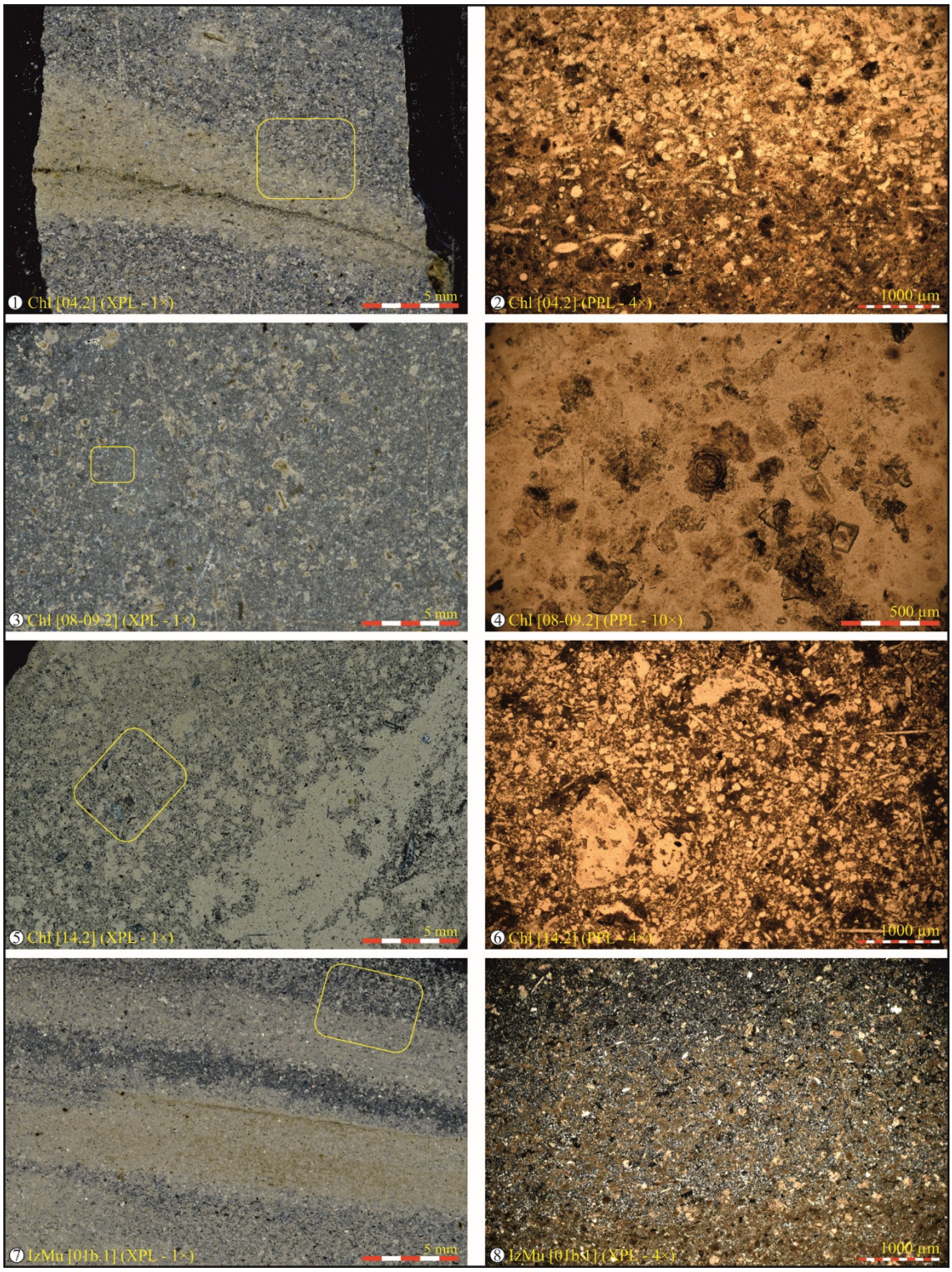
Pl. VII. Photomicrographs of samples from the fining up-ward depositional sequence in the Middle Mb. of Audia Fm. (Audia Nappe, GPS point Au 00, layer 7, Hangu village, Neamț County): 1-2. Laminated calcareous glauconitic sublithic arenite; 3-4. Glauconitic lithic greywacke; 5-6. Laminated detrital-rich spiculite packstone/radiolarian wackestone; 7-8. Carbonaceous mudstone; PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii de probe din secvența depozițională fining up-ward din Membrul Mijlociu al Fm. de Audia.



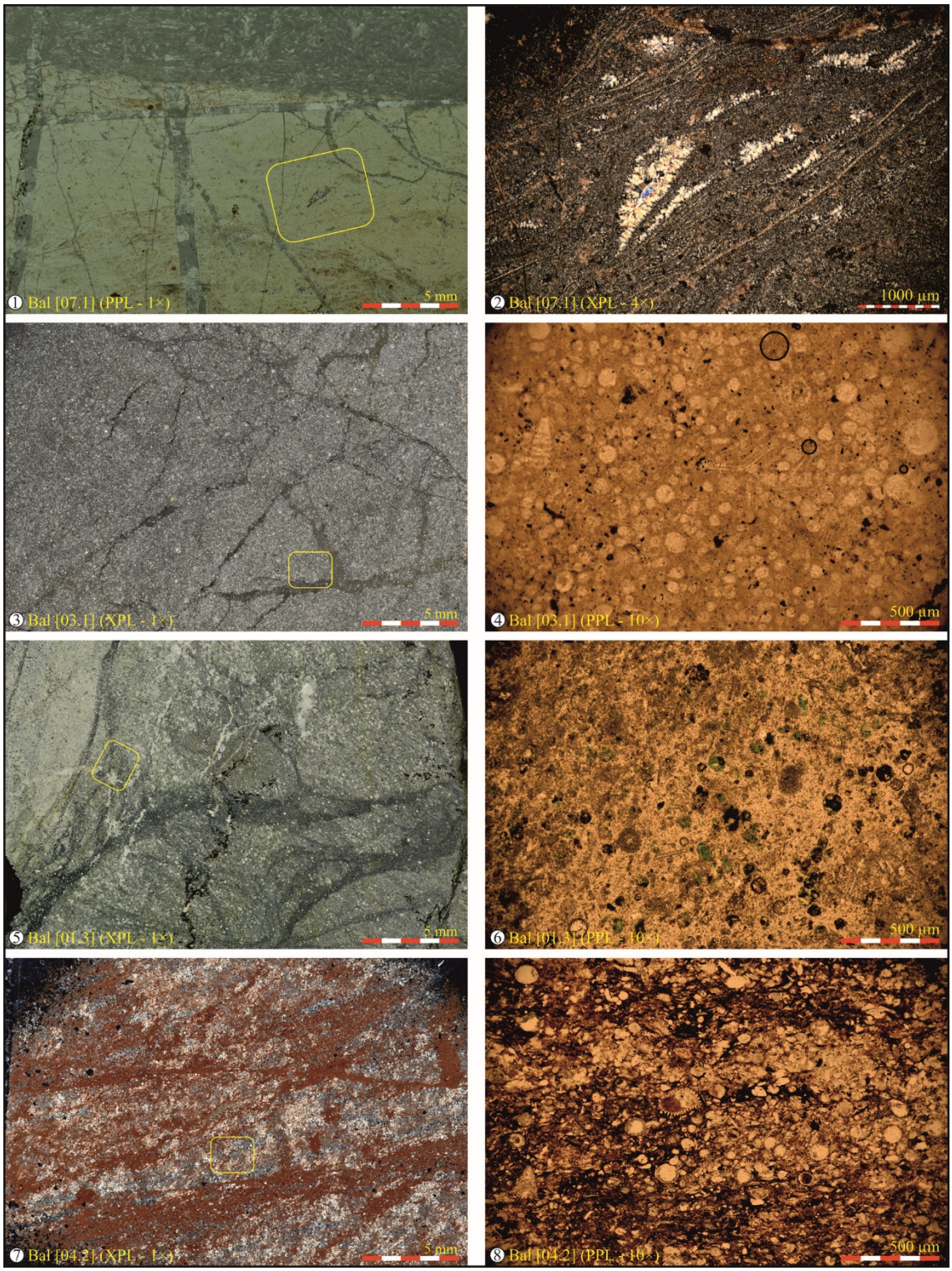
Pl. VIII. Photomicrographs of siliceous rocks from Hangu (1-4), Izvorul Muntelui (5-6), and Țiganului valleys (7-8): 1-2. Audia detrital-rich spiculite; 3-4. Audia carbonaceous black mudstone; 5-6. Audia laminated carbonaceous black radiolarian chert; 7-8. Cârnu-Șiclău radiolarian chert; PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii de roci silicioase de pe văile Hangu, Izvorul Muntelui și Țiganului.



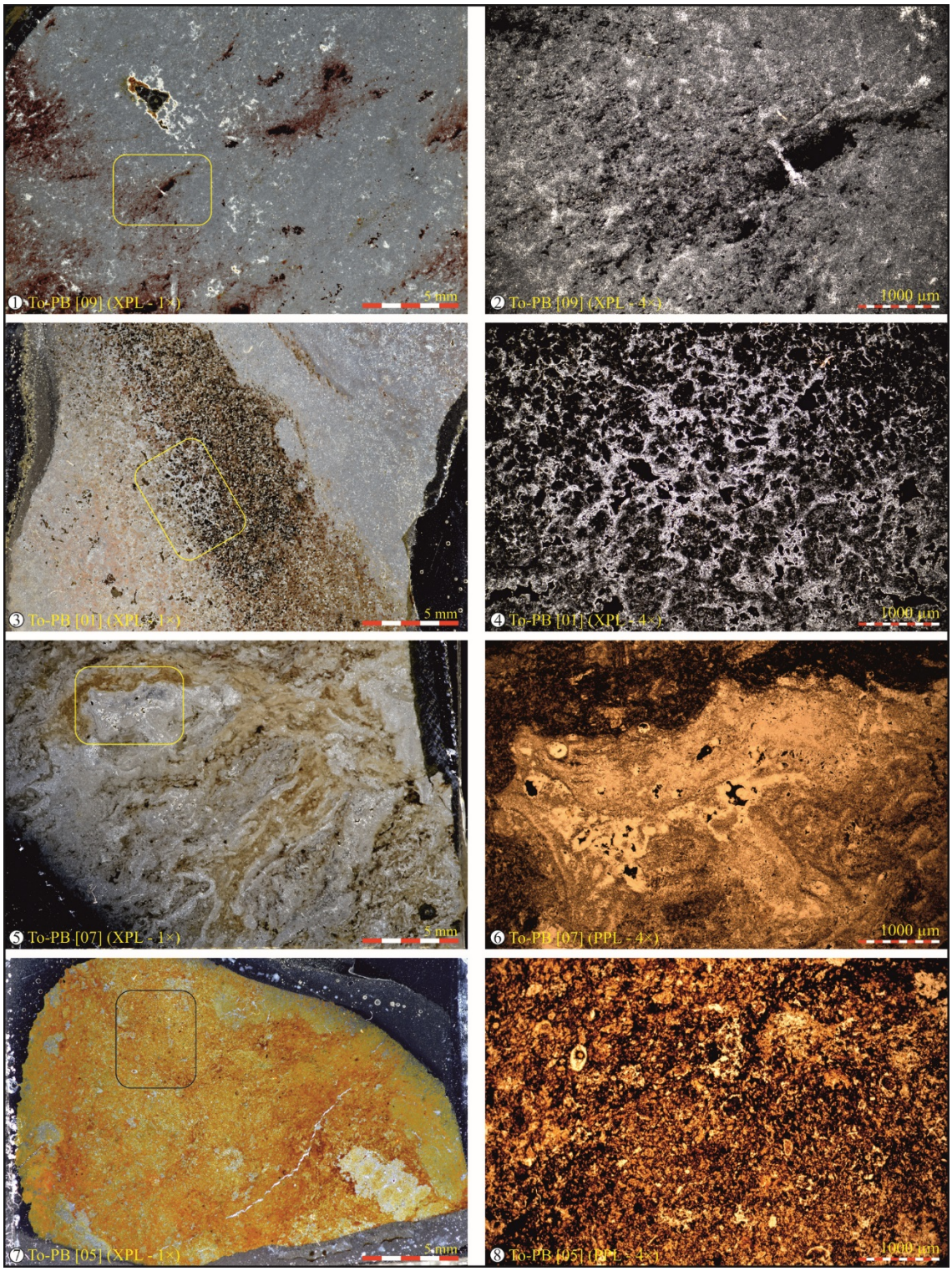
Pl. IX. Photomicrographs of Audia sandstones: 1-2. Siliceous-calcareous glauconitic lithic greywacke; 3-4. Siliceous glauconitic lithic greywacke; 5-6. Siliceous glauconitic sublithic arenite; 7-8. Calcareous glauconitic sublithic arenite; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii cu gresii de Audia.



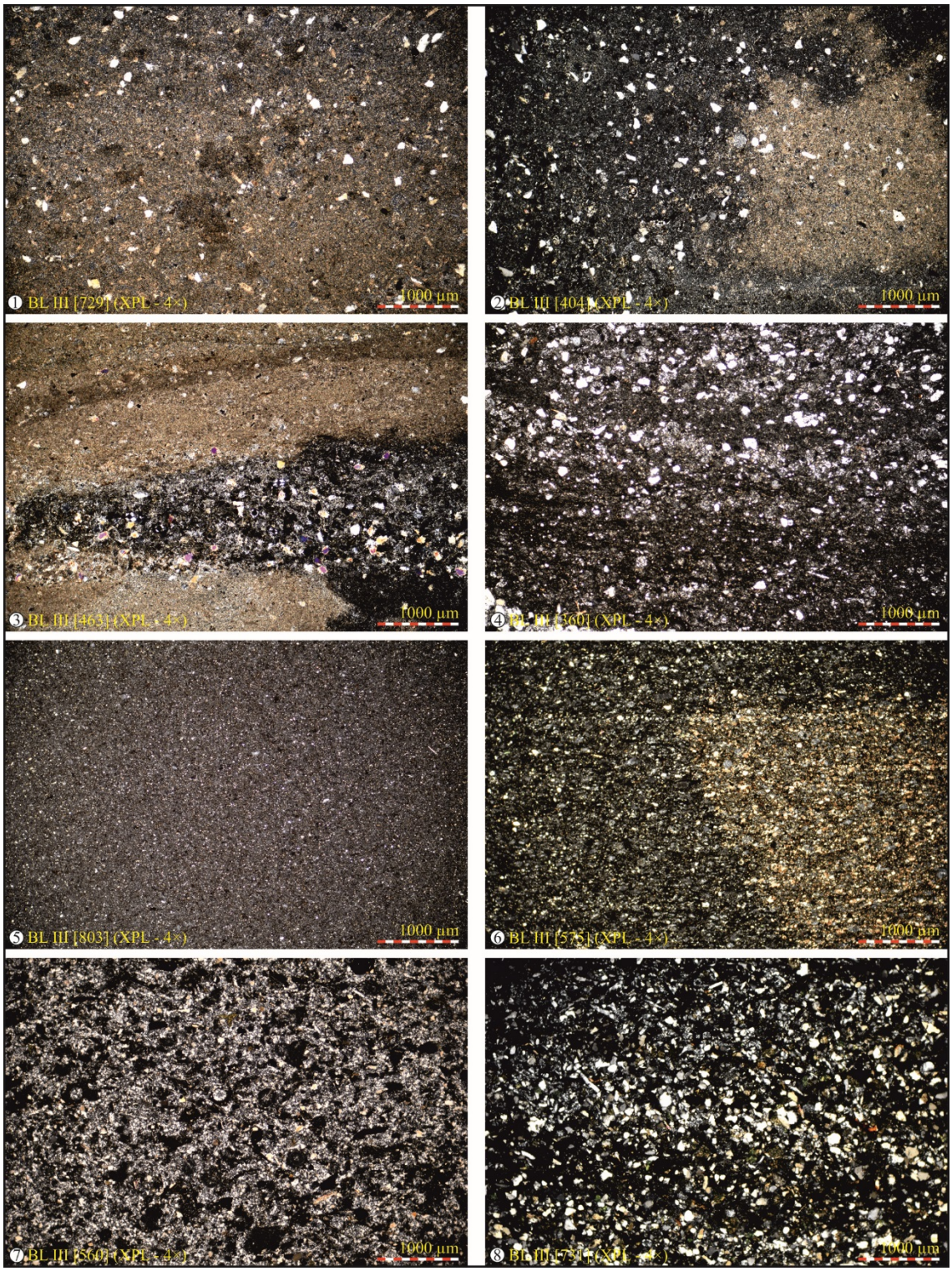
Pl. X. Photomicrographs of samples from Ceahlău Mountain (1-6) and Izvorul Muntelui creek (7-8): 1-2. Ceahlău chert, dedolomitized spiculitic-intraclastic wackestone (MF 1) with a lamina of dedolomitized intraclastic packed wackestone (MF 3); 3-4. Ceahlău chert, dedolomitized bioclastic-intraclastic wackestone (MF 2); 5-6. Dedolomitized, partially silicified bioclastic wackestone limestone; 7-8. Ceahlău chert with alternating laminae of MF 3, MF 2, and MF 1; PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021). Fotomicrografii ale unor probe de pe muntele Ceahlău și de pe pârâul Izvorul Muntelui.



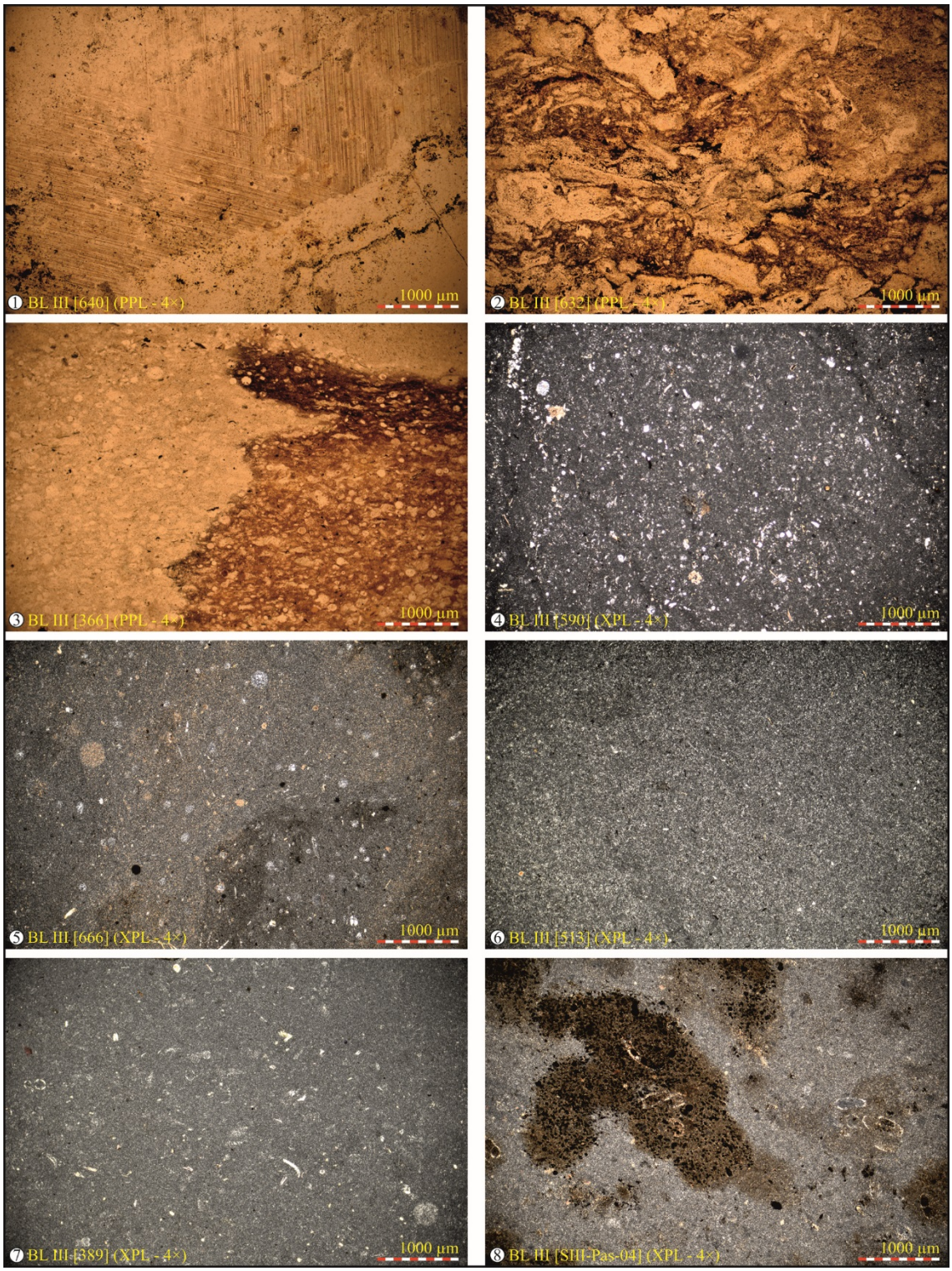
Pl. XI. Photomicrographs of Hăghimaș syncline cherts: 1-2. Mollusc shells chert (packstone); 3-4. Jurassic greenish radiolarite (packed wackestone); 5-6. Triassic carbonaceous radiolarian chert (wackestone); 7-8. Triassic reddish radiolaritic siliceous-ferruginous-carbonaceous rock (packed wackestone); PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii cu silicolite din sinclinalul Hăghimaș.



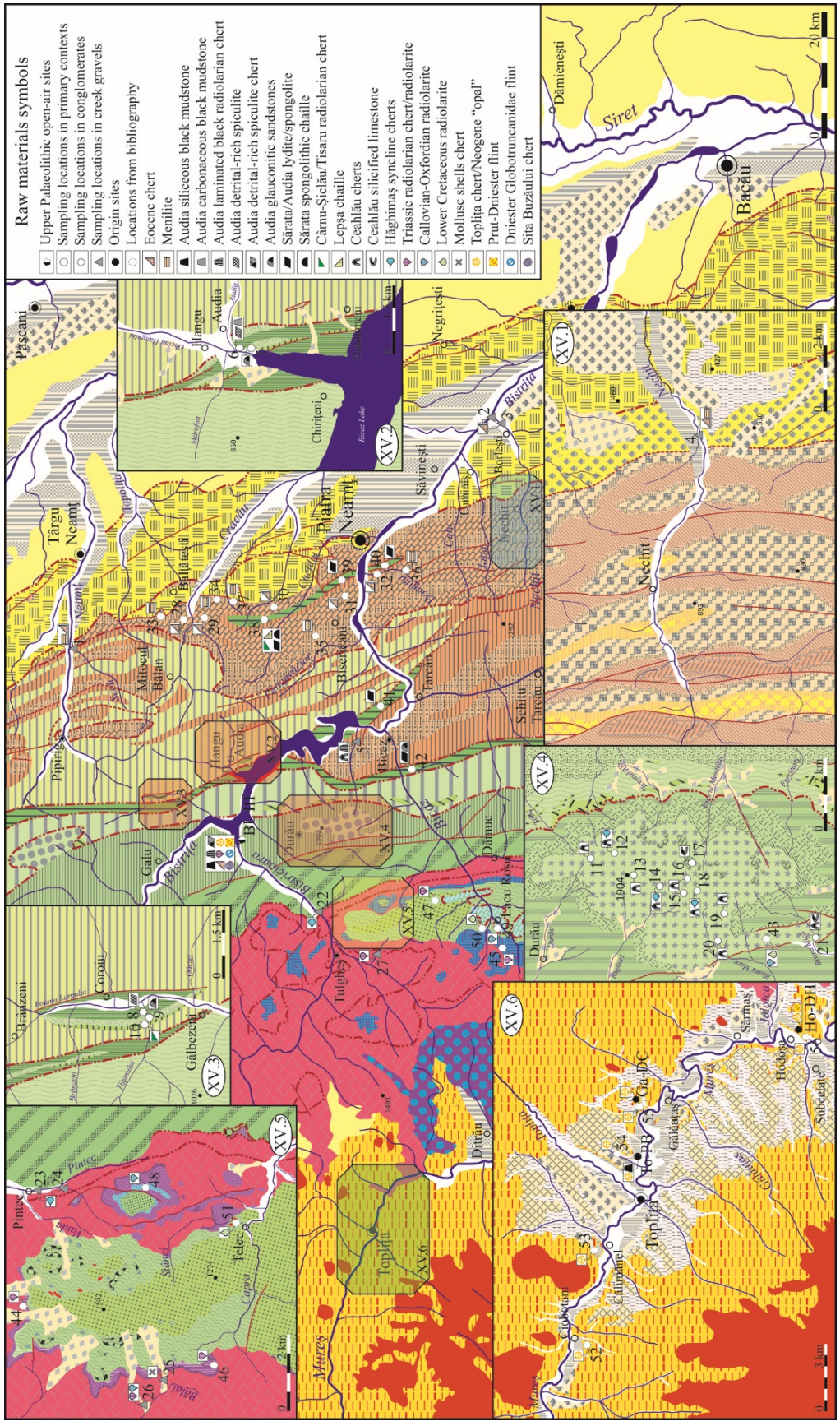
Pl. XII. Photomicrographs of origin samples from Toplița-*Pârâul Baicăului* (Harghita County): 1-2. Toplița non-fossiliferous chert with massive fabric; 3-4. Toplița non-fossiliferous chert with breccia fabric; 5-6. Toplița non-fossiliferous chert with flow banding; 7-8. Toplița fossiliferous chert with bioclastic packed wackestone fabric (algae fragments, mollusc shells, and charophyte gyrogonites); PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii cu probe de origine de la Toplița-*Pârâul Baicăului* (jud. Harghita).



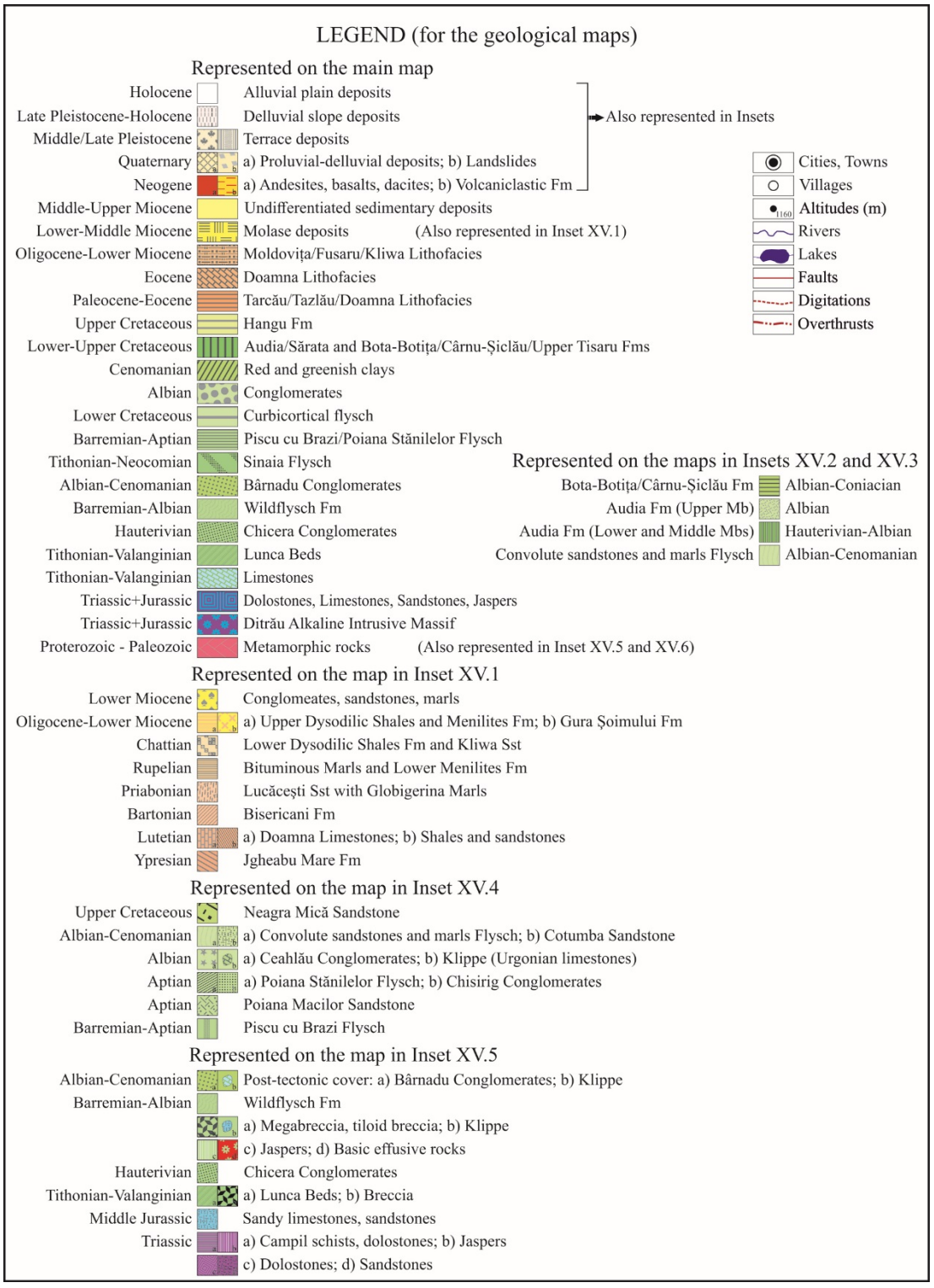
Pl. XIII. Photomicrographs of samples from Bistricioara-*Lutărie III* (Neamț County): 1. Eocene chert (MF 1); 2. Eocene chert (MF 3), detrital-rich bioclastic chert (with planktonic foraminifera); 3-4. Eocene chert, laminated detrital-rich bioclastic chert; 5. Siliceous black mudstone; 6. Audia laminated black radiolarian chert; 7. Audia detrital-rich spiculite chert; 8. Audia laminated siliceous glauconitic sublithic arenite (very fine sand); XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii de probe de la Bistricioara-*Lutărie III* (jud. Neamț).



Pl. XIV. Photomicrographs of samples from Bistricioara-*Lutărie III* (Neamț County): 1. Toplița non-fossiliferous chert with breccia fabric and fragments of silicified wood; 2. Toplița non-fossiliferous chert with flow banding; 3. Bicoloured detrital-rich radiolarite; 4. Detrital-rich radiolarian chert; 5. Sita Buzăului radiolarian chert; 6. Prut-Dniester spiculite flint; 7-8. Dniester Globotruncanidae flint; PPL - plane polarized light; XPL - cross-polarized light (photographs by Al. Ciornei 2021).
Fotomicrografii de probe de la Bistricioara-*Lutărie III* (jud. Neamț).



Pl. XV. Occurrence map of archaeologically relevant siliceous rocks in the extended study area. Occurrences of siliceous rocks: 1-27. Sampling locations from this study (Annexes 1-7); 28-56. Locations from bibliography (Table 5); Upper Palaeolithic sites: BL III, To-PB (see legend of Pl. I); Ga-DC - Gălăuțaș-*Dealul Cisc*; Ho-DH - Hodoșa-*Dealul Hodoșa*.
Harta ocurentei de roci silicioase de importantă arheologică în zona extinsă de studiu.



Pl. XV. *Continued*. Legend for the geological maps. The map supports were redrawn and modified after parts from the Geological Map of Romania 1: 1000000 (Pl. XV - M. Săndulescu *et alii* 1978), Tazlău Sheet (Inset XV.1 - M. Micu *et alii* 1983), and geological maps from published papers (Insets XV.2, XV.3 - Gr. Alexandrescu 1968; Inset XV.4 - M. Săndulescu 1990 and C. Grasu 1965; Inset XV.5 - M. Săndulescu 1975; Inset XV.6 - T. Bandrabur, V. Codarcea 1974).
Continuare. Legenda pentru hărțile geologice.

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
1	Sec 01	-	47.21869	26.21180	gravel	creek gravel	Quaternary	menilite, greyish-brownish chert, greenish siliceous sandstone	10	10	0
2	Nec 01	-	46.80131	26.55260	gravel	gravel bar	Quaternary	greyish-brownish chert, sandstones, mudstones/marlstones, various metamorphic rocks	19	19	1
3	Nec 02	-	46.78292	26.52683	gravel	gravel bar	Quaternary	greyish-brownish chert	1	1	1
-	Nec 03a	-	46.76666	26.46884	marlstone	Salt Fm.	Lower Miocene	light grey-greenish marlstone and greywacke	3	3	0
4	Nec 03b	-	46.76285	26.45877	gravel	gravel bar	Quaternary	greyish-brownish chert, menilite, laminated grey-brownish bituminous marlstone	5	5	4
-	Nec 04	-	46.76256	26.44416	marlstone	Lower Dysodilic Shales Fm. and Kliwa Sst.	Oligocene-Lower Miocene	greyish-brownish bituminous marlstone, sandstone and vein quartz	5	5	0
-	Nec 05	-	46.76839	26.43326	sandstone	Bisericani Fm.	Eocene	whitish-beige calcareous sandstone, beige very fine grained limestone, dark grey marlstone	3	3	0
-	Nec 06	-	46.76851	26.43230	gravel	creek gravel	Quaternary	grey-greenish laminated siliceous sandstone	1	1	0
									47	**47**	**6**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 1. Stops recorded along Nechit and Secu creeks (Neamț County).
Stopuri înregistrate de-a lungul văilor Nechit și Secu (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
-	Cr 01	399.60	46.89899	26.1087	shale and sandstone	Podu Secu Fm.	Eocene	-	0	0	0
-	Po 01b	431.00	46.88762	26.12855	sandstone	Fusaru Fm., Arenitic Mb.	Lower Miocene	-	0	0	0
-	Po 01a	418.92	46.88682	26.12193	sandstone and shale	Podu Secu Fm.	Eocene	-	0	0	0
-	Po 02a	423.00	46.88587	26.12182	sandstone and shale			-	0	0	0
-	Po 02b	437.47	46.88504	26.12099	sandstone and shale			medium grey micaceous mudstone	1	1	0
-	Po 02c	438.00	46.88485	26.12098	marlstone, shale and sandstone			-	0	0	0
-	Po 02d	452.00	46.88368	26.12045	sandstone and shale			-	0	0	0
-	Po 06a	490.00	46.88065	26.11758	shale and sandstone			-	0	0	0
-	Po 06b	507.00	46.88060	26.11738	sandstone and shale			-	0	0	0
-	Po 03b	616.00	46.87282	26.10403	sandstone	Fusaru Fm., Arenitic Mb.	Lower Miocene	-	0	0	0
-	Po 03	659.84	46.87140	26.09904	sandstone and shale	Fusaru Fm., Pelitic-arenitic Mb.	Lower Miocene	-	0	0	0
-	Po 04	692.92	46.87013	26.09567	marlstone, sandstone and shale			medium grey micaceous sandstone	1	1	0
-	Po 04b	727.03	46.86914	26.09292	gravel	creek gravel	Quaternary	medium grey-brownish marlstone	1	1	0
-	Po 05	910.35	46.87017	26.08161	shale and sandstone	Tarcău Sst Fm.	Eocene	-	0	0	0
									3	**3**	**0**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 2. Stops recorded along Potoci and Crasna creeks (Neamț County).
Stopuri înregistrate de-a lungul văilor Potoci și Crasna (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
-	IzMu 01	463.86	46.93792	26.08268	sandstone	Fusaru Fm., Arenitic Mb.	Lower Miocene	-	0	0	0
5	IzMu 01b	464.00	46.93795	26.08252	gravel	creek gravel	Quaternary	dark grey chert	1	1	1
	IzMu 02	492.72	46.94020	26.07362	gravel	creek gravel	Quaternary	light brown-beige siliceous rock, blackish siliceous mudstone	3	3	1
-	IzMu 02b	512.00	46.94180	26.06830	sandstone	Fusaru Fm., Arenitic Mb.	Lower Miocene	-	0	0	0
-	IzMu 03	521.42	46.94304	26.06465	marlstone	Bituminous Marls Fm.	Oligocene	-	0	0	0
-	IzMu 04	530.87	46.94368	26.06141	sandstone and shale	Fusaru Fm., Arenitic Mb.	Lower Miocene	-	0	0	0
-	IzMu 05	568.37	46.94335	26.05530	sandstone			-	0	0	0
-	IzMu 06b	593.20	46.94758	26.04104	sandstone and shale			-	0	0	0
-	IzMu 06	594.20	46.94770	26.04071	mudstone/marlstone and sandstone	Fusaru Fm., Pelitic-arenitic Mb.	Lower Miocene	-	0	0	0
-	IzMu 07	617.46	46.94638	26.03384	shale and sandstone	Tarcău Sst Fm.	Eocene	medium grey micaceous sandstone	1	1	0
									5	**5**	**2**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 3. Stops recorded along Izvorul Muntelui Valley (Neamț County).
Stopuri înregistrate de-a lungul văii Izvorul Muntelui (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
-	Au 05	-	47.06178	26.09721	gravel	creek gravel	Quaternary	medium grey very fine-grained limestones and sandstones	8	8	0
-	Au 06	-	47.06054	26.07041	gravel	creek gravel	Quaternary	greyish very fine-grained limestones and sandstones	5	5	0
-	Au 04	-	47.06230	26.06682	marlstone/very fine-grained limestone and sandstone	Hangu Fm.	Late Campanian-Maastrichtian	medium grey very fine-grained limestones/marlstones and sandstones	4	4	1
-	Au 03	-	47.06586	26.06337	sandstone			greyish sandstone	1	1	0
-	Au 02	-	47.06290	26.05577	gravel	creek gravel	Quaternary	grey very fine-grained limestones/marlstones and sandstones	15	15	0
-	Au 01	-	47.06303	26.05382	shale and sandstone	Hangu Fm.	Late Campanian-Maastrichtian	grey very fine-grained limestones/marlstones and sandstones	13	13	1
-	Au 01b	-	47.06255	26.05367	shale and sandstone			grey very fine-grained limestones/marlstones and sandstones	4	4	0
6	Au 00	559.00	47.06142	26.03798	shale, mudstone, very fine-grained limestone, sandstone	Audia Fm, Middle Mb.	Late Barremian-Early Albian	blackish mudstones, greyish sandstones, dark grey limestones, laminated chert	29	29	16
-	Au 07	581.41	47.05481	26.03793	shale and sandstone			medium grey sandstone	1	1	1
7	Au 16	536.00	47.06064	26.03787	sandstone and shale	Audia Fm., Upper Mb.	Early-Late Albian	-	0	0	0
	Au 15	535.35	47.06035	26.03795	sandstone and shale			dark grey sandstone	2	2	2
	Au 14	533.84	47.05978	26.03797	sandstone and shale			medium grey siliceous sandstone	1	1	1
	Au 13	533.82	47.05968	26.03798	sandstone and shale			dark grey siliceous sandstone	1	1	1
	Au 12b	533.41	47.05952	26.03787	sandstone and shale			grey-greenish sandstone	2	2	0
	Au 12	533.65	47.05945	26.03788	sandstone and shale			grey-brownish and greenish sandstone	2	2	2
	Au 11b	566.39	47.05928	26.03759	sandstone and shale			grey-greenish siliceous sandstone	2	2	2
	Au 11	564.85	47.05931	26.03776	sandstone and shale			dark grey-greenish siliceous sandstone	1	1	1
	Au 10	563.62	47.05882	26.03765	sandstone and shale			-	0	0	0
	Au 09	618.95	47.05678	26.03957	sandstone and shale			dark grey siliceous sandstone	1	1	1
	Au 08	629.50	47.05678	26.03991	sandstone and shale			-	0	0	0
									92	**92**	**29**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 4. Stops recorded along Audia and Hangu valleys (Neamț County).
Stopuri înregistrate de-a lungul văilor Audia și Hangu (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
8	Tig 01	600.49	47.12651	25.99642	shale, sandstone, mudstone	Audia Fm., Middle Mb.	Late Barremian-Early Albian	blackish mudstone, laminated chert	4	4	1
9	Tig 02	602.37	47.12603	25.99541	sandstone and shale	Audia Fm., Upper Mb.	Early-Late Albian	medium to dark grey sandstone and mudstone	4	4	1
	Tig 02b	606.61	47.12585	25.99507	sandstone and shale			-	0	0	0
	Tig 02c	616.02	47.12686	25.99538	sandstone and shale			-	0	0	0
	Tig 02d	627.49	47.12655	25.99499	sandstone, mudstone and shale			dark grey micaceous sandstone, dark grey greywackes	9	9	2
10	Tig 03	620.27	47.12649	25.99460	shale and marlstone	Cârnu-Șiclău Fm.	Late Albian-Coniacian	grey-greenish rough chert, medium greenish siliceous marlstone	2	2	1
-	Tig 04b	633.07	47.12632	25.99424	very fine-grained limestone/marlstone, shale, sandstone			greyish marlstone/very fine-grained limestone	3	3	1
-	Tig 03b	625.07	47.12641	25.99414	shale and sandstone			-	0	0	0
-	Tig 04a	646.63	47.12649	25.99353	shale, sandstone, marlstone/very fine-grained limestone	Hangu Fm.	Late Campanian-Maastrichtian	medium grey and burgundy marlstone/very fine-grained limestone	4	4	1
-	Tig 05b	654.62	47.12665	25.99261	shale, very fine-grained limestone/marlstone, sandstone			medium grey and greenish marlstone/very fine-grained limestone, medium grey sandstone	6	6	0
-	Tig 05	657.00	47.12667	25.99187	shale, very fine-grained limestone/marlstone, sandstone			reddish and grey-greenish marlstone/very fine-grained limestone	6	6	2
-	Tig 06b	658.54	47.12660	25.99117	shale and marlstone/very fine-grained limestone			grey and grey-greenish marlstone/very fine-grained limestone	10	10	2
-	Tig 06a	658.94	47.12677	25.99061	shale and marlstone/very fine-grained limestone			-	0	0	0
-	Tig 07	660.69	47.12667	25.98917	shale and sandstone			medium grey siliceous sandstone	1	1	0
									49	**49**	**11**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 5. Stops recorded along Țiganului Valley (Neamț County).
Stopuri înregistrate pe valea Țiganului (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/ Period		Co	MA	TS
-	Ma 01	-	46.96140	25.91278	creek gravel	creek gravel	Quaternary	chert	0	0	0
-	Sc 01	1226.00	46.95483	25.92132	surface	passim	Quaternary	chert	2	2	0
20	Chl 01b	-	46.95488	25.92421	surface	altered Ceahlău conglomerates	Quaternary	chert	1	1	0
	Chl 01	1359.29	46.95410	25.92608				chert	1	1	0
-	Chl 02	1657.77	46.95662	25.93611	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	limestone	1	1	0
-	Chl 03	1739.19	46.96065	25.93680				limestone	1	1	0
-	Chl 17	1709.00	46.95426	25.93339				-	0	0	0
19	Chl 17b	1698.00	46.95408	25.93462				chert	1	1	0
	Chl 18	1682.00	46.95348	25.93731				chert	1	1	0
-	Chl 19	1299.00	46.92417	25.93569				silicified limestone, chert, quartzite	5	5	0
21	Chl 20	1259.00	46.93260	25.92685				silicified limestone, chert	6	6	0
	Chl 20b	1259.00	46.93285	25.92700	creek gravel	creek gravel	Quaternary	chert, silicified limestone, sandstone	6	6	0
-	Chl 21	875.00	46.91998	25.89375				chert, quartzite	2	2	0
-	Chl 16	1189.00	46.97462	25.96377	Urgonian limestone klippe	Ceahlău conglomerates	Albian	-	0	0	0
-	Chl 15	1381.00	46.97297	25.95625	conglomerates with sandstone layers			-	0	0	0
17	Chl 14	1508.00	46.96360	25.96179	Urgonian limestone klippe			limestone, silicified limestone	6	6	3
16	Chl 13	1566.82	46.96476	25.95681	conglomerates with sandstone layers			chert	1	1	1
18	Chl 23c	1597.00	46.95936	25.95012	surface	altered Ceahlău conglomerates	Quaternary	chert	1	1	0
	Chl 23b-23c	-	-	-				chert	1	1	0
	Chl 23b	1630.00	46.95992	25.94950				greenish jasper	1	1	0
	Chl 23a	1640.00	46.96006	25.94954				-	0	0	0
15	Chl 04	1757.44	46.96597	25.94897	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	chert	4	4	4
14	Chl 22	1701.00	46.97037	25.94685	surface	altered Ceahlău conglomerates	Quaternary	chert, greenish jasper	3	3	0
-	To 03	-	46.97529	25.94833				-	0	0	0
-	To 02-03	-	-	-				chert	4	4	0
13	To 02	-	46.97687	25.94916	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	chert	2	2	0
	To 01	1904.00	46.97755	25.94988				chert	1	1	0

Annex 6. Stops recorded on Ceahlău Mountain (Neamț County).
Stopuri înregistrate pe muntele Ceahlău (jud. Neamț).

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/ Period		Co	MA	TS
-	Chl 12	1731.07	46.97858	25.95172	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	limestone	1	1	0
12	Chl 11	1704.00	46.98297	25.95555	surface	altered Ceahlău conglomerates	Quaternary	chert	1	1	0
	Chl 10	1564.91	46.98605	25.95862	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	chert, limestone, reddish jasper	4	4	0
	Chl 09-10	-	-	-	surface	altered Ceahlău conglomerates	Quaternary	chert	3	3	0
11	Chl 09	1398.10	46.98934	25.95533	conglomerates with sandstone layers	Ceahlău conglomerates	Albian	chert	2	2	0
	Chl 08-09	-	-	-	surface	altered Ceahlău conglomerates	Quaternary	chert	5	5	3
	Chl 08	1341.25	46.99047	25.95357				chert	3	3	1
-	Chl 07b	1268.34	46.99848	25.94954	conglomerate	Ceahlău conglomerates	Albian	-	0	0	0
-	Chl 07a	1251.31	46.99878	25.94886	sandstone			-	0	0	0
-	Chl 06b	1116.00	46.99843	25.94509	sandstone and conglomerate	Poiana Macilor Sandstone	Aptian	-	0	0	0
-	Chl 06	987.41	46.99866	25.93864	sandstone			-	0	0	0
-	Chl 05	1034.39	46.97816	25.97527	sandstone	Neagra Mică Sandstone	Turonian-Senonian	grey-brownish micaceous sandstone	1	1	0
-	Chl 05b	1017.00	46.98430	25.97752	conglomerate and sandstone			-	0	0	0
									71	**71**	**12**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstone.

Annex 6. *Continued.*
Continuare.

No. in Pl. XV	Stops	Elevation (m)	GPS co-ordinates (Lat. N)	GPS co-ordinates (Long. E)	Context			Rock types sampled/observed and recorded	Samples		
					Lithology (predominant)	Geological deposit	Stage/Period		Co	MA	TS
22	VBis 01	613.44	46.97934	25.81869	gravel	creek gravel	Quaternary	reddish jasper	0	0	0
-	Va 01	743.38	46.94683	25.83657	gravel			blackish very fine-grained limestone	1	1	1
-	Va 02	751.61	46.94617	25.83524	gravel			grey-burgundy laminated crystalline limestone	1	1	1
23	Pin 01	732.20	46.94715	25.84174	gravel			dark greenish jasper	0	0	0
-	Pin 02	665.84	46.96476	25.83360	gravel			reddish jasper	0	0	0
24	Chi 01	792.46	46.93748	25.84289	gravel			reddish jasper	0	0	0
-	Chi 02	860.56	46.93411	25.83859	dolostone/limestone	Dolostones and limestones	Triassic	medium grey and grey-greenish crystalline limestone	6	6	0
-	Chi 03	862.51	46.93391	25.83844	dolostone/limestone			medium grey and grey-rosy crystalline limestone	5	5	2
27	Bal 01	751.91	46.92079	25.76092	gravel	creek gravel	Quaternary	reddish and greenish jasper	3	3	1
	Bal 02	768.85	46.91827	25.76528	gravel			reddish and greenish jasper	2	2	1
26	Bal 03	808.77	46.91629	25.77118	gravel			reddish and greenish jasper	2	2	1
	Bal 04	828.28	46.91723	25.77303	gravel			bicoloured red and green jasper	2	2	2
-	Bal 05	833.75	46.91761	25.77368	metapelites	Rarău gneiss Fm.	Proterozoic-Palaeozoic	-	0	0	0
-	Bal 06	958.08	46.92205	25.78082	dolostone/limestone	Dolostones and limestones	Triassic	-	0	0	0
-	Bal 08	981.56	46.92276	25.78180	dolostone/limestone			-	0	0	0
-	Bal 09	987.73	46.92304	25.78205	dolostone/limestone and mudstone			grey-brownish crystalline limestone	2	2	0
-	Bal 10	989.01	46.92312	25.78187	dolostone/limestone			-	0	0	0
25	Bal 07	992.64	46.91174	25.78473	gravel	creek gravel	Quaternary	burgundy jasper	1	1	1
-	Bal 11	1056.59	46.91333	25.78831	conglomerate	Wildflysh Fm.	Barremian-Albian	-	0	0	0
-	Bal 12	1073.15	46.91416	25.78893	conglomerate			-	0	0	0
-	Bal 13	1105.25	46.91443	25.79092	dolostone/limestone klippe			light grey-greenish-rosy limestone	7	7	1
									32	**32**	**11**

Co – collected; MA – macroscopic analysis; TS – thin sections; Fm. – Formation; Mb. – Member; Sst. – sandstones.

Annex 7. Stops recorded along Bălai and Pintec valleys (Harghita County).
Stopuri înregistrate de-a lungul văilor Bălai și Pintec (jud. Harghita).

Bone tools from Getahovit-2 cave site (Armenia)

Noushig ZARIKIAN, Irena KALANTARYAN*

Abstract: *The paper presents the results of osteological and typological bone tools recovered from Getahovit-2 cave site (Armenia) during excavations held in 2018-2019. A multi-aspect analysis revealed the kinds of raw materials used for the production of bone tools and provided insights into how the specimens were worked and used. All were made from mammal bones, mostly cattle, sheep/goat and deer. Awls used to work with a soft organic material, were the most common tool types at the site. The presence of tools made from wild mammals' bones may possibly contribute to the discussion on contacts between farmers and hunter-gatherers or to the farmers that also practiced hunting.*

Rezumat: *Lucrarea prezintă rezultatele osteologice și tipologice ale uneltelor de os identificate în peștera Getahovit-2 (Armenia) în timpul săpăturilor desfășurate în perioada 2018-2019. Analizele complexe au avut rolul de a identifica tipurile de materii prime utilizate pentru producția uneltelor de os și au oferit sugestii asupra modului în care au fost prelucrate și utilizate acestea. Toate uneltele au fost realizate din oase de mamifere, în principal bovine, oi/capre și căprior. Împungătoarele cu care se lucrau materialele organice moi reprezintă cele mai comune tipuri de unelte pentru acest sit. Prezența uneltelor realizate din oase de mamifere sălbatice sugerează existența relațiilor dintre crescătorii de animale și vânători-culegători sau de ce nu practicarea vânătorii de către crescătorii de animale.*

Keywords: *Bone tools, osteological analysis, Getahovit-2 cave, Armenia.*

Cuvinte cheie: *unelte de os, analize osteologice, peștera Getahovit-2, Armenia.*

◈ Introduction

'Bone tool' is a generic term used to identify implements made of various animal tissues that include bone, tooth, antler, and ivory. During the Paleolithic (2.6 Ma to 10,000 BP), these tools took different forms and have been studied by archaeologists to address a variety of questions (L. Backwell, F. d'Errico 2014).

This paper presents the results of analysis of 21 artefacts made from animal bones showing traces of working or use, recovered from Getahovit-2 cave archaeological site, in Tavush Province in Armenia. The analysis aimed to identify the animal species the raw material came from and possible uses.

However, numerous evidences, coming from Armenia, suggests that the exploitation of modified animal bones should be viewed as an expression of a much older behavior. Some of the oldest evidence relating to the use of modified animal bones comes from Late Neolithic site (K.A. Hayrapetyan *et alii* 2014) and Chalcolithic site in Armenian contexts (L. Stapleton *et alii* 2014). Animal bones were used by early hominids for termite foraging at the sites (B. Gasparyan *et alii* 2014).

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◈ Getahovit-2 Cave Site excavation and stratigraphy

The Eneolithic period of Getahovit-2 cave has a unique position due to both environmental and archaeological contexts. This cave is the perfect example of a site that was used by pastoralists during the Chalcolithic period in the region. It is the first, where the phenomenon has been fixed and studied in depth.

◈ History of Research

The cave survey launched by international joint Armenian-French (Mission Caucasus) expedition, aimed to investigate the early period occupations at the Northern Armenia. Under the direction of I. Kalantarian the collaborative excavations here started at 2011 and continued to 2017, unfolding cultural deposits of few Medieval period horizons, that were over lied by the layers of Chalcolithic. Finally, with the help of the deep test sounding the horizon of Upper Paleolithic period was discovered in the cave under the sterile layer.

Chalcolithic period represented in Getahovit-2 cave placed in the middle sequence of the chronological chart based on radiometric dating. More, one data from 2014 deep sounding excavations, showed the very early Chalcolithic period presence (5289-4995 cal BC), which is extremely interesting because the time range still remain unknown in Armenia and in the southern Caucasus in general.

Starting from 2018, the excavations at Getahovit-2 cave are conducting by Institute of Archaeology and Ethnography NAS RA with the very actual financial support of Ijevan Wine and Brandy factory. During the last field season, we uncovered several layers of the earlier occupations that were post-dated 4700 BC and pre dated upper Paleolithic (the last ^{14}C date that we have is *terminus post quem* for the mentioned layers).

◈ The cave

Getahovit-2 small cave is placed (located) at the valley (N 40°54′38.5′′, E 045°05′59.7′′) formed by the Khachaghbyur river (the tributary of Aghstev) at the elevation of ca 968 m a. s. l., in between modern villages Yenokavan and Getahovit (Tavush region, north east Armenia). It is one among the numerous caves located on the terraces and vertical, sheer cliffs of the canyon (fig. 1, 2). The cave consists of two halls: the first one, opened to the south, covers an area of 64 m^2 and second (small one), that can be accessed through a narrow passageway. This second room is filled by a large accumulation of sediment. Even it has smaller scales, the presence of the artifacts indicate that this place can give some perspectives of occupation also. During last excavation season some parts here started to be cleaned. In front of the entrance of the cave, a terrace covering a surface of about 60 m^2 overlooks the valley.

The excavations started at the first hall of the cave sized 13x8 m in 2011 with the small-scale trench (2x2 m). As a result, two main occupation phases had been fixed (attested)- Medieval (IX-X, XI-XIII cc.) and Chalcolithic (the last quarter of the fifth millennium BC (4360-4320)).

Based on the whole period of the excavations the stratigraphical review of the cave layers is possible to conclude, that the general time periods of occupations that are known until now are 1. Upper Paleolithic, 2. Chalcolithic and 3. Medieval (tab. 1).

◈ General stratigraphy

Upper Palaeolithic, Level 6 (Level VII - 2014)

The deepest, Upper Paleolithic occupation level, we got by deep sounding excavation in 2014 (fig. 3, 4). It appeared at a depth of about 3.2 m and lies directly on the bedrock, which is strongly slop in the excavated place. However, the virgin soil has not yet been reached on the terrace side, where other earlier levels probably remain to be discovered.

In above mentioned level (Beta-393561: 19750 ± 70 BP or 22020-21685 cal BC), faunal remains, charcoal and a lithic industry in obsidian were found in area B6, where an irregular not very deep pit (ST 73) was opened, from where a large number of microliths were found.

Sterile Geological Deposits, Levels 4, 5 (Level VI - 2014)

Half a meter of sterile very compact and stony deposits (Level 5), characteristic of a period of gelifraction covers the Upper Palaeolithic occupation (fig. 4). Apparently corresponds to the cold phases of the end of the Pleistocene, from the Late Glacial Maximum to the Younger Dryas. The latter covered by a very compact clayey sediment characteristic of deposits that have accumulated under a warmer, more humid climate characterized the beginning phases of Holocene (fig. 4).

Chalcolithic Level 3 (Levels IV and III - 2014)

The level consists of horizons that are presenting two phases of period, mostly middle time sequence with some late dates (between 4624 and 4171 cal BC, for the calibrated median values of the dates) and early Chalcolithic part with only one proved radiocarbon date for now(LTL-14987A: 6174 ± 45 BP, that is 5289–4995 cal BC with a calibrated median value of 5127 cal BC). The newly data will come soon that can postdated the last one based on the excavations and stratigraphy. What is very important that the Chalcolithic layers partly has superimposed deposits of the sheepfold with the specific remains and the site in general is the best example of the seasonal home of the ancient herders. The layers that were represented Chalcolithic Middle periods are mostly similar and well differentiated unlike the earliest ones.

Sterile I Level 2 (level II - 2014)

Level II was a sterile solid layer between the Chalcolithic and Medieval and it is separated from the Medieval by a thin, dark brown layer formed by the decay of natural components, also sanitary clean with fire. (tab. 1).

Medieval Level 1 (Level I - 2014)

Level I consisted of conditional nominal units corresponding to the several stages (five at least) of medieval settlement.

The radiocarbon dating indicates an occupation of the High Middle Ages (between 987 and 1102 cal AD, for the calibrated median values of the dates) (tab. 1). The least three general occupation horizons were fixed, with the sub horizons with the numerous structures and the way of the life space organizations inside the cave. The strangest situation was with the several burials had been done inside (I. Kalantaryan*et alii* 2012) and the unknown tomb structure.

The chronological chart of the site can be described as follows (tab. 1 and 2).

The first level is represented by several Medieval occupation horizons in the cave. These are separated from the rest by the second sterile level. Several horizons are represented by different stages and intensity of occupation with the interesting fact of their being burials inside the cave (I. Kalantaryan *et alii* 2012).

Level 3 represents the Chalcolithic period occupation and can be divided into two phases according to the dates based on the data of radiocarbon analyses – middle and early Chalcolithic. The middle Chalcolithic period horizons are seven and the most intense activity apparent during the last occupation layers inside the cave. The cave is also unique because of

the excavated coprolites layers, which indicate various horizons of the Chalcolithic period. It was possible to follow the different stages of accumulation of burnt, mineralized residues of the sheep and goat dung. The process of the accumulation of layers in the cave gives us for the first time the opportunity to study the life and the lifestyle of the region's ancient pastoralists This level is represented by horizons 1, 2 and 3. Horizon 1 includes US 31, 33-2015 (US 30=32=35). It has mostly no structures, but traces of previous activities are extant. The most interesting and long-term occupation during the middle Chalcolithic was Horizon 2 (2016 - US 34=36, 2014- US 6, Layer 5, US 37) with pits, hearths and even the remains of basic stone masonry, which was probably used as a bench. The next horizons, such as N 4 and 5 represent a short occupation period and contain minor traces of occupation. The sub horizon 5a that includes US 48 a, b (2017 excavations) has another composition and is very well correlated with US 11 and US 12 from 2014, where the first was determined as a yellowish, compact layer with an absence of materials and the second was compacted and yellowish grey, where there were some finds of charcoal pieces and bones, which is quite similar to US 48b. The descriptions noted during 2014 was nearly the same as those described in 2017. Despite the fact that there were unique finds of obsidian flakes and bone remains, these layers (US 48 a, b) seemed to be nearly sterile and the absence of structures can also be regarded as a clear sign of non-occupation (fig. 3).

Finally, very light, episodic traces seen on the mud layer (US 52) were from two hearths. This layer separates the earlier Chalcolithic Horizon 7 from the previous ones. The ^{14}C data from one of the structures showed a time range of 4542-4371 cal BC. The main layer with the traces of Chalcolithic occupation (US 51, 53 – west and US 54, 55 – east) excavated during the season of 2018 was preserved under a layer nearly 10 cm thick of muddy sedimentation that entered the cave from the southeastern part. In general, the layer was represented by hearths, which differ from each other in terms of structure and use intensity. It was thick enough, in some places, to provide an indication that two phases of the same occupation had been seen obviously, in some cases there were signs of hearth reuse. (for example, str. 213) The fireplace - structure 213 (from where we did the selection of the several types of mollusks) also belong to the mentioned horizon 7, indicated by more intense traces of activity of hunters and herders. It was one of the double used fireplaces, placed at the H5. Its last use appeared during the layer we called US 54 with the sizes NS=0.43 m, EW=0.384 m, alt 2.27-2.34 m (I. Kalantaryan, G. Ghanem 2019).

The second cluster of structures belonging to the same layer, appeared later (US 57), perhaps due to the sharp decline of the southeastern position of the layer. The only one known for now – the early Chalcolithic horizon is separated as Horizon 8. And seems to be the first with traces of the Chalcolithic users who entered the cave to provide themselves with a temporary home. Lower Levels 4 (US 15) and 5 (US 16) represent the geological sedimentation (categorized by the geomorphologist as fluvial and alluvial) They cover the horizon (Level 6, US 17, US 18), with the most interesting level marked by occupation traces from the Upper Palaeolithic, dating to 22,020-21,685 BC. A small pit was discovered during the excavations of 2014, along with an assemblage of microliths.

Fig. 1. Getahovit-2 cave location in Armenia.
Locația peșterii Getahovit-2 in Armenia.

Fig. 2. Getahovit-2 cave.
Peștera Getahovit-2.

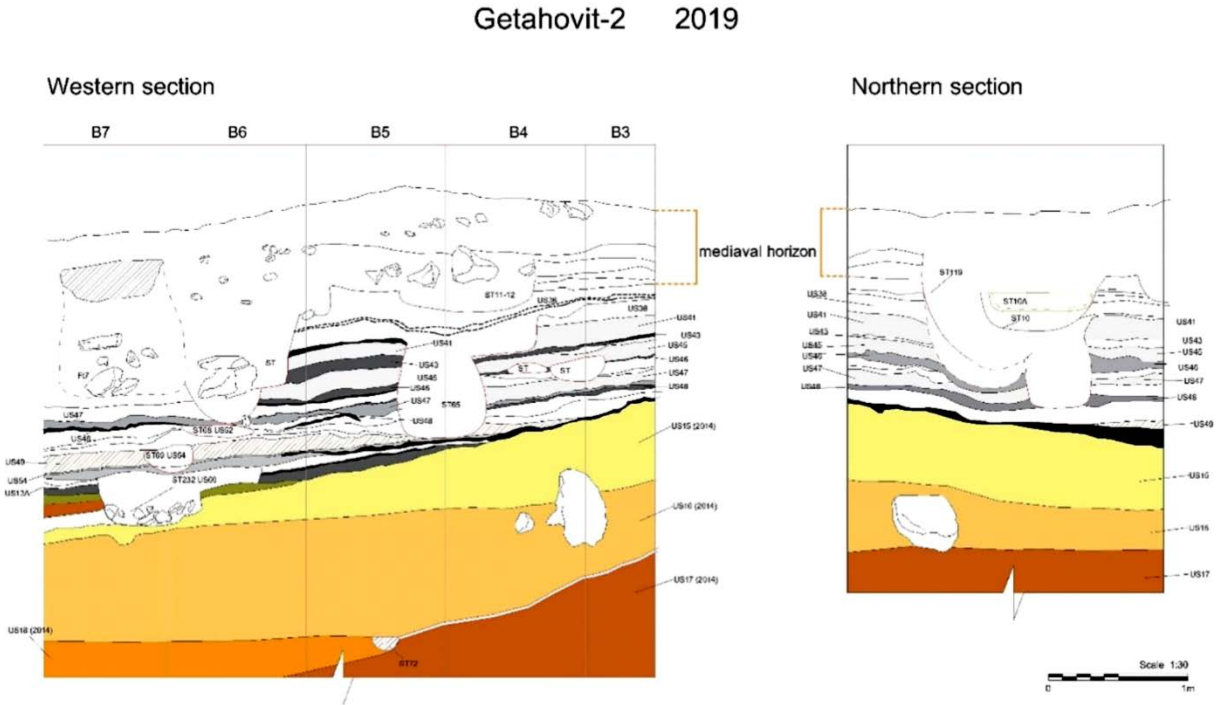


Fig. 3. Stratigraphy of the western and northern sectors of Getahovit-2 cave.
Stratigrafia profilelor de vest și de nord din peștera Getahovit-2.

Levels & horizons		Stratigraphic units	Dates
Level 1 Medival			
Horizon 1		US3 (TR2)	
Horizon 2		Leyer 2 (2011)	1021-1206 AD
Horizon 3		US19, 20	897-1024 AD
Horizon 4		US21	
Level 2 Sterile			
Sterile		US4=US8	
Level 3 Chalcolithic			
Middle Chalcholithic	Horizon 1	US31, 35	4341-4077 BC
	Horizon 2	US36, 37	4447-4258 BC
	Horizon 3		4541-4360 BC
	Horizon 4	US44, 45	
	Horizon 5	US46, 47	
	Subhorizon 5a Sterile	US48	
	Horizon 6	US52	4683-4463 BC
	Subhorizon 6a (mud layer (sterile)	US49	
	Horizon 7	US53, 54 (US57)	4703-4545 BC
Early Chalcolithic	Horizon 8	US14 (2014)	5289-4995 BC
Level 4 Geological fluvial sedimentation			
		Lower part of US15 (2014)	
Level 5 Geological co-luvial sedimentation			
		US16 (2014)	
Level 6			
Upper Paleolithic	Horizon 1	US18 (2014)	22020-21685 BC

Tab. 1. Chronological chart of Getahovit-2 cave based on radiometric dating.
Diagrama cronologică a peșterii Getahovit-2 bazată pe datele radiometrice.

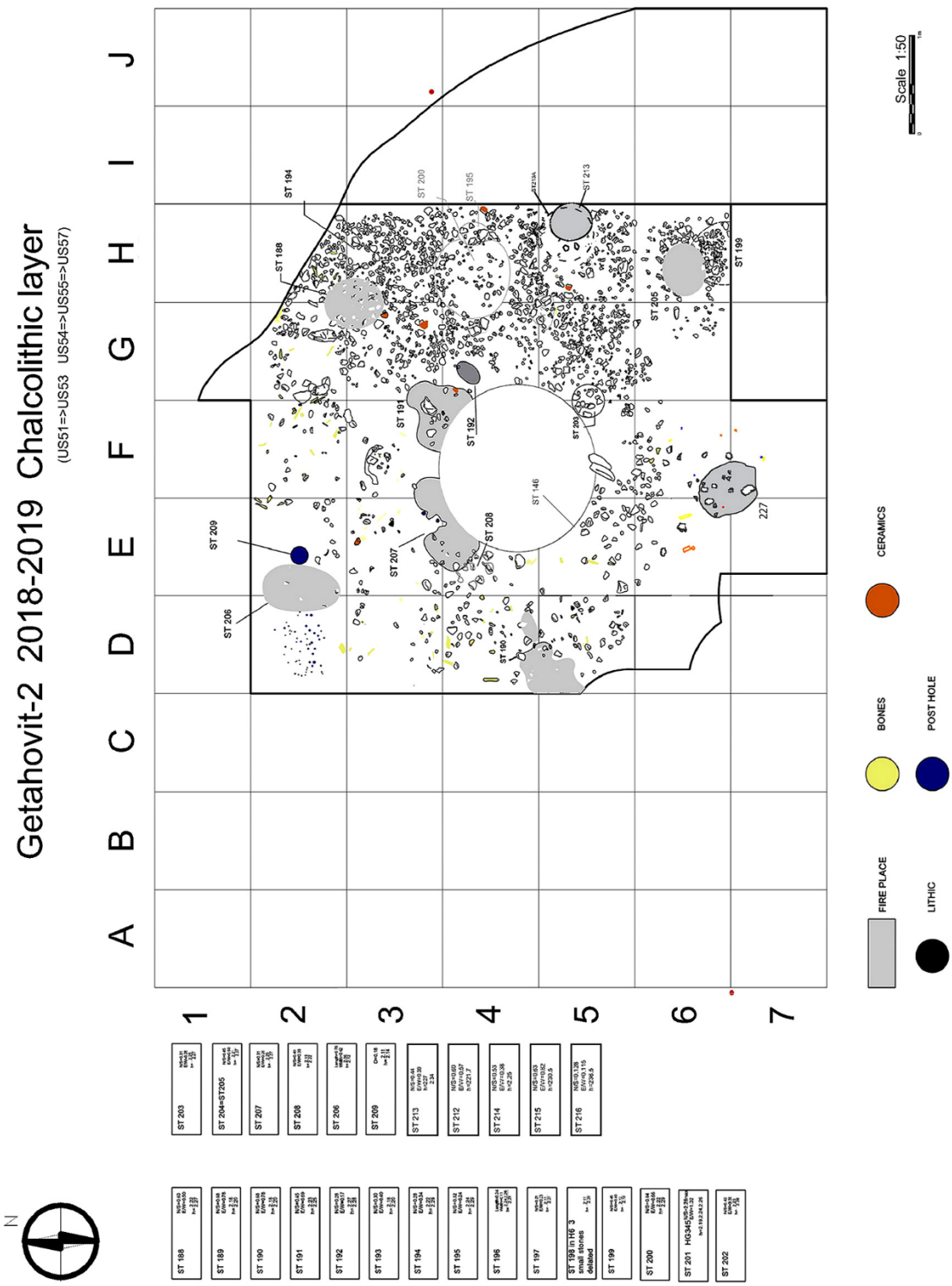


Fig. 4. Plan of the Chalcolithic layer.
Planul nivelului calcolitic.

Code Lab.	Year	Sequence	Level	Material	Date BP	Date AD (95%)	Period
1LTL12043A	2011	C7	decap. 03	Charcoal	933 ± 45	1021-1206 AD	Middle-Ages
Lyon-10370 (SacA-34117)	2012	D7	niv.3, F10, near the skull	Charcoal	1060 ± 30	897-1024 AD	
Lyon-13486 (SacA-47796)	2015	G3	str.81 (child tomb)	Charcoal	980 ± 30	993-1155 AD	
						Date cal BC (95%)	
BETA-306022	2011	C7	decap. 05	Charcoal	5490 ± 30	4445-4262	Chalcolithic
Lyon-10368 (SacA-34115)	2012	D6	niv. 4	burnt bone	5520 ± 30	4449-4331	
Lyon-10369 (SacA-34116)	2012	D6	niv. 5	Charcoal	5575 ± 30	4458-4353	
Lyon-11540 (SacA-38689)	2013	B5	US 5	Charcoal	5485 ± 40	4447-4258	
LTL-14985A	2014	B4/ B5	US 06 st.65	Charcoal	5626 ± 45	4541-4360	
LTL-14986A	2014	C7	US 12 st.69	Charcoal	5719 ± 40	4683-4463	
Lyon-13482 (SacA-47792)	2015	E3	US 32	Charcoal	5420 ± 35	4346-4179	
Lyon-13484 (SacA-47794)	2015	I6	str.97	Charcoal	5340 ± 35	4316-4051	
Lyon-13483 (SacA-47793)	2015	I6	US 30	Charcoal	5400 ± 35	4341-4077	
Lyon-13485 (SacA-47795)	2015	I4	st.127	Charcoal	5435 ± 35	4347-4050	
BETA-510630	2018		US 52 st.187	Charcoal	5640 ± 30	4542-4371	
BETA-510631	2018		US 57, next to st.104	Charcoal	5770 ± 30	4703-4545	
LTL-14987A	2014	D7	US 14 st.71	Charcoal	6174 ± 45	5289-4995	Late Neolithic
BETA-393561	2014	B6	US 18 st.73	Sediment	19750 ± 70	22020-21685	Upper Palaeolithic

Tab. 2. Getahovit-2 excavations and stratigraphy.
Getahovit-2 săpătura și stratigrafia.

◈ Materials and methods

The materials presented in this paper is originating from Getahovit-2 cave (US 49, 51, 52, 53, 54, 56, 60, structure 146, 222) excavated during 2018-2019 excavation seasons (tab. 3.). A comprehensive sampling strategy was adopted at the site. Dry sieving was used to recover the bones in addition to picking. The samples were sieved using 1 mm sieve. Of the sieved material in the >1mm fraction, all organic remains (plants, insects, micromammals), bones, pottery fragments, etc., were separated via hand-picking and labeled appropriately. The faunal remains were identified in the laboratory by the first author, according to N.K. Vereshchagin, 1967; VG. Heptner *et alii* 1988; S. Hillson 2009 and M. Mashkour, F.A. Mohaseb 2015. Microscopicanalysis is used to detect signs of wear on working edges. For this aim we used stereoscopic microscope mbc 9 with magnifications 8x or 14x.

The recorded bone tools are morphologically very diverse (awls, arrowhead, weaving tools etc.). Most of these tools were made from hard animal materials (bone and antler). A strong selectivity of raw material is set down for each tool type, with a preference for cervid antlers and long bones. Comparison of metric structures with material recorded in other papers took place too. Following Scheinsohn (2010), it is known that metric and geometrical properties are directly linked to mechanical ones.

Bone No.	**Excavation date**	**US/structure**	**square**	**age ^{14}C BC**	**Identified tool**
Bone No.	03.10.2018	US 56	D5	4703-4545	Arrowhead
0030/18	20.09.2018	US 52	G5	4683-4463	Weaving tool
0032/18	21.09.2018	US 52	G6	4683-4463	Awl
0030/18	30.09.2018	US 51	D5	4703-4545	Awl
	22.09.2018	US 53	D2	4703-4545	Weaving tool
0030/18	22.09.2018	US 53	D2	4703-4545	Ornamented bone fragment
0031/18	2018	US 49	F5	4542-4371	Ornamented bone fragment
	22.09.2018	US 52	H5	4683-4463	Weaving tool
	20.09.2018	US 52	F3	4683-4463	Beveled tool
	20.09.2018	US 52	G5	4683-4463	Beveled tool
0025/18	25.09.2018	US 51	F2	4703-4545	Awl
0026/18	22.09.2018	US 52	H6	4683-4463	Awl
0027/18	2018	US 51	E4	4703-4545	Awl
	2018	US 51	E4	4703-4545	Awl
0030/18	27.09.2018	US 54	E2	4703-4545	Awl
	30.09.2018	US 51	E2	4703-4545	Weaving tool
0030/18	29.09.2018	US 51	D2	4703-4545	Ornamented bone
0024/18	30.09.2019	US 60	E6	post 4703-4545	Awl
0039/19	22.09.2019	US 60	F6	post 4703-4545	Awl
0040/19	28.09.2019	US 60	D6	post 4703-4545	Stripes – beads
0041/19	2019	Str.222	F6-7	medieval	hook
0010/13	2013	US 0	I7	medieval	hook

Tab. 3. Bone tools from the Getahovit-2 cave site.
Unelte de os din peștera Getahovit-2.

◈ Results. Bone types

Pointed tools. Points (any tool with a sharp point and no perforation, including what are often referred as awls, pins, perforators) are the most significant group of bone tools in Getahovit-2 Cave layers. The majority of the points are made of Cervid's long bones and a few identified as a metapodial bone. Getahovit points fall into not elaborately worked group (fig. 5).

Bone technology extraction techniques for these group of tools can be divided into two groups a) fractured: by direct or indirect cutting percussion and b) pressured: such as grooving, usually followed by fracturing, which leaved different types of marks on the bone material, such as: fractured faces with impact notches, deep groove marks, corroded and striated edges (fig. 6).

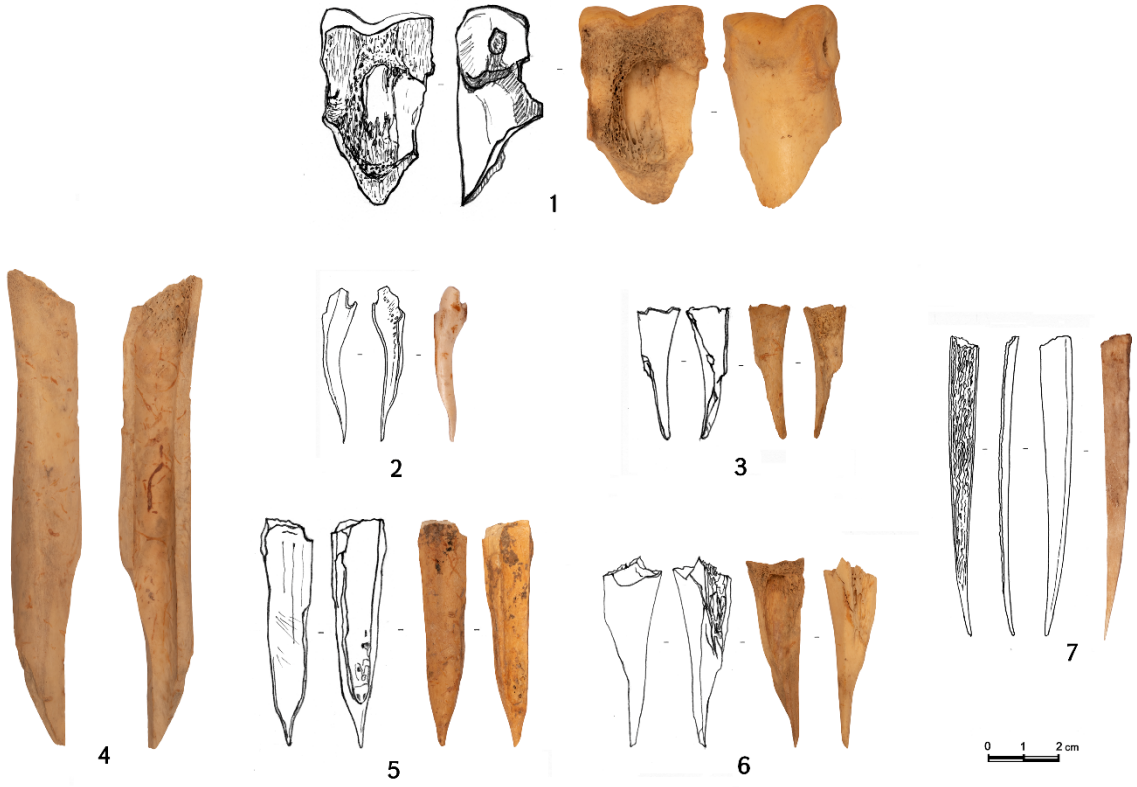


Fig. 5. Awls from Getahovit-2.
Împungătoare de la Getahovit-2.

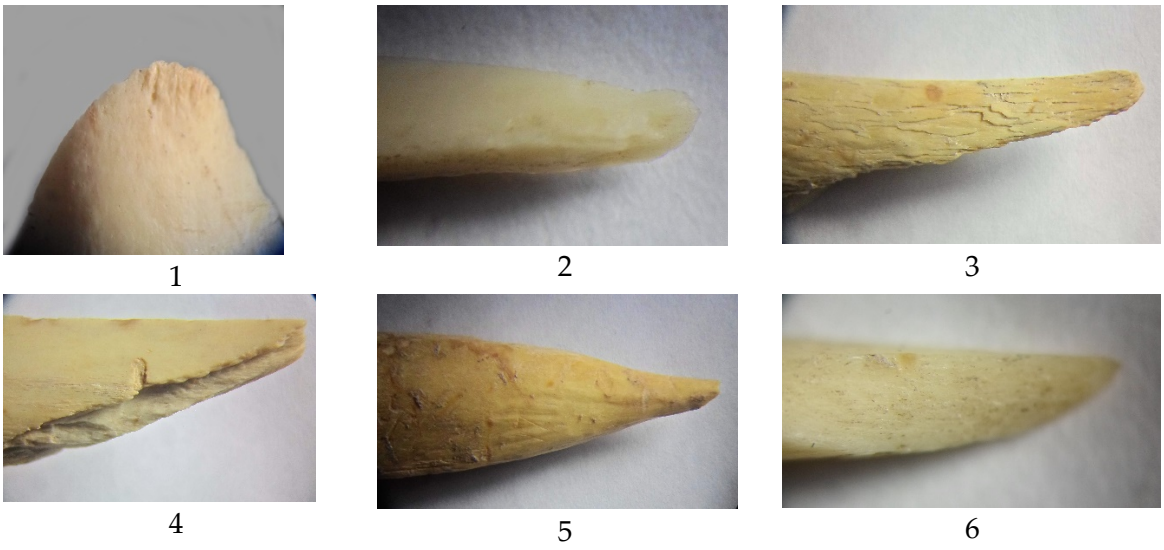


Fig. 6. Awls use-wear marks.
Urme de uzură ale împungătoarelor.

Beveled tools. Beveled tools are made on flat part of long bones worked to have straight, smoothed edges. The ends can be blunt or rounded. The ends of most of this type of tools are not sharp enough to have been used as awls, nor are they sufficiently sturdy, and they typically taper to one edge instead of a central point. The two tools we recovered were not complete, missing two ends or at least one end. The first one (fig. 7) was only 2.5 cm long, made from large mammal long bones (tibia is the preferred skeletal element) and the second (fig. 8) was 5 cm but thin and probably part of sheep/goat rib. Beveled end made by direct percussion and by adzing, which must help to use these tools in animal leathers or furs workings.

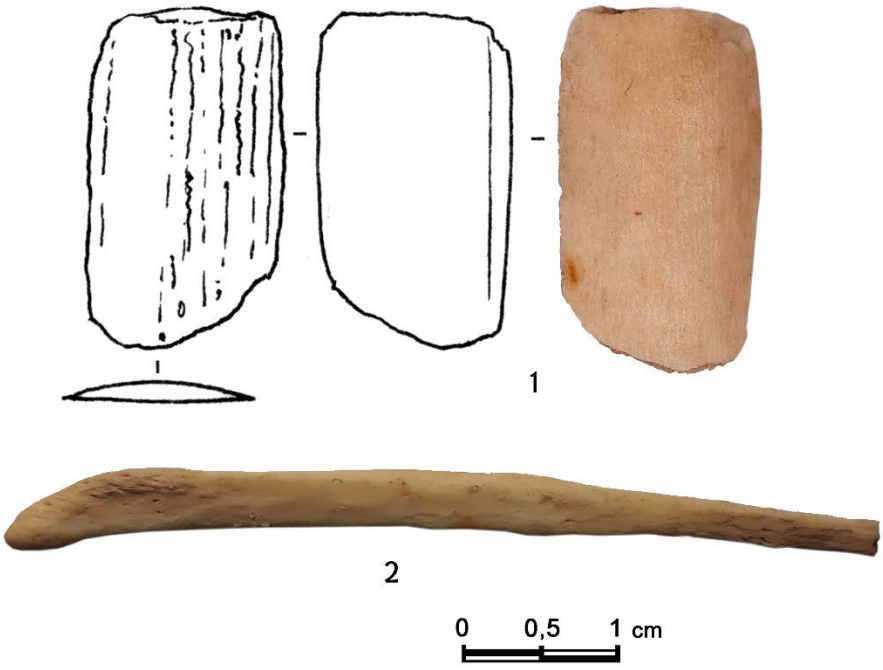
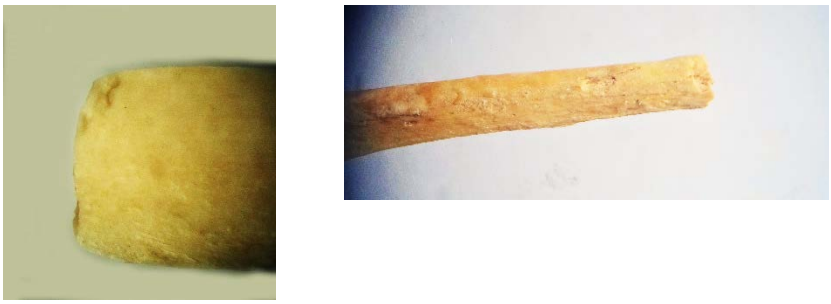


Fig. 7. Beveled tool from Getahovit-2 cave.
Unelte teșite din peștera Getahovit-2.



1 2

Fig. 8. Beveled tools use-wear marks.
Urme de uzură ale dălților.

Hooks. Hooks are straight tools with a pointed tip and a hole for stringing at the end. They are in general well formed, smoothened, most often oval, cylindrical or even have a flatter profile. represent flat bars of 5-5.5 cm of length widened from the pointed tip to the blunt end which has a semicircular eye at the lateral side. These hooks were being common from the Neolithic period up to modern times and had multifarious usage in different handicrafts (knitting, crocheting) and especially for knitting of fishing nets (B. Peters 1986). The finds of such tools at Getahovit-2 are unique as they are unknown from the excavations of the medieval sites of Armenia. A similar item is known only in Garni which is considered to be a fragment of a bow (H. Petrosyan 1988). These elements are almost exclusively crafted from long bones (ulna, tibia etc.) or from horns by grinding, tempering, polishing (fig. 9). Use-wear traces, including flattening, fractions and rounding of the surfaces and transversal grooves are obvious on each hook.

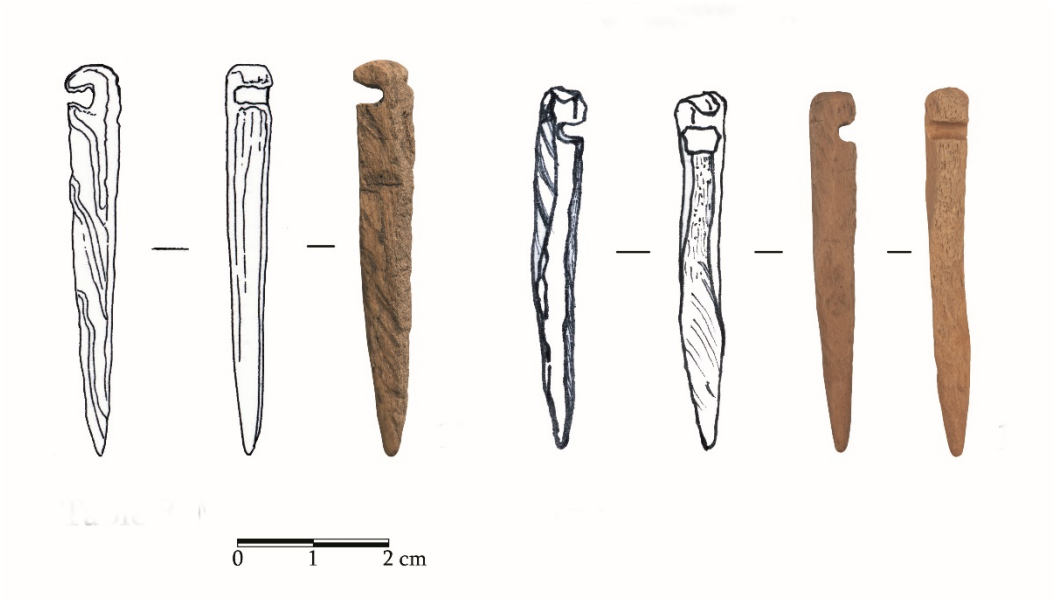


Fig. 9. Hooks from Getahovit-2 cave.
Cârlige din peștera Getahovit-2.

Weaving tools. Primitive spinning, weaving and may be polishing tools recorded from Getahovit-2 cave. Four tools of different widths and different design, made of horn phalanges and long bone of Cervids supposed to be used in weaving stuff from leather, wicker, bark and

thick threads (fig. 10).The first bone is small cervid horn cut straight successfully and the anterior bone tissue wear shows the usage of this bone as weaving tool. The second and third bones have clear incisions on the outer part as use-wear evidences. On the last bone except the straight cut we can notice the mechanical traces of force application in the form of cracks (fig. 11).

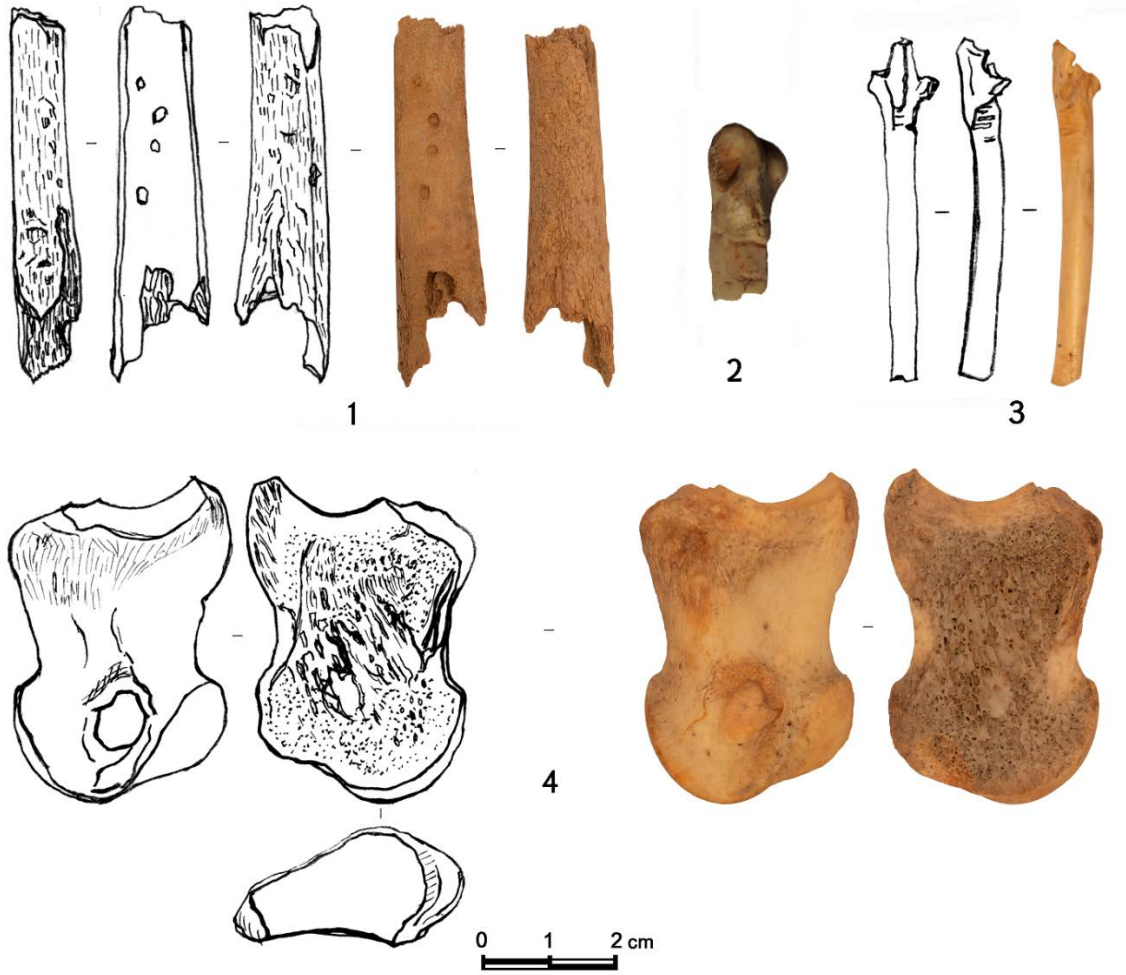
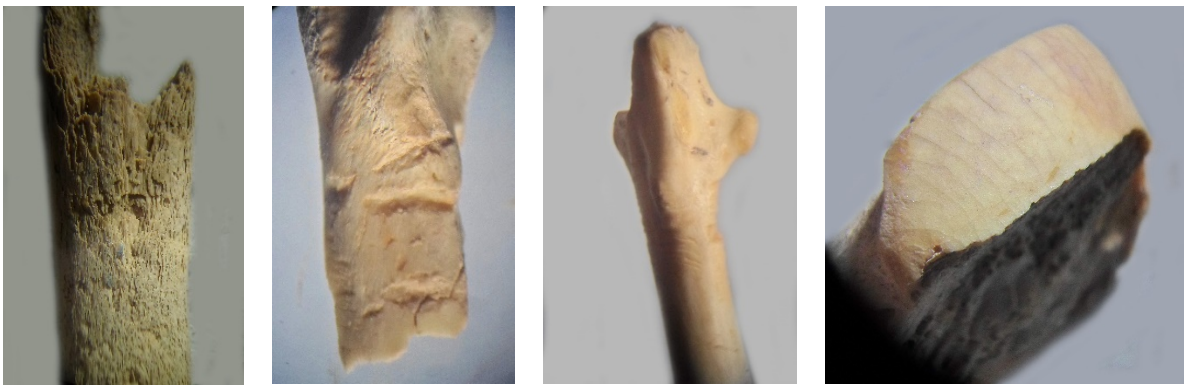


Fig. 10. Weaving tools from Getahovit-2 cave.
Unelte de țesut din peștera Getahovit-2.



1 2 3 4

Fig. 11. Weaving tools use-wear marks.
Urme de uzură ale uneltelor de țesut.

Arrowhead. One arrowhead recorded from Getahovit-2 cave (fig. 12). This arrowhead is made of the diaphysis of long bone. Bone and species cannot be identified, as a rule, but most likely tibial bone of cattle or horse or deer were used, their bones occur also among faunal remains of these sites. The size of this arrowhead tells the possibility to use it in fishing practices rather than hunting big mammals. Figure 13 shows the use-wear marks of the arrowhead, short scratchesnear the working edge. Similar evidence used for a comparison the recorded arrowhead by N. Skakun from Russia (N. Skakun *et alii* 2014).

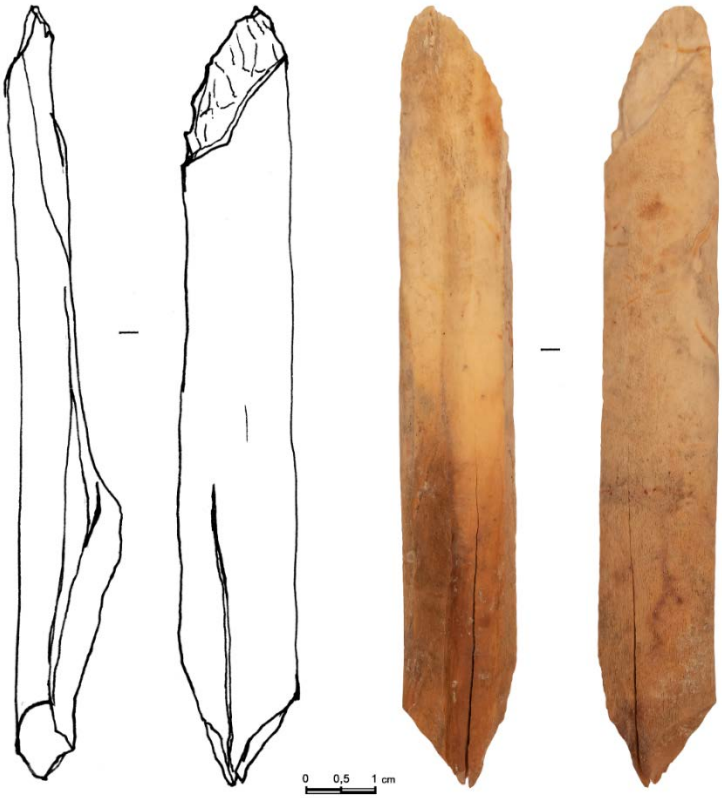


Fig. 12. Arrowhead from Getahovit-2 cave
Vărfuri de săgeată din peștera Getahovit-2.

Fig. 13. Arrowhead use-wear marks.
Urme de uzură ale vârfurilor de săgeți.

Ornamented bones and beads. Most of the bone ornaments at Getahovit-2 sites are tubular beads (fig. 14). Several polished tubes appear to be blanks for making tubular beads. Bird long bones were the preferred taxa and skeletal elements for making tubular beads, which generally had highly polished surfaces and abraded ends. One bead made from vertebras body part, which could not be identified to taxa. These beads may have been made and used as ritual paraphernalia by the ceremonial or simply as a necklace. directional scars result of drilling on the outer surface, and polish (fig. 15).

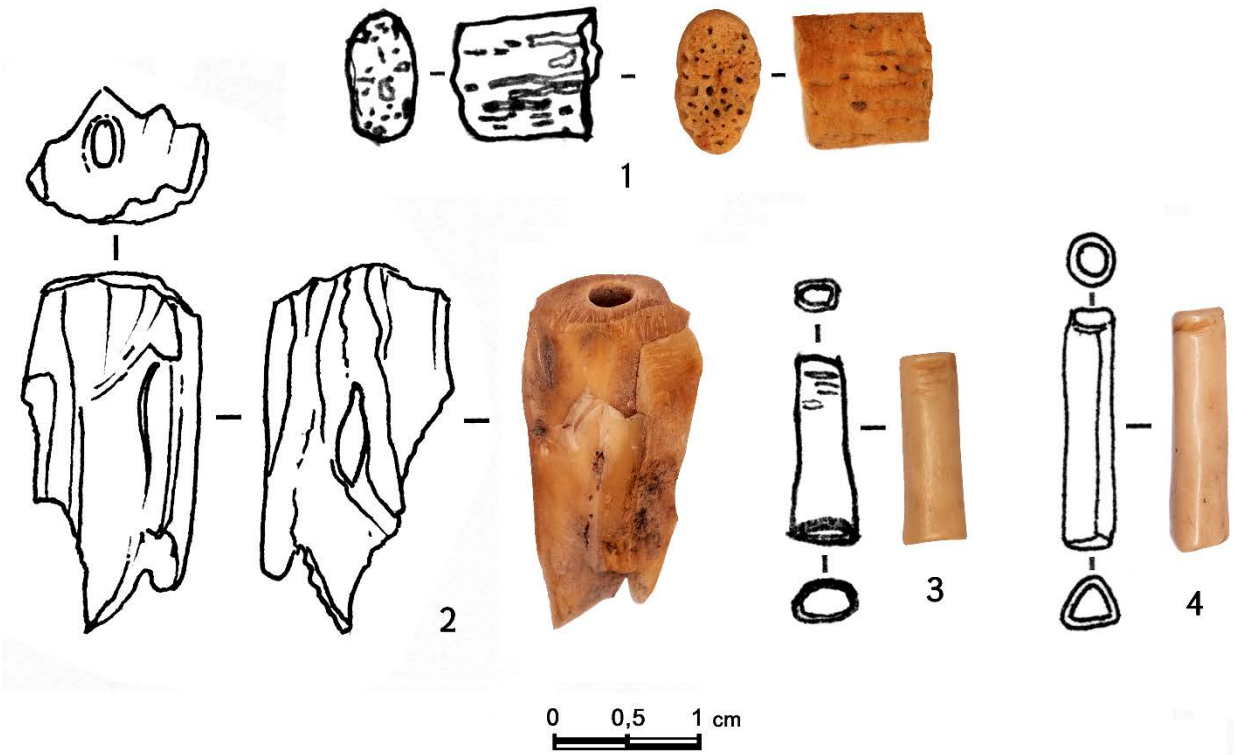
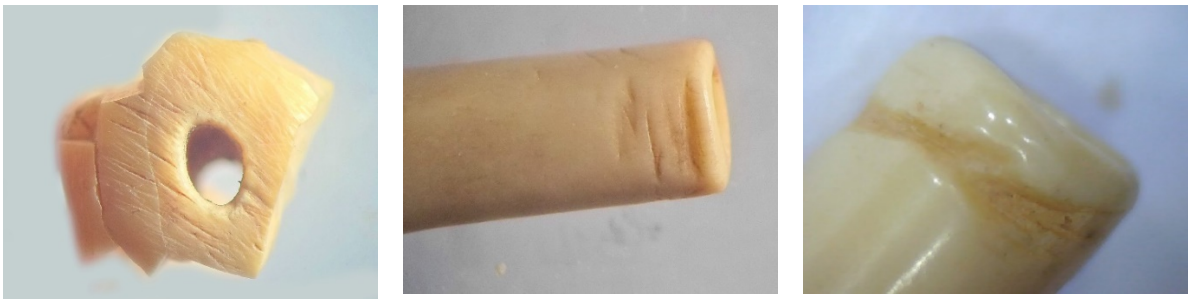


Fig. 14. Ornamented bones from Getahovit-2 cave.
Podoabe de os din peștera Getahovit-2.



1 2 3

Fig. 15. Use-wear of bone beads.
Urme de uzură ale podoabelor.

◈ Conclusions

The industry of tools made of stone as those make of bones during the life in the caves had special singularities. If during the life in the seasonal sites of the Chalcolithic period such

as Godedzor (Syunik Marz) in the south of Armenia (C. Chataigner *et alii* 2010) it is possible to see the clear evidence of the workshops for bone or obsidian tools producing (G. Palumbi *et alii* 2021), in the cave such as Getahovit-2, where the habitat was subservient to cattle breeding (herding), with the vital activities like hunting and gathering all the processes were shorter and simplified. There were no finds of the perfectly processed bone tools, the same was in the case of obsidian, where only broken and fragmented parts or the flakes were found mostly. Of course, it was clear that for the cave occupants sensible way was to take the best tool products with them. During the season 2018-2019 there was the first time when the traces of the preparation of the future tools were found, which means that the occupants of the cave were settled for a comparably long time and produced more. The first time at the site, especially from the Chalcolithic layers, there were the finds of decorations. Except for the awls, which usually present the largest group of the tool industry, other bone tools appeared also at the discussed layers of the Getahovit-2 site. Based on experimental results, we identified the extraction techniques in the archaeological assemblages of Getahovit-2. Most of tools (awls and arrowhead) were made from long bones. We high spot the importance of bone as a resource for tools and ornaments in the Getahovit-2 cave. By coordinating the analysis of bone implements from Eneolithic period site and by comparing bone tools across specific backgrounds (Y. Zaidner, M. Weinstein-Evron 2012), the disparity in the specific set of tasks associated with each inhabitation has been seen.

The presence of these tools in conjunction with other instruments, underline the importance of filament working in this period. Some bone tools, especially awls clearly had a range of uses, beveled tools can be tied more closely to specific spinning and weaving tasks, while the hooks from Medieval layers presents a short period of human activity near rivers (knitting fishing nets).

Overall, we aim to analyze and find way for the identification of bone objects. Through the systematic discussion of bone tools as part of larger archaeological composite, we see that basic classes of bone execute were broadly shared. Here, these findings are as introduction to the irregular economic practices, task profession, and likely interactions between this period inhabitants in the cave.

The results suggest that the hunter-gatherer societies in Getahovit-2 cave the bone technology required a careful selection of raw materials and the fracturing would have been the most common and economic option.

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Topografia și cronologia descoperirilor funerare eneolitice de la Alba Iulia-*Lumea Nouă* (cercetările 2003-2018)

Marian-Bogdan CONDURĂȚEANU*,
Mihai GLIGOR**

Rezumat: *Studiul prezintă descoperirile funerare aparţinând grupului cultural Foeni rezultate în urma cercetărilor arheologice efectuate între 2003 şi 2018 în situl de la Alba Iulia-*Lumea Nouă*. Datele sunt integrate într-un sistem informaţional geografic şi sunt corelate cu analizele osteoarheologice şi determinările ^{14}C.*

Abstract: *The study presents the funerary discoveries belonging to the Foeni cultural group resulted from the 2003-2018 archaeological researches at the Alba Iulia-*Lumea Nouă *site. The information is integrated in a GIS and is correlated with the osteoarchaeological analysis and the ^{14}C data.*

Cuvinte cheie: *Alba Iulia-*Lumea Nouă*, grupul cultural Foeni, eneolitic, topografie, GIS, date osteoarheologice, analize ^{14}C.*

Keywords: *Alba Iulia-*Lumea Nouă*, Foeni cultural group, Eneolithic, topography, GIS, osteoarchaeological analysis, ^{14}C data.*

◈ Introducere

Situl Lumea Nouă este localizat în nord-estul municipiului Alba Iulia (fig. 5), pe a doua terasă a Mureșului, la ieșirea către localitatea suburbană Miceşti şi este mărginit la est şi nord de terasa înaltă a unui pârâiaş dispărut acum, cunoscut sub numele de Uj din hărțile vechi (fig. 57), afluent al râului Ampoi, iar la sud şi vest de Calea Moţilor (DN74). Centrul său pare a fi în preajma fermei Arhiepiscopiei Romano-Catolice, iar întinderea cunoscută este de circa 40 ha (fig. 7). Situl a fost descoperit întâmplător în anul 1942 de către lucrătorii angajaţi de Primăria Alba Iulia cu ocazia efectuării unor puțuri pentru captarea unui izvor şi construirea de bazine pentru aprovizionarea cu apă potabilă a orașului. Muncitorii au descoperit atunci un strat compact de arsură şi cioburi de vase astfel că au alertat muzeul local, care la 6 martie 1942 a întreprins primele sondaje. Cercetările arheologice au fost coordonate de Dumitru și Ion Berciu și au avut loc în perioadele 11-23 aug. 1944, 10-20 sept. 1945, 6-7 nov. 1945 şi 22-25 aug. 1947 (D. Berciu, I. Berciu 1949, p. 1-2).

Cercetările la situl de la Lumea Nouă au fost reluate în campaniile din 1961-1963, 1976, 1995-1996 (M. Gligor 2007, p. 161-174; M. Gligor 2016, p. 32-33). Situl este protejat, fiind marcat atât în RAN sub numărul 1026.05, cât şi în LMI sub codul AB-I-m-A-00005 şi ca atare a făcut, începând cu 2002 şi până în prezent, obiectul a numeroase cercetări arheologice preventive şi sistematice efectuate în perimetrul acestuia (M. Gligor 2009, p. 25-58; M. Gligor 2020 p. 10-16, Pl. I-XIII; M. Mărgărit *et alii* 2020, p. 301, Fig. 1, Tab. 1).

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◈ O istorie a sitului ilustrată prin hărți topografice și fotografii aeriene

A doua ridicare ridicare topografică a Imperiului Habsburgic, comandată de Împăratul Francisc I, în cadrul căreia au fost întocmite peste 3300 planşe la scara 1:28.800 în proiecţia topografică Cassini s-a realizat în perioada 1806-1869. Pe una dintre acestea este consemnată pentru prima dată denumirea sitului, *Neue Welt* – Lumea Nouă. Tot acum sunt menționate şi două mori pe pârâul Uj, Moara Episcopală de Sus (*Obere Bischofs M*[uhl]) şi Moara Episcopală de Jos (*Untere Bischofs M*[uhl]), care încadrează situl la NE şi, respectiv, SE (fig. 1). Cea de-a treia ridicare topografică (*Franzisco-Josephinische Landesaufnahme*) a fost realizată între 1869-1896. Pentru zona noastră de interes se constată păstrarea toponimelor prezentate mai sus sub formă prescurtată din cauza scării mai mici (1:75.000). În plus faţă de ridicarea anterioară apare marcat un pod la sud de sit pe drumul spre Miceşti (fig. 3). Ambele hărţi utilizate în articolul de faţă au fost achiziţionate în formă georeferenţiată de pe situl mapire.eu.

Cea mai veche imagine aeriană a sitului de la Alba Iulia-*Lumea Nouă* cunoscută până în prezent este cea de recunoaştere aeriană de la mijlocul anului 1938, aparţinând Luftwaffe. Din păcate, fotografia acoperă doar jumătatea sudică a sitului (fig. 3). Imaginea a fost îmbunătăţită înainte de georeferenţiere în software-ul de inteligenţă artificială Sharpen AI de la Topaz Labs. Fotograma DTM din 1955 (fig. 5) aduce detalii topografice suplimentare asupra colţului nord estic al sitului - neacoperit de fotograma germană din 1938 - şi lămureşte traseul superior al pârâului Uj înspre nord precum şi traseul drumului vechi de exploatare în sit, dispărut astăzi, care, după ce înainta câteva zeci de metri spre nord, cotea uşor pe direcţia NNV, menţinându-se paralel cu drumul spre Miceşti, actualul DN74.

De menţionat şi schiţa sumară găzduită de articolul fraţilor Berciu din 1949 deja amintit mai sus (fig. 4), care ulterior este integrată[1] în harta topografică (fig. 6) publicată în monografia din 2009 dedicată acestui sit.

Situl este împărţit în 3 mari zone (M. Gligor 2009, p. 25, pl. XX): Zona A, mărginită la est de canalul colector şi la vest de strada Alcala de Henares; Zona B, mărginită la vest de strada Alcala de Henares şi la est de râpa fostului pârâiaș Uj; Zona C, localizată la vest de canalul colector (fig. 6).

[1] A se vedea zonele haşurate.

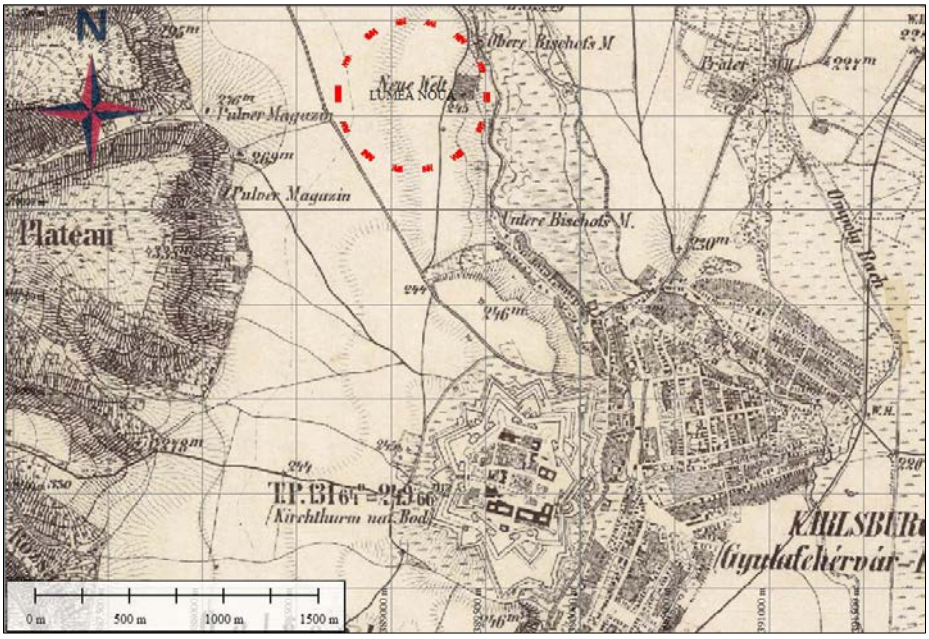

Fig. 1. Karlsburg-Neue Welt (Alba Iulia-*Lumea Nouă*) pe a doua ridicare Franciscană, scara 1:28.800[2].
Karlsburg-Neue Welt (Alba Iulia-*Lumea Nouă*) on the second Habsburg land survey, scale 1:28,800.

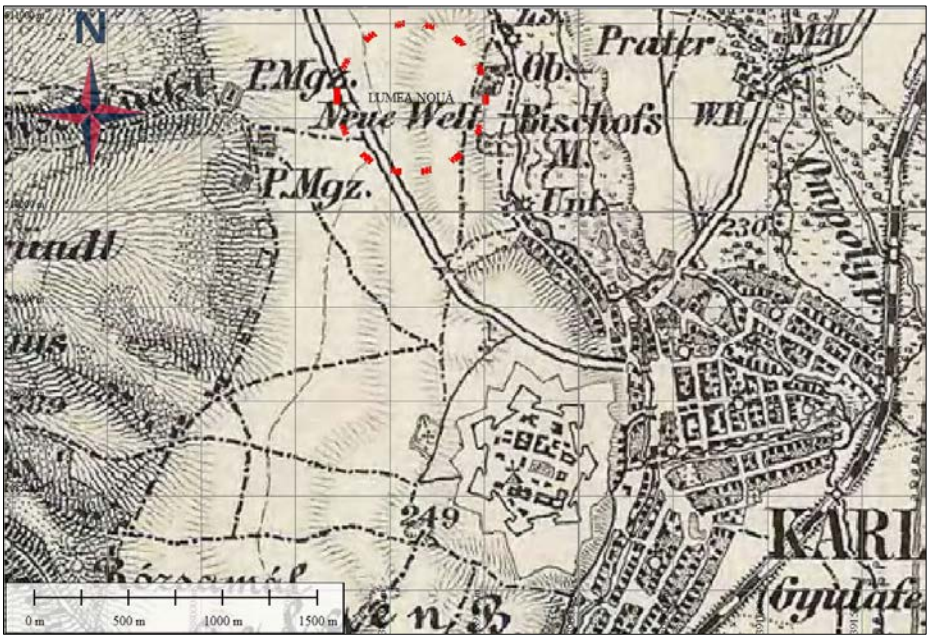

Fig. 2. Neue Welt W.H.[3] pe a treia ridicare Franciscano-Iosefină la scara 1:75.000[4].
Lumea Nouă (Neue Welt) W.H. on the third Habsburg land survey, scale 1:75,000.

[2] Sursa https://mapire.eu/en/map/secondsurvey-transylvania/?bbox=2619998.4703134308%2C5792769.362231882%2C2629089.699365099%2C5795635.750792576&map-list=1&layers=54 (accesat 10.03.2021).
[3] Abr. Wacht Haus – Post de Pază.
[4]https://mapire.eu/en/map/thirdsurvey25000/?bbox=2619998.4703134308%2C5792769.362231882%2C2629089.699365099%2C5795635.750792576&map-list=1&layers=129 (accesat 10.03.2021).

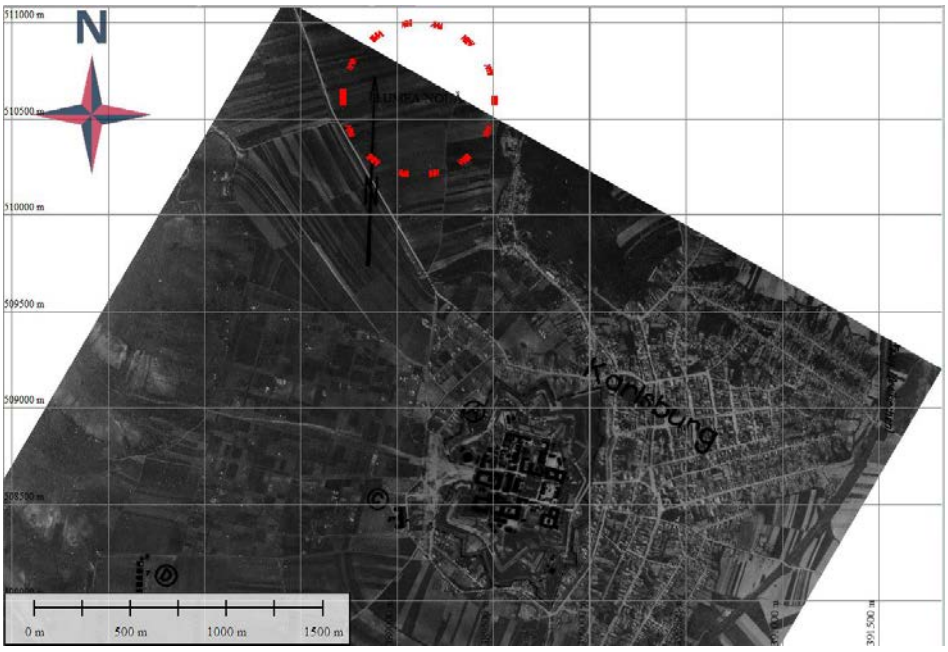

Fig. 3. Alba Iulia și zona sitului *Lumea Nouă*, imagine aeriană Luftwaffe[5] (scara 1:16.000), realizată în 1938.
Alba Iulia and the *Lumea Nouă* site, on 1938 Luftwaffe aerial reconnaissance photo (scale 1:16,000).

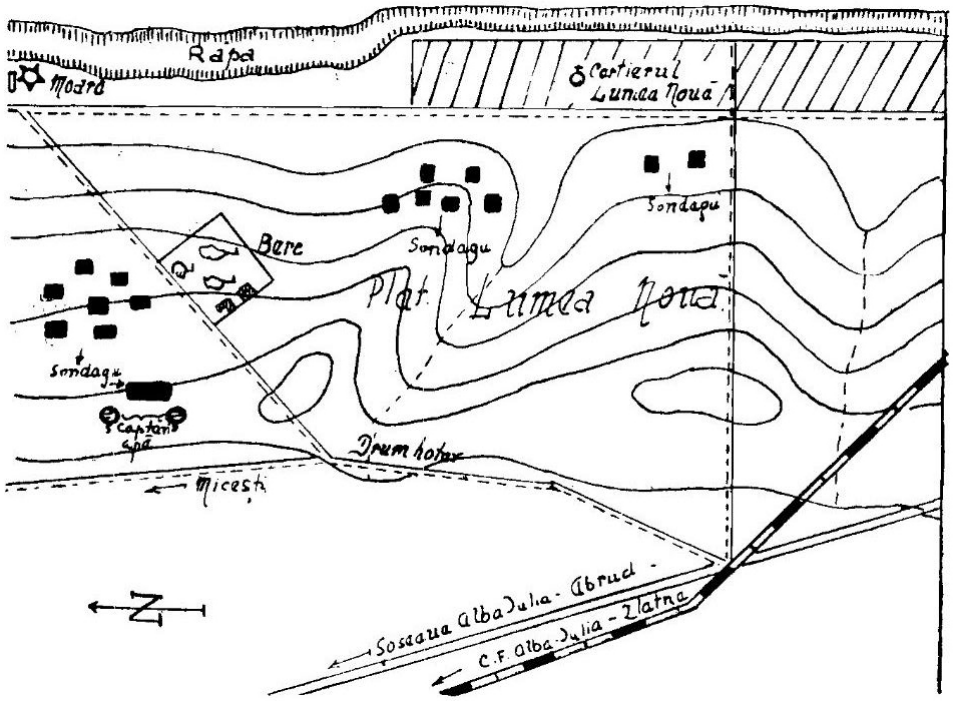

Fig. 4. Schița topografică a sitului Alba Iulia-*Lumea Nouă* la nivelul anului 1947 (*apud* D. Berciu, I. Berciu 1949, fig. 1).
1947 The topographical sketch of the Alba Iulia-*Lumea Nouă* site (*apud* D. Berciu, I. Berciu 1949, fig. 1).

[5] Sursa imaginii este https://www.wwii-photos-maps.com directorul /Miscellaneous Maps/Romanian Maps/Alba Iulia 132.tif (accesat 28.11.2021 folosind WinSCP).

Fig. 5. Situl de la Alba Iulia-*Lumea Nouă* suprapus peste fotograma DTM 10476-55[6]. Stereo70. GlobalMapper v23.
The Alba Iulia-*Lumea Nouă* site overlaid on top of the DTM 10476-55 aerial photogram. Stereo70. GlobalMapper v23.

◈ Repertoriul descoperirilor funerare aparţinând grupului cultural Foeni de la Alba Iulia-*Lumea Nouă*

Lucrarea de faţă îşi propune o interpretare actualizată a tuturor datelor referitoare la descoperirile funerare eneolitice din perioada 2003-2018 din situl de la Alba Iulia-*Lumea Nouă* prin integrarea, utilizând mijloace GIS, a datelor, hărţilor, ridicărilor şi fotografiilor de sit existente. Pentru acest deziderat, toate planurile de situaţie şi de detaliu au fost georeferenţiate în software-ul GlobalMapper v22.1, utilizând caroiajele din sistemul de coordonate Stereo70 (proiecţie Stereo70 pe datum-ul S-42 Romania). În unele cazuri au fost utilizate fişierele CAD în format shapefile sau DXF cu unităţile de cercetare arheologice şi au fost folosite pentru georeferenţierea mai departe a planurilor de detaliu în cadrul planului de situaţie general.

[6] Imagine reprodusă cu permisiunea scrisă a deţinătorului de copyright, U.M. 02583 Bucureşti, cf. contract A3069 din 21.05.2021.

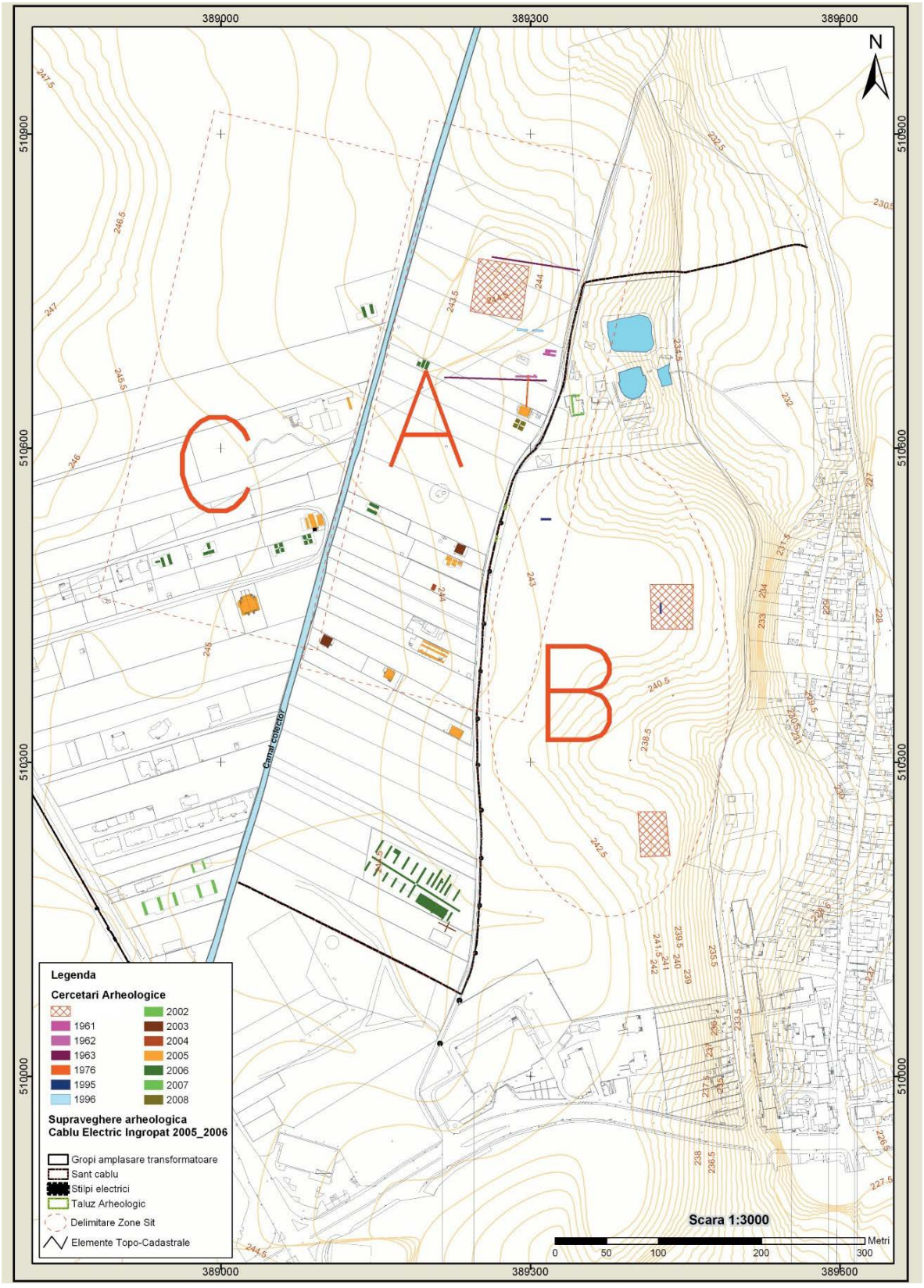

Fig. 6. Harta cu dispunerea unităților de cercetare arheologică de la Alba Iulia-*Lumea Nouă*, la nivelul anului 2008 (*apud* M. Gligor 2009, pl. XX).
The 2008 layout of the archaeological research units from Alba Iulia-*Lumea Nouă* (*apud* M. Gligor 2009, pl. XX).

Prin cercetările arheologice efectuate în perioada 2003-2018 (Sp. II/2003, Sp. III/2005, Sp. VI/2005, Sp. I/2011, Sp. I/2013-2014, Sp. I/2014, Sp. II/2015, Sp. II/2018, Sp. III/2018, Sp. V/2018) a fost realizat un număr de 10 descoperiri cu caracter funerar (M. Gligor 2006; M. Gligor 2007; M. Gligor 2010; M. Roşu, M. Gligor 2011; M. Gligor *et alii* 2012; Gligor 2013; M. Gligor, S. Băcueţ Crişan 2014; M. Gligor, K. Mcleod 2014; Ch. Lundberg, M. Gligor 2015; M. Gligor, K. Mcleod 2015; M. Gligor *et alii* 2018; A. Fetcu *et alii* 2020a; A. Fetcu *et alii* 2020b; M. Gligor *et alii* 2021) în perimetrul sitului (fig. 7-8). Pentru sistematizarea informaţiei, la fiecare descoperire cu caracter funerar au fost urmărite şi puse în evidenţă următoarele caracteristici:

i. Contextul arheologic;
ii. Planurile topo de detaliu pentru poziţionarea exactă pe hartă;
iii. Datele ^{14}C pentru obținerea cronologiei absolute a fiecărui context funerar;
iv. NMI (Numărul Minim de Indivizi), estimarea vârstei şi sexului decedaţilor din fiecare descoperire funerară[7].

Fig. 7. Harta descoperirilor funerare de la Alba Iulia-*Lumea Nouă*. Fundal GoogleMaps. Stereo70. GlobalMapper v23.
The Alba Iulia-*Lumea Nouă* funerary discoveries map. GoogleMaps background. Stereo70. GlobalMapper v23.

[7] Studiul de faţă nu tratează elementele de paleopatologie şi problematica cauzelor deceselor. O sinteză pentru traumele de tipul fracturilor prin înfundare depistate pe craniile din contextele funerare de la Alba Iulia-*Lumea Nouă* vezi la M. Gligor et *alii* 2018, p. 31, 36-40, Tab. 1, 4-7, Fig. 5.

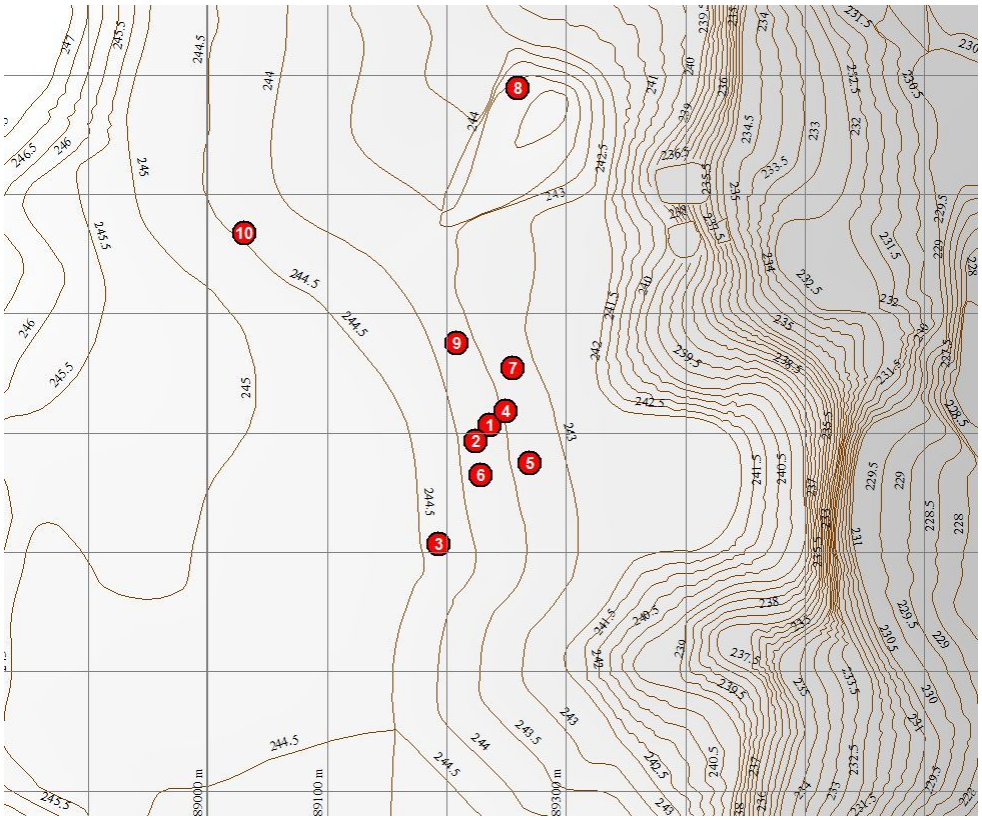

Fig. 8. Harta descoperirilor funerare de la Alba Iulia-*Lumea Nouă*. Pe fundal modelul digital de elevaţii rezultat în urma prelucrării curbelor de nivel publicate în planurile anterioare. Stereo70. GlobalMapper v23.
The Alba Iulia-*Lumea Nouă* funerary discoveries map. In the background the digital elevation model generated through the vectorization of previously published hypsometry Stereo70. GlobalMapper v23.

◈ I. Sp. II/2003 (1- fig. 7-8)

I.i. Contextul arheologic (fig. 9-10)

In caroul C, de la aproximativ ▼0,75 m, a fost identificată groapa G1 cu diametrul variabil cuprins între 1,50–1,70 m, marcată de pietre dispuse pe conturul exterior. G1 conţine resturi umane osoase, aparţinând unor indivizi care nu erau în conexiune anatomică, cu excepţia unuia singur, descoperit pe fundul gropii. Au fost depistate şi oase lungi care se aflau în poziţie oblică, ce indică o descărnare a membrelor aflate în poziţia menţionată. Printre resturile scheletice umane au fost identificate şi bucăţi de diferite dimensiuni de chirpici, antrenate în G1 din resturile unei locuinţei de suprafaţă cercetată în proximitate. Materialul ceramic rezultat în urma golirii gropii este de factură Foeni, Vinča şi ceramică pictată Lumea Nouă. Este foarte probabil ca fragmentele ceramice să fi fost antrenate în interiorul gropii în momentul practicării acesteia (M. Gligor 2009, p. 32, pl. VI, VII/2, XXXIII/2, CCII-CCV; M. Gligor 2013, p. 204). În imediata apropiere a unui craniu a fost descoperit un inel de buclă confecţionat prin batere din cupru nativ şi care este interpretat ca inventar funerar din categoria podoabelor (M. Gligor, S. Varvara 2008, p. 168, fig. 3-5). Descoperirea funerară din G1 este o înmormântare multiplă.

Fig. 9. G1, □C, Sp. II/2003, ▼0,80 m (*apud* M. Gligor 2013, fig. 2).
G1, □C, Sp. II/2003, ▼0.80 m (*apud* M. Gligor 2013, fig. 2).

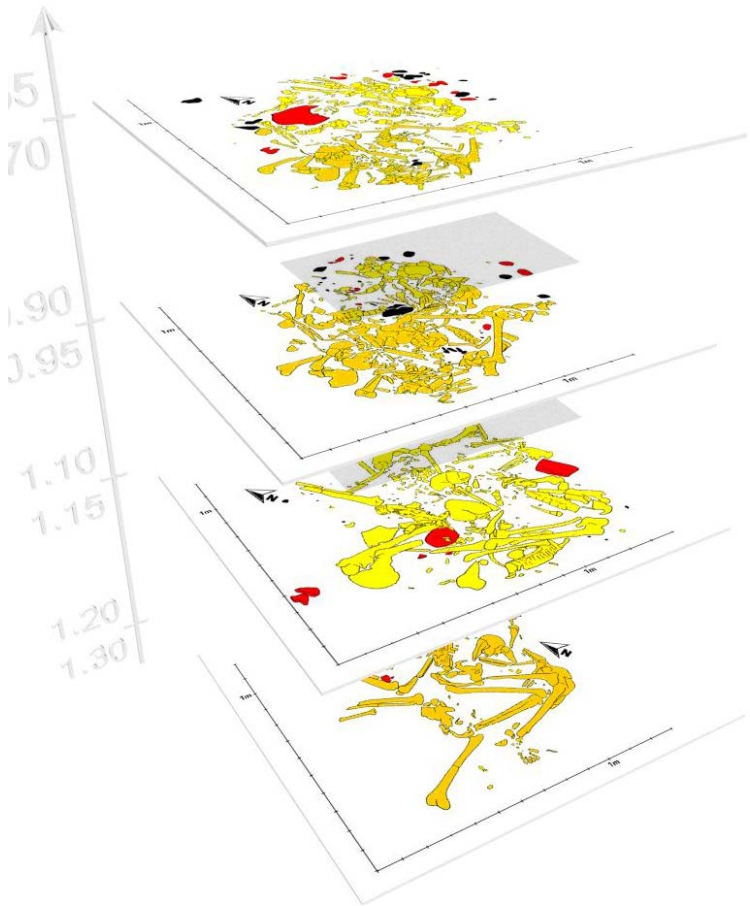

Fig. 10. Suprapunere relevee G1, Sp. II/2003, după M. Gligor, K. Mcleod 2015, p. 26, fig. 1 (a-d). Imagine realizată în software 3D de Ştefan Juglea.
3D overlay of Sp. II/2003, G1 depth plans, after M. Gligor, K. Mcleod 2015, p. 26 fig. 1 (a-d). Image realized în 3D software by Ştefan Juglea.

I.ii. Plan topo (fig. 11)

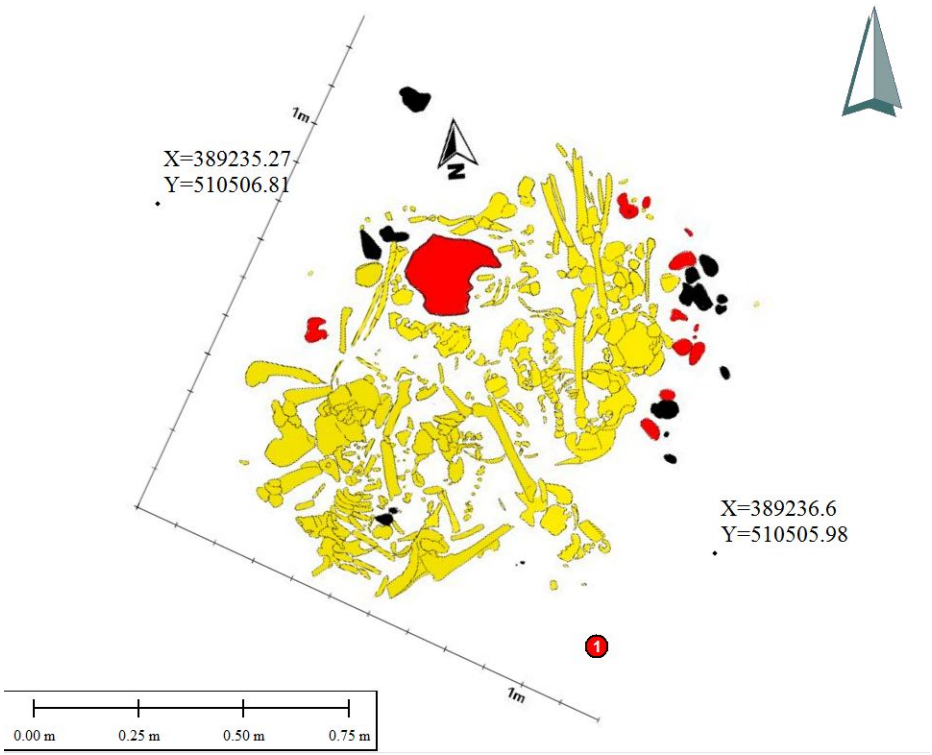

Fig. 11. Plan georeferenţiat Sp. II/2003, □C, G1, ▼0,65 m-0.75 m (*apud* M. Gligor, K. Mcleod 2015, fig. 1a). Stereo70. GlobalMapper v23.
Sp. II/2003 geo-referenced plan, □C, G1, ▼0.65-0.75 m (*apud* M. Gligor, K. Mcleod 2015, fig. 1a). Stereo70. GlobalMapper v23.

I.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 4 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 1 şi fig. 12 (M. Gligor 2007, p. 171; M. Gligor 2009, p. 141; M. Gligor 2014 p. 92; M. Gligor, K. McLeod 2015, p. 24).

Context Arh.	Cod ALN	Cod Lab. Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
□C/G1, ▼0,65-0,75m	ALN #18	Poz-59120	5665 ± 35 BP	4528-4460 calBC	4494 BC	4591-4374 calBC	4483 BC
□C/G1, ▼0,90 m	ALN #01	Poz-19489	5750 ± 50 BP	4683-4543 calBC	4613 BC	4716-4466 calBC	4591 BC
□C/G1, ▼1,00 m	ALN #02	Poz-19375	5650 ± 40 BP	4536-4451 calBC	4494BC	4556-4365 calBC	4460 BC
□C/G1, ▼1,20-1,25m	ALN #19	Poz-59121	5720 ± 35 BP	4605-4501 calBC	4553 BC	4683-4466 calBC	4575 BC

Tab. 1. Rezultatele datărilor ^{14}C din Sp. II/2003, □ C, G1.
Sp. II/2003, □ C, G1 ^{14}C radiocarbon dating results.

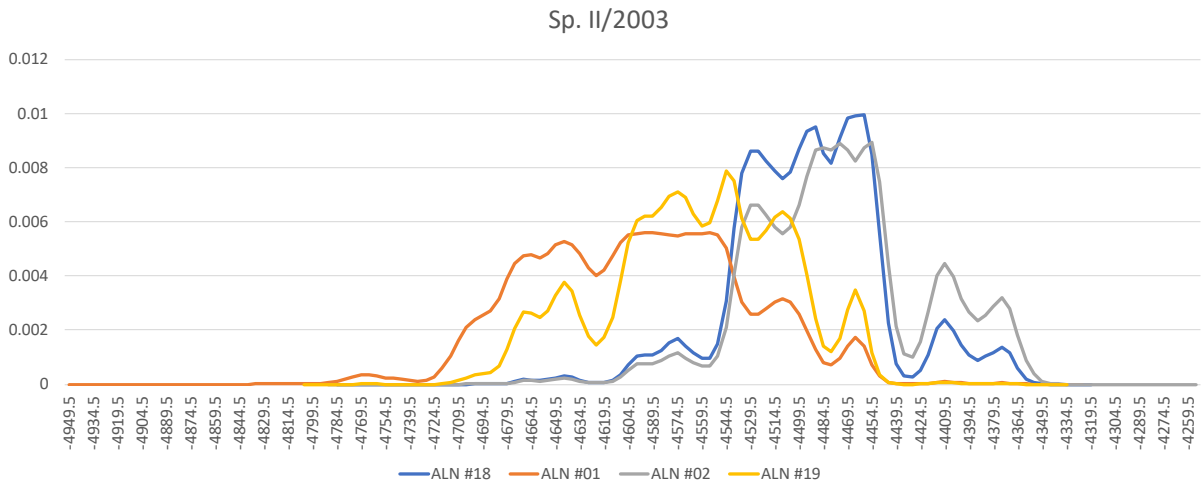

Fig. 12. Distribuţia probabilităţilor datărilor ^{14}C din Sp. II/2003. OxCal v4.4[8].
The Sp. II/2003 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

I. iv. NMI, estimarea vârstei şi sexului (fig. 13-14)

$NMI_{Sp.\ II/2003}$ = 17 (M. Gligor, K. McLeod 2015, p. 25). În fig. 13-14 sunt reprezentate grafic datele privind estimarea vârstei şi sexului decedaţilor din contextul funerar G1 (M. Gligor, K. McLeod 2015, p. 25-26, tab. 2-8).

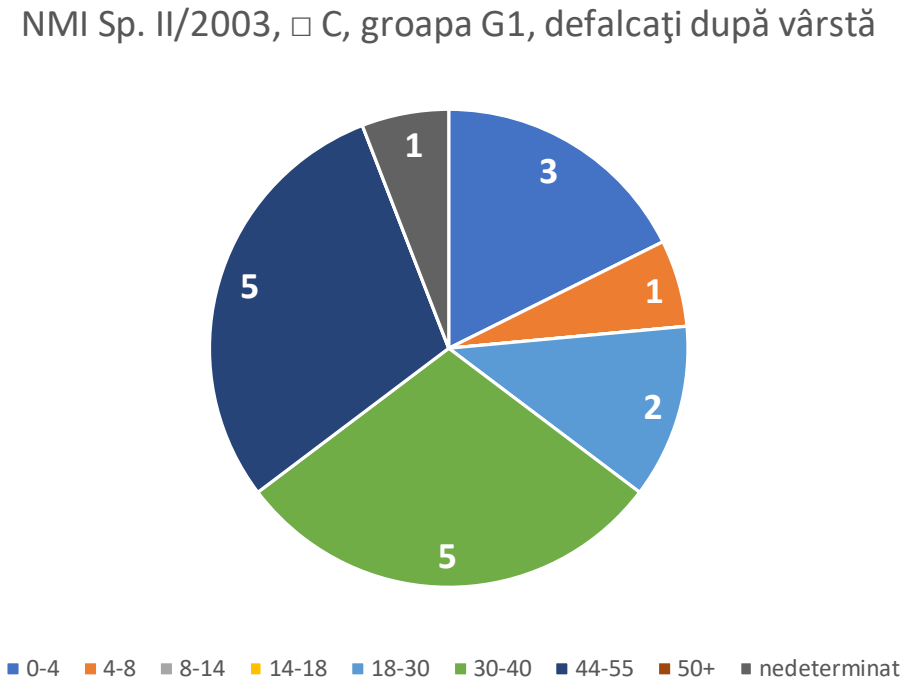

Fig. 13. NMI Sp. II/2003 , □C, G1, defalcaţi după vârstă.
The Sp. II/2003, □C, G1 MNI distribution according to age.

[8] Bronk Ramsey 2009, https://c14.arch.ox.ac.uk/oxcal/OxCal.html.

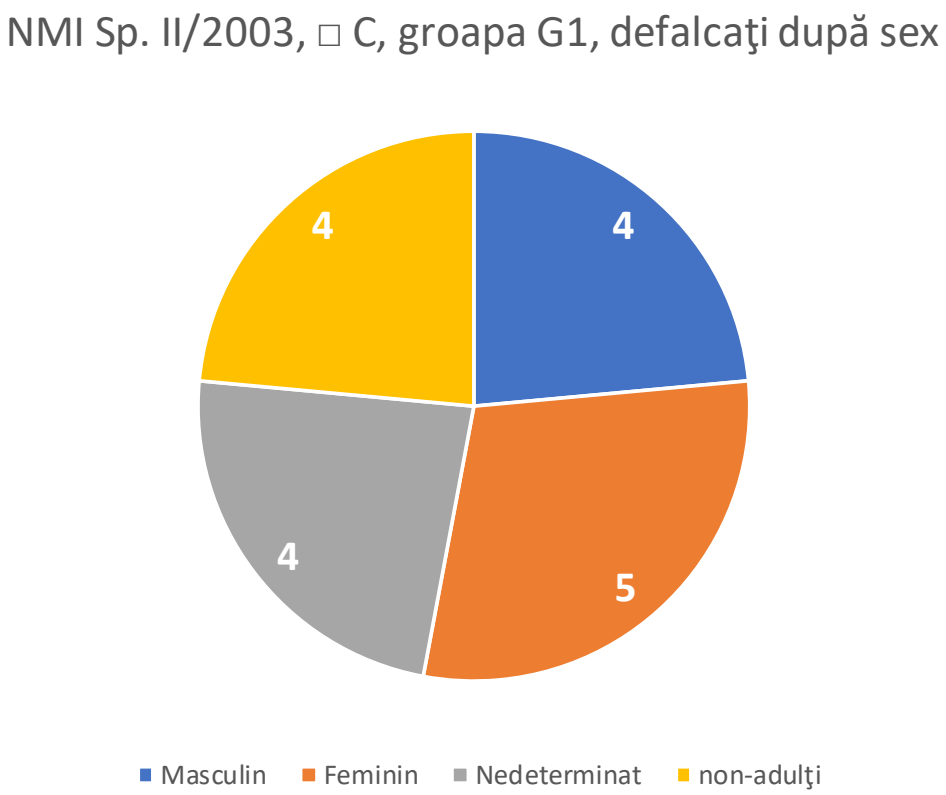

Fig. 14. NMI Sp. II/2003, □C, G1, defalcaţi după sex.
The Sp. II/2003, □C, G1 MNI distribution according to sex.

◈ II. Sp. III/2005 (2- fig. 7-8)

II.i. Contextul arheologic (fig. 15)

În caroul B, la ▼0,65 m a fost depistată o aglomerare de oase umane. S-a delimitat Cx01 cu suprafaţa de 5x2,5 m şi groapa G1 cu dimensiunile de 1,35x1,65 m şi adâncimea maximă de 2,10 m. Întreaga suprafaţă cu resturi scheletice a beneficiat de o caroiere internă pentru cercetarea descoperirii funerare, fiind individualizate 16 unităţi cu dimensiunea de 1mp. S-a constatat faptul că scheletele nu au fost descoperite în conexiune anatomică. Un procentaj semnificativ de oase lungi au fost depistate în poziţie oblică, fapt ce acreditează ideea că trupurile defuncţilor nu au beneficiat de nici un fel de atenţie în momentul îngropării. Numai din golirea G1 au fost recuperate peste 20 de cranii umane. De asemenea, spre fundul gropii G1 s-a observat un strat de aprox. 0,50 m de cenuşă, dar şi arsură de culoare cărămizie, dovada unui foc puternic. Unele dintre oasele umane prezintă urme de ardere secundară (M. Gligor 2009, p. 36-38, pl. VIII-XI, CCVI-CCXII; M. Gligor *et alii* 2018, p. 31-33, fig. 4). Descoperirea funerară din Cx01/G1 este o înmormântare multiplă.

Fig. 15. Cx01, □B (m. 14, 5, 11–12), Sp. III/2005, ▼0,80 m (*apud* M. Gligor 2009, Pl. CCVIII/2).
Cx01, □B (m. 14, 5, 11–12), Sp. III/2005, ▼0.80 m (*apud* M. Gligor 2009, Pl. CCVIII/2).

Asociat scheletelor, în Cx01, dar mai ales în G1, au fost depistate material faunistic, artefacte de os, material litic, dar şi un mare număr de fragmente ceramice. Din această ultimă categorie se detaşează o amforă pictată aparţinând grupului Foeni ce a putut fi restaurată. Fragmentele ce compun amfora au fost descoperite în Cx01 (m 3, 5), după cercetarea şi demontarea nivelului cu resturi scheletice umane, majoritatea între -0,90-1,20 m în Cx01 şi la -1,20-1,75 m în G1 (m 13) (M. Gligor 2020, p. 10-11, pl. II-III/1-5).

II.ii. Plan topo (fig. 16)

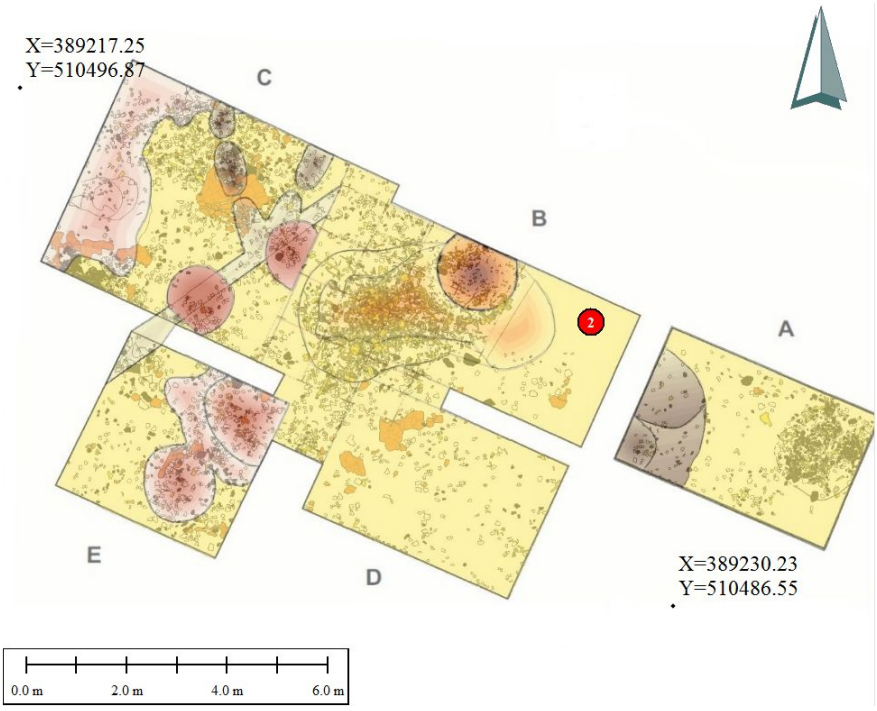

Fig. 16. Sp. III/2005. Cx01, G1 pe baza M. Gligor 2009, Pl. XI suprapusă în transparenţă peste Pl. XV/2. Stereo70. GlobalMapper v23.
Sp. III/2005. Cx01, G1 based on M. Gligor 2009, Pl. XI overlaid in transparency on top of Pl. XV/2. Stereo70. GlobalMapper v23.

II.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 5 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 2 şi fig. 17 (M. Gligor 2009, p. 141; M. Gligor 2014, p. 92, Tab. 1; M. Gligor *et alii* 2018, p. 41, Tab. 10).

Context Arh.	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
□B/Cx01, ▼0,80 m	ALN #03	Poz-19376	5670 ± 40 BP	4539-4460 calBC	4500 BC	4611-4373 calBC	4492 BC
G1, ▼1,10 m	ALN #04	Poz-19377	5770 ± 40 BP	4686-4561 calBC	4624 BC	4717-4526 calBC	4622 BC
G1, ▼1,55–1,60 m	ALN #09	Poz-22521	5690 ± 40 BP	4553-4461 calBC	4507 BC	4679-4450 calBC	4565 BC
G1, ▼1,85–1,90 m	ALN #10	Poz-22522	5695 ± 35 BP	4553-4464 calBC	4509 BC	4653-4454 calBC	4554 BC
G1, ▼1,75 m	ALN #20	Poz-59122	5755 ± 35 BP	4677-4549 calBC	4613 BC	4704-4519 calBC	4612 BC

Tab. 2. Datările probelor ^{14}C din Sp. III/2005.
Sp. III/2005 ^{14}C radiocarbon dating results.

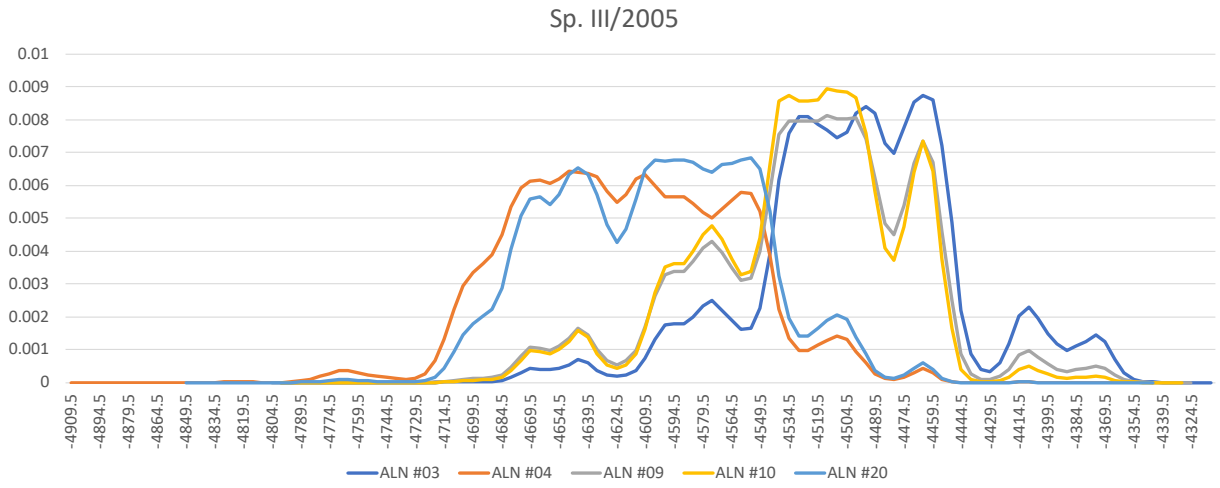

Fig. 17. Distribuţia probabilităţilor datărilor ^{14}C din Sp. III/2005. OxCal v4.4.
The Sp. III/2005 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

II. iv. NMI, estimarea vârstei şi sexului (fig. 18)

$NMI_{Sp.\ III/2005}$ = 61. În fig. 18 sunt reprezentate grafic datele privind estimarea sexului[9] decedaţilor din Cx01/G1 (M. Gligor *et alii* 2018, p. 35, Tab. 2).

[9] Cf. M. Gligor *et alii* 2018, p. 35, au fost luate în calcul pentru estimarea sexului doar exemplarele de cranii de adulţi, iar datorită stării fragmentare a materialului osos nu s-a putut realiza o analiză concludentă a vârstei decedaţilor. S-au identificat doar 9 indivizi de sex feminin cu vârsta cuprinsă între 30-45 ani şi 7 indivizi de sex masculin cu vârsta cuprinsă între 25-40 ani.

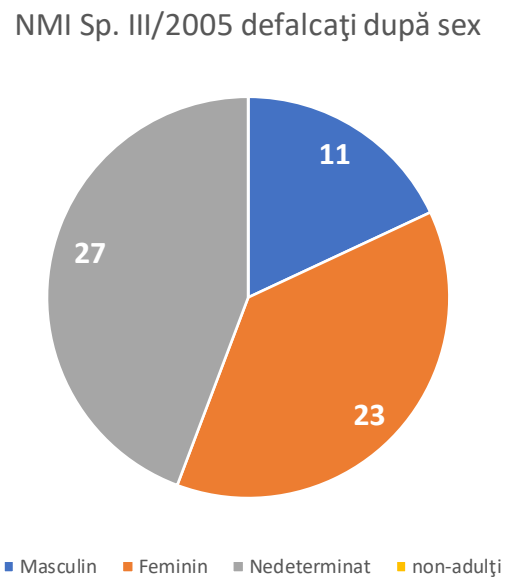

Fig. 18. NMI Sp. III/2005 defalcaţi după sex.
The Sp. III/2005 MNI distribution according to sex.

◈ III. Sp. VI/2005 (3- fig. 7-8)

III.i. Contextul arheologic (fig. 19)

În S I, în şanţul St. 2/2005, la adâncimea de 1,70 m faţă de nivelul actual de călcare a fost identificat un schelet (M1), orientat SV–NE, întins, culcat pe partea dreaptă, piciorul stâng este deplasat de la bazin şi suprapune piciorul drept. Poziţia scheletului lasă impresia că decedatul a fost mai degrabă aruncat în şanţul deschis şi nu a fost depus conform unui ritual. M1 nu are inventar funerar (M. Gligor 2009, p. 40, pl. VII/1).

Fig. 19. M1, S I, Sp. VI/2005 (*apud* M. Gligor 2009, Pl. CXCVI/2).
M1, S I, Sp. VI/2005 (*apud* M. Gligor 2009, Pl. CXCVI/2).

III.ii. Plan topo (fig. 21)

Prin Sp. VI/2005 au fost evidenţiate şanţurile St. 1-2 de formă asemănătoare (profil în formă de V, cu fundul ascuţit sau rotunjit), dispuse aproape paralel şi orientate în aceeaşi direcţie (NE-SV), oferind o imagine generală a unui sistem de fortificaţie cu rol de protecţie a aşezării pe latura sudică (fig. 20-21). Astfel, St. 1, cercetat prin practicarea S I- S III/2005, are deschidere la partea superioară cuprinsă între 1,75-2,80 m şi adâncime maximă de 1,45 m, în vreme ce St. 2, evidenţiat tot prin S I- S III/2005 are deschidere la partea superioară cuprinsă între 3,10-3,60 m şi adâncime de 2,50 m. Distanţa dintre cele două şanţuri este de 12 m (M. Gligor 2009, p. 39-40, pl. CXC/1).

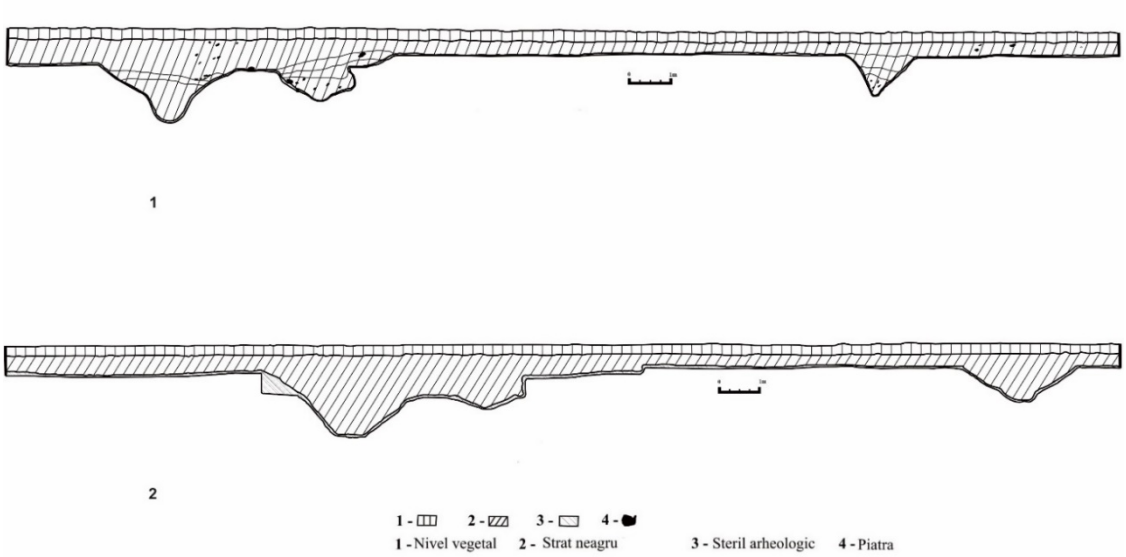

Fig. 20. Stratigrafia șanțurilor St. 1-2 descoperite în Sp. VI/2005 (*apud* M. Gligor 2009, Pl. XXVII).
The Sp. VI/2005 St. 1-2 ditches' stratigraphy (*apud* M. Gligor 2009, Pl. XXVII).

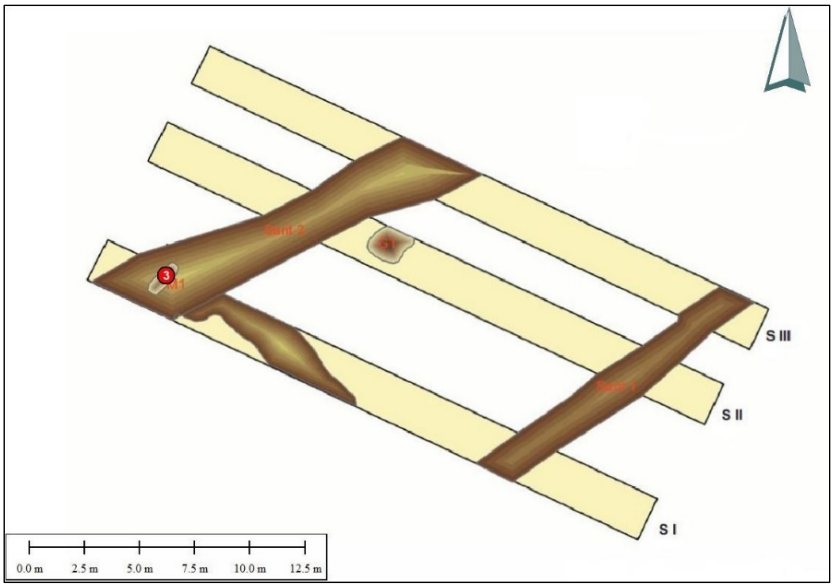

Fig. 21. Plan de situaţie cu poziţionarea M1 din Sp. VI/2005, S I, la baza St. 2 (*apud* M. Gligor 2009, Pl. XIV/2).
Situation plan with the Sp. VI/2005 S I M1 positioning, at the bottom of the St. 2 ditch (*apud* M. Gligor 2009, Pl. XIV/2).

III.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 1 probă din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 3 şi fig. 22 (M. Gligor 2014, p. 92, Tab. 1).

Context Arh.	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
S I, Şt. 2/M1, ▼1,70 m	ALN #13	Poz-58209	5785 ± 35 BP	4694-4591 calBC	4642.5 BC	4716-4546 calBC	4631 BC

Tab. 3. Datarea probei ^{14}C aparținând M1, S I, Sp. VI/2005.
M1, S I, Sp. VI/2005 ^{14}C radiocarbon dating result.

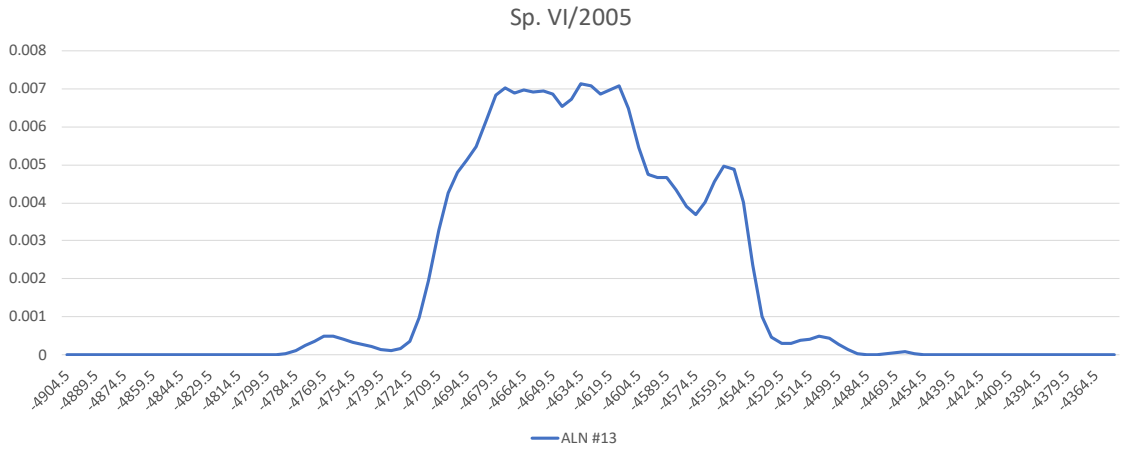

Fig. 22. Distribuţia probabilităţilor datării ^{14}C din Sp. VI/2005. OxCal v4.4.
The Sp. VI/2005 ^{14}C radiocarbon dating probability distribution. OxCal v4.4.

III. iv. NMI, estimarea vârstei şi sexului

$NMI_{Sp.\ VI/2005} = 1$. M1 este un individ de sex feminin, având vârsta de 25-30 ani (*adultus*) la momentul decesului (M. Roşu, M. Gligor 2011, p. 350).

◈ IV. Sp. I/2011 (4- fig. 7-8)

IV.i. Contextul arheologic (fig. 23-24)

C1 din Sp. I/2011, caroul D, s-a conturat pe aproximativ 2x2 m, la ▼0,20-0,40 m, sub forma unei aglomerări de resturi scheletice umane care nu erau în conexiune anatomică, descoperite aşezate pe pământ (nu înclinate) în aranjamente de formă rectangulară, constituite din oase lungi conţinând cranii în spaţiul interior. Pe fundul C1 (▼0,35-0,40 m) au fost identificate oase umane în conexiune anatomică. Fragmente ceramice aparţinând unor vase din categoria uzuală marchează limitele exterioare ale C1. Complexul C1, parte a stratului Foeni, suprapune groapa unui bordei Vinča B (M. Gligor 2013, p. 204-205, fig. 5; M. Gligor, K. McLeod 2014, p. 63-64, Fig. 2/a-d, 3, 5-6). Descoperirea funerară din C1 este o înmormântare multiplă.

Fig. 23. C1, □D, Sp. I/2011, ▼0,20 m, inedită (foto Mihai Gligor).
C1, □D, Sp. I/2011, ▼0.20 m (photo by Mihai Gligor).

Fig. 24. C1, □D, Sp. I/2011, ▼0,40 m, inedită (foto Mihai Gligor).
C1, □D, Sp. I/2011, ▼0.40 m (photo by Mihai Gligor).

IV.ii. Plan topo (fig. 25-26)

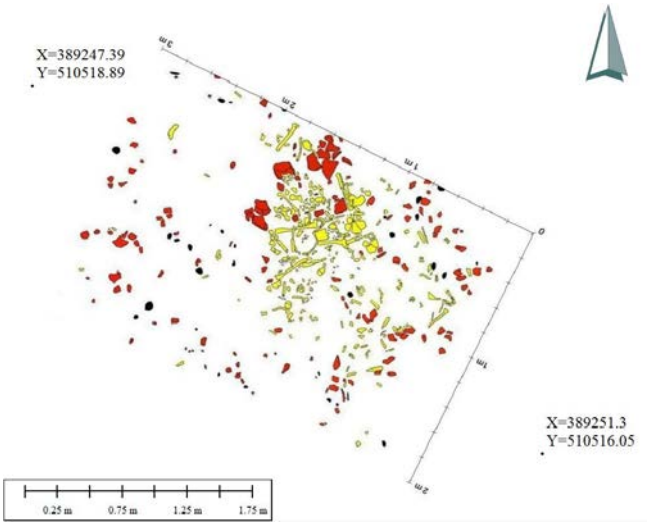

Fig. 25. Plan detaliu Sp. I/2011, □D, C1, ▼0,20–0,25 m, pe baza M. Gligor 2013, p. 205, fig. 5a.
Sp. I/2011, □D, C1, ▼0.20–0.25 m detailed plan, after M. Gligor 2013, p. 205, fig. 5a.

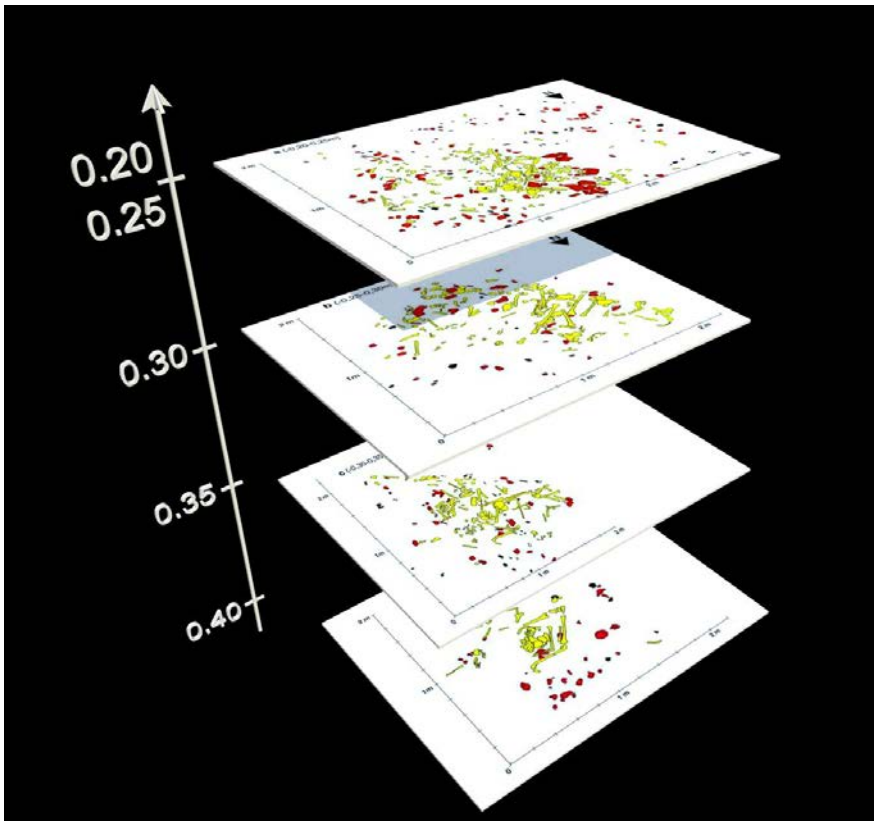

Fig. 26. Suprapunere relevee C1, □D, Sp. I/2011, (după M. Gligor 2013, p. 205, fig. 5/a-d). Imagine realizată în software 3D de Şt. Juglea şi A. Dorondei.
3D overlay of C1, □D, Sp. I/2011 depth plans (after M. Gligor 2013, p. 205, fig. 5/a-d). Image realized in 3D software 3D by Şt. Juglea and A. Dorondei.

IV.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 4 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 4 şi fig. 27 (M. Gligor 2012, p. 286; M. Gligor 2014 p. 92, Tab. 1; M. Gligor, K. McLeod 2014, p. 66-67).

Context Arh.	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
□D, C1, ▼0,20 – 0,25 m	ALN #11	Poz-47401	5680 ± 40 BP	4545-4461 calBC	4503 BC	4669-4400 calBC	4535 BC
□D, C1, ▼0,35 – 0,40 m	ALN #12	Poz-47402	5690 ± 40 BP	4553-4461 calBC	4507 BC	4679-4450 calBC	4565 BC
□D, C1, ▼0,25 – 0,30 m	ALN #22	Poz-59124	5585 ± 35 BP	4452-4370 calBC	4411 BC	4486-4351 calBC	4419 BC
□D, C1, ▼0,30 m	ALN #23	Poz-59125	5655 ± 35 BP	4526-4456 calBC	4491 BC	4556-4370 calBC	4463 BC

Tab. 4. Datările probelor ^{14}C din Sp. I/2011, □D, C1.
Sp. I/2011, □D, C1 ^{14}C radiocarbon dating results.

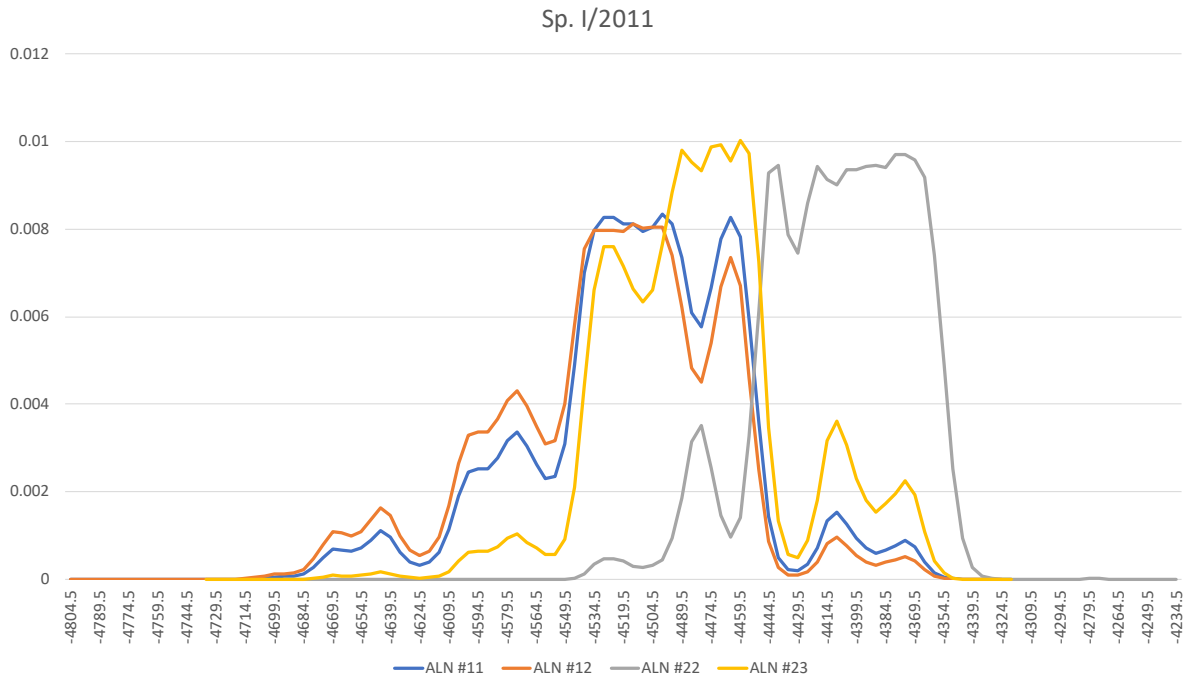

Fig. 27. Distribuţia probabilităţilor datărilor ^{14}C din Sp. I/2011. OxCal v4.4.
The Sp. I/2011 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

IV. iv. NMI, estimarea vârstei şi sexului (fig. 28-29)

$NMI_{Sp.\ I/2011}$ = 18 (M. Gligor, K. McLeod 2014, p. 69-70). În fig. 28-29 sunt reprezentate grafic datele privind estimarea vârstei şi sexului decedaţilor din C1 (M. Gligor, K. McLeod 2014, p. 71, 85, Tab. 1).

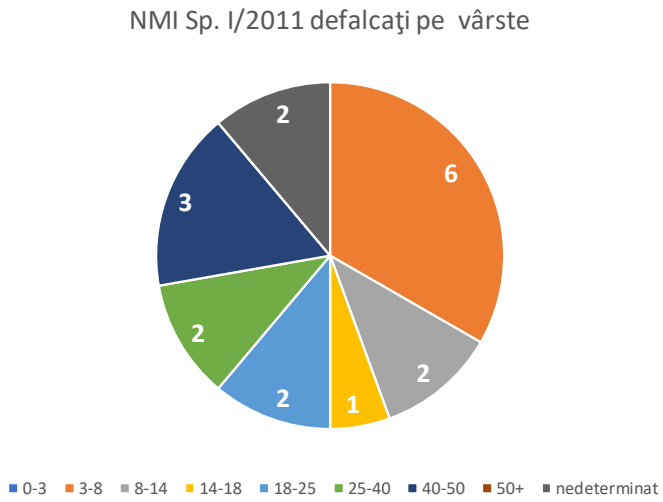

Fig. 28. NMI Sp. I/2011 defalcaţi după vârstă.
The Sp. I/2011 MNI distribution according to age.

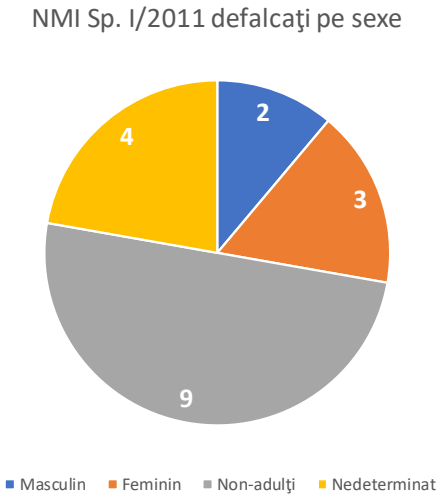

Fig. 29. NMI Sp. I/2011 defalcaţi după sex.
The Sp. I/2011 MNI distribution according to sex.

◈ V. Sp. I/2013-2014 (5- fig. 7-8)

V.i. Contextul arheologic (fig. 30)

Cercetarea sistematică organizată pe un teren aparţinând Arhiepiscopiei Romano-Catolice de Alba Iulia s-a derulat în două campanii succesive în 2013-2014 cu scopul de a obţine informaţii arheologice suplimentare privitor la descoperirile funerare prilejuite de cercetările anterioare (Sp. II/2003, Sp. III/2005, Sp. I/2011). De interes pentru articolul de faţă este complexul Cx04, cercetat în ambele campanii, în carourile B-C şi la excavarea căruia s-au descoperit scheletele în conexiune anatomică a şapte indivizi (M1, M2, M3, M6, M7, M8 şi M9). Cu Cx04 a fost notat un şanţ depistat la adâncimea de aprox. 0,60 m faţă de nivelul de călcare actual, conturat în sterilul lutos de culoare galbenă, de formă uşor neregulată şi orientare NE-SV. Deschiderea şanţului la partea superioară variază între 0,95-1,10 m, în timp ce fundul şanţului are o lăţime de 0,30-0,40 m. Adâncimea medie a Cx04 este de 0,65 m, constatându-se însă o variaţie de nivel de aproximativ 0,40-0,50 m către capătul de NE, astfel că M1 şi M2 se

găsesc la o adâncime considerabil mai mare comparativ cu M8 şi M9 de la capătul de SV. Cercetările au permis dezvelirea şanţului pe o lungimea de 14,31 m. După poziţia scheletelor se poate afirma că nu s-a acordat nicio grijă celor decedaţi aceştia fiind aruncaţi pe fundul şanţului (fig. 30), lipsa inventarului funerar fiind un argument suplimentar în acest sens. Ca secvenţe ale depunerii în şanţ, se observă că în cazul lui M1 şi M2 cel din urmă a fost primul, la fel pentru M3 şi M6, M3 a fost pus în şanţ primul. M2 şi M3, pe de o parte, şi M8 şi M9, pe de altă parte, sunt dispuşi cap la cap (fig. 31). Stratigrafic, șanțul taie stratul Vinča B, inclusiv un bordei de mari dimensiuni și nu s-au identificat indicii care să stabilească dacă a fost săpat special ca loc de odihnă final pentru decedați. Este posibil aşadar ca șanțul să fi fost săpat înainte de evenimentul îngropării decedaţilor și să fi avut o utilitate inițială diferită. Pornind de la dimensiunile acestuia, pare puțin probabil să fi fost realizat cu scop defensiv, ca parte a fortificaţiei aşezării (M. Gligor *et alii* 2021, fig. 1, 5-7, 8/a-c, 9-10).

Fig. 30. Imagine din dronă din 2014 (M3, M6-M9) a descoperirii funerare din Cx04. Stereo70. GlobalMapper v23.
2014 UAV image of the Cx04 (M3, M6-M9) funerary discoveries. Stereo70. GlobalMapper v23.

V.ii. Plan topo (fig. 31)

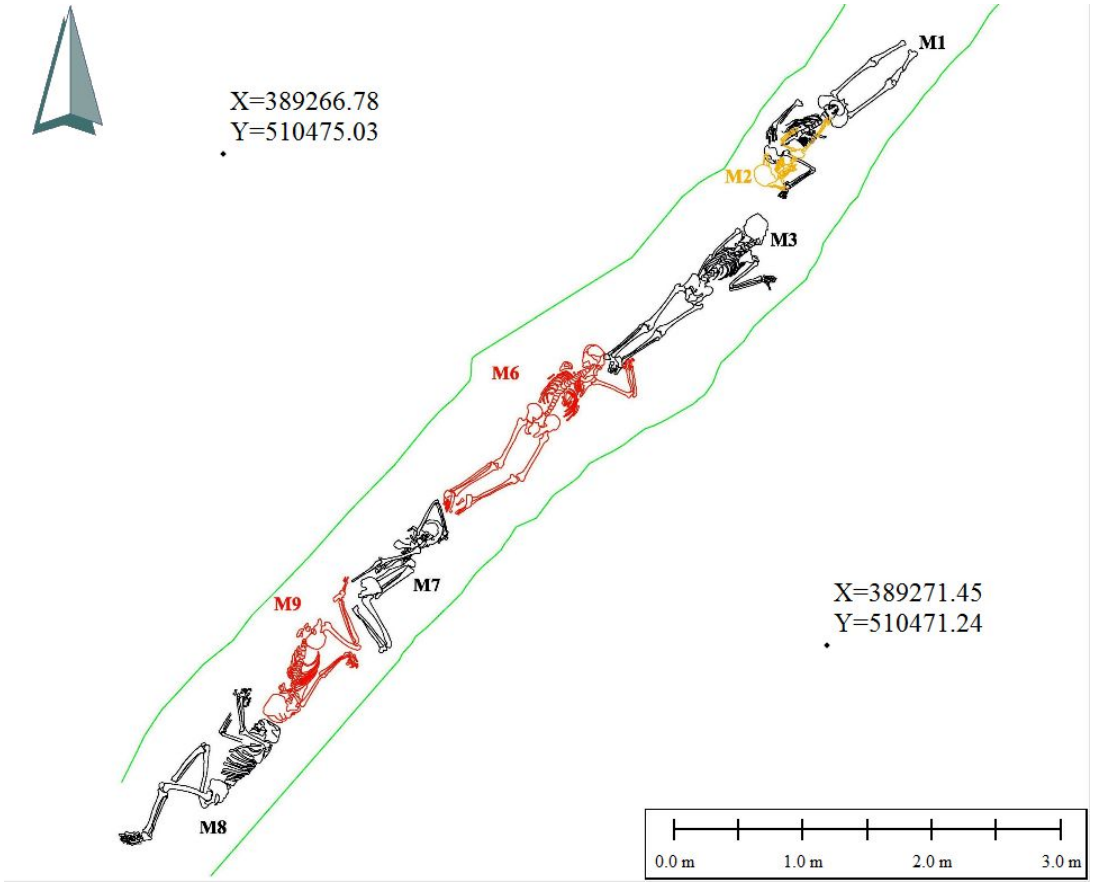

Fig. 31. Plan topo detaliu M1-M3, M6-M9/Cx04, pe baza M. Gligor *et alii* 2021, fig. 5a.
Detailed topographic plan of M1-M3, M6-M9/Cx04, based on M. Gligor *et alii* 2021, fig. 5a.

V.iii Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 4 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 5.1 şi fig. 32 (M. Gligor 2014, p. 92, Tab. 1; M. Gligor *et alii* 2021,Tab. 2).

Context Arheologic	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
□B, Cx04, M1, ▼1,75 m	ALN #14	Poz-58210	5590 ± 35 BP	4454-4370 calBC	4412 BC	4488-4353 calBC	4421BC
□B, Cx04, M2, ▼1,90 m	ALN #15	Poz-58211	5580 ± 30 BP	4448-4370 calBC	4409 BC	4461-4351 calBC	4406 BC
□C, Cx04, M3, ▼1,40-1,50m	ALN #31	Poz-80111	5610 ± 35 BP	4427-4370 calBC	4399BC	4516-4357 calBC	4437BC
□C, Cx04, M9, ▼1,40-1,50m	ALN #32	Poz-80112	5700 ± 35 BP	4582-4487 calBC	4535 BC	4619-4456 calBC	4538BC

Tab. 5.1. Datările probelor ^{14}C din Cx04/2013-2014.
Cx04/2013-2014 ^{14}C radiocarbon dating results.

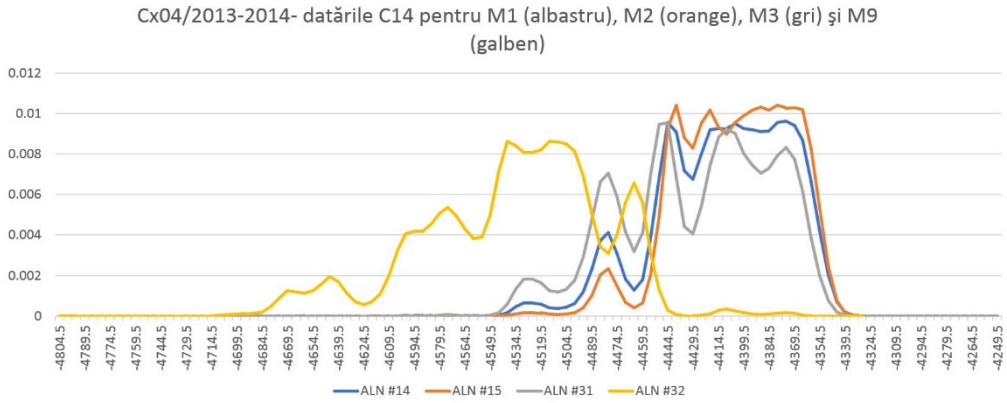

Fig. 32. Distribuţia probabilităţilor datărilor ^{14}C pentru Cx04, Sp. I/2013-2014. OxCal v4.4.
The Cx04, Sp. I/2013-2014 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

V. iv. NMI, estimarea vârstei şi sexului (fig. 33)

$NMI_{Sp.\ I/2013-2014} = 7$ (M. Gligor *et alii* 2021). În tab. 5.2 şi fig. 33 sunt reprezentate grafic datele privind estimarea vârstei şi sexului decedaţilor din Cx04 (M. Gligor *et alii* 2021, Tab. 3).

Defunct	Sex	Vârstă
M1	F	40-50
M2	Non-adult	18 luni ± 6
M3	M	17-23
M6	M	28-35
M7	M	24-40
M8	M	35-50
M9	M	16-24

Tab. 5.2. Estimarea vârstei şi sexului defuncţilor din Cx04, Sp. I/2013-2014.
Cx04, Sp. I/2013-2014 deceaseds' age and sex estimation.

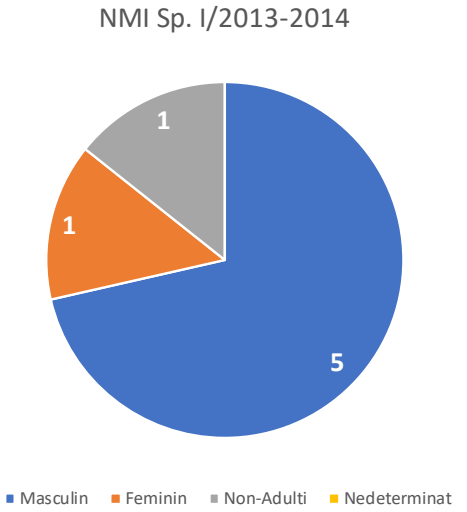

Fig. 33. NMI din Cx04, Sp. I/2013-2014, defalcaţi după sex.
The Cx04, Sp. I/2013-2014 MNI distribution according to sex.

◈ VI. Sp. I/2014 (6- fig. 7-8)

VI.i Contextul arheologic

În caroul D, la adâncimea de aprox. 0,55 m au fost identificate piese scheletice aparţinând unor cranii umane. O aglomerare de pietre de râu şi fragmente ceramice din categoria uzuală au mai fost recuperate în imediata apropiere a craniilor. Un număr de 5 cranii, păstrate incomplet, au fost relevate într-un spaţiu cu dimensiunile de 0,70x0,70 m[10], complexul primind indicativul Cx01. Descoperirea funerară din Cx01 este o înmormântare secundară.

VI.ii. Plan topo (fig. 34)

Poziţionarea descoperirilor funerare s-a obţinut prin georeferenţierea imaginii Sp. I/2014 din dronă.

Fig. 34. Imagine din dronă georeferenţiată a descoperirii funerare din Sp. I/2014, Cx01, □D. Stereo70. GlobalMapper.
Geo-referenced UAV image of the Sp. I/2014, Cx.01, □D funerary discovery. Stereo70. GlobalMapper.

VI.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 3 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 6 și fig. 35.

[10] Studiul dedicat acestei descoperiri funerare se află în curs de publicare.

Context Arh.	Cod ALN	Cod Poznan	Datare absolută
□D, Cx01, Sk. 1, ▼0,60-0,70m	ALN #24	Poz-70808	5600 ± 40 BP
□D, Cx01, Sk. 3, ▼0,60-0,70m	ALN #25	Poz-70809	5470 ± 40 BP
□D, Cx01, Sk. 5, ▼0,60-0,70m	ALN #26	Poz-70810	5510 ± 40 BP

Tab. 6. Datările probelor ^{14}C din Cx01, □D, Sp. I/2014.
Cx01, □D, Sp. I/2014 ^{14}C radiocarbon dating results.

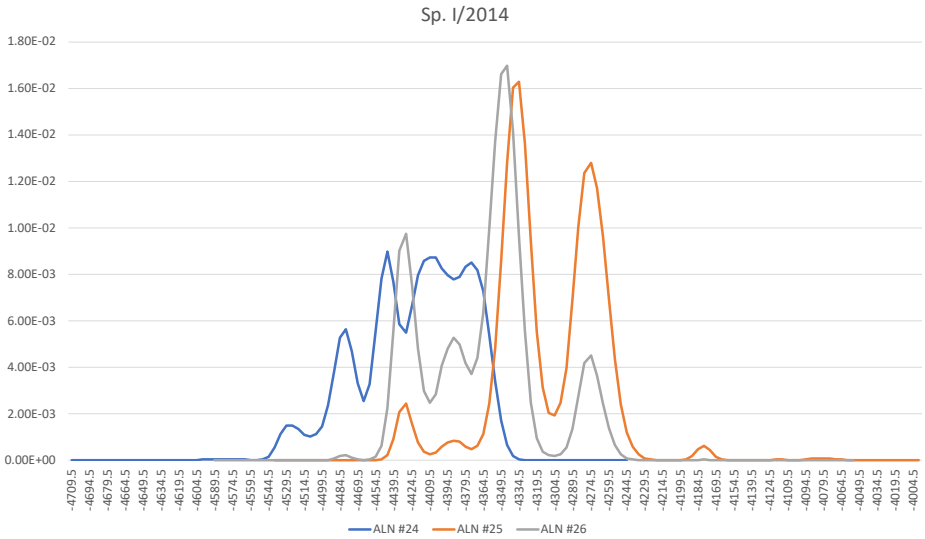

Fig. 35. Distribuţia probabilităţilor datărilor ^{14}C din Cx01, Sp. I/2014. OxCal v4.4.
The Cx01, Sp. I/2014 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

VI. iv. NMI, estimarea vârstei şi sexului (fig. 36)

$NMI_{Sp.\ I/2014} = 5$. În fig. 36 sunt reprezentate grafic datele privind estimarea sexului din Cx01[11].

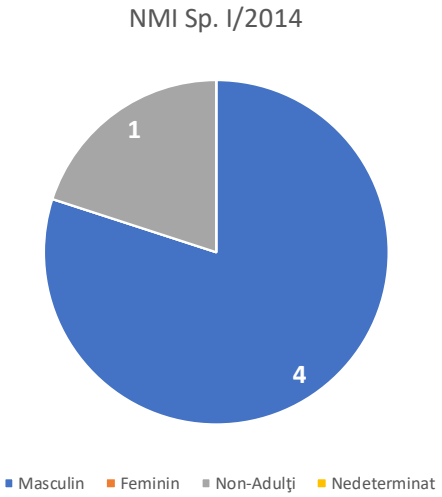

Fig. 36. NMI Sp. I/2014, defalcaţi după sex.
The Sp. I/2014 MNI distribution according to sex.

[11] Analizele osteoarheologice au fost efectuate de K. Mcleod şi A. Fetcu. Descoperirea funerară din Sp. I/2014 este în curs de publicare.

◈ VII. Sp. II/2015 (7- fig. 7-8)

VII.i. Contextul arheologic (fig. 37)

În caroul D, la adâncimea de aprox. 0,45-0,50 m, au fost identificate piese scheletice umane care majoritatea nu se aflau în conexiune anatomică, în interiorul unei gropi de formă circulară cu diametrul de 1,3-1,4 m, notată Cx01. S-au identificat şi membre articulate desprinse de corp. Groapa a fost practicată printre resturile constând din fragmente masive de chirpici rezultate din incendierea unei locuinţe de suprafaţă. Fundul Cx01 a fost atins la adâncimea de aprox. 0,85-0,95 m, odată cu recuperarea a două schelete complete. Un tip specific de vas din repertoriul grupului Foeni, anume vasul suport, a fost descoperit în două exemplare în Cx01, în stare fragmentară (Ch. Lundberg, M. Gligor 2015, p. 73-80, Fig. 3/a-d, 4/a-d, 5/a-d, 6-7). Descoperirea funerară din Cx01 este o înmormântare multiplă.

Fig. 37. Cx01, □D, Sp. II/2015 (*apud* Ch. Lundberg, M. Gligor 2015, fig. 4b).

Cx01, □D, Sp. II/2015 (*apud* Ch. Lundberg, M. Gligor 2015, fig. 4b).

VII.ii. Plan topo (fig. 38-39)

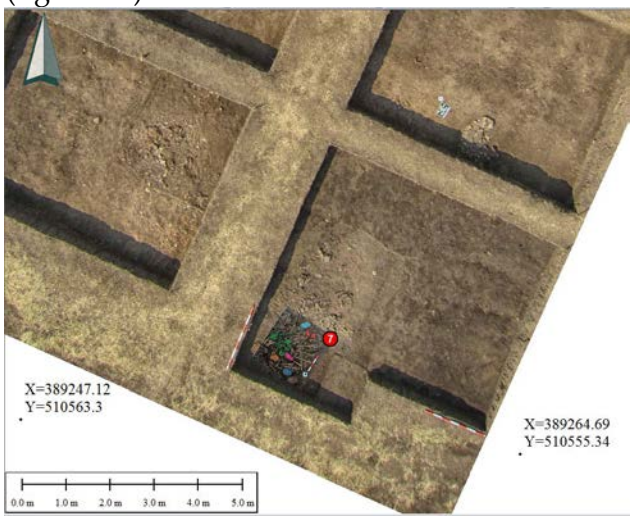

Fig. 38. Poziţionarea Cx01, □D, Sp. II/2015, pe imagine georeferenţiată din dronă suprapusă de interpretarea din Ch. Lundberg. M. Gligor 2015, fig. 7c. Stereo70. GlobalMapper v23.

The positioning of Cx.01, □D, Sp. II/2015, with UAV geo-referenced imagery background overlaid by the topmost bone interpretation from Ch. Lundberg, M. Gligor 2015, fig. 7c. Stereo70. GlobalMapper v23.

Fig. 39. Suprapunerea interpretării Cx01, □D, Sp. II/2015, pe baza Ch. Lundberg, M. Gligor 2015, fig. 6/a-d şi fig. 7/a-c. Imagine realizată prin mijloace grafice de Alin Gayraud.
3D overlay of the Cx.01, □D, Sp. II/2015 depth bone interpretation from Ch. Lundberg, M. Gligor 2015, fig. 6/a-d şi fig. 7/a-c. Image realized in DTP software by Alin Gayraud.

VII.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 4 probe din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 7 și fig. 40 (Ch. Lundberg, M. Gligor 2015, p. 81, Tab. 1).

Context Arheologic	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
Cx.01, □D, Sk 6, ▼0.43m	ALN #27	Poz-77264	5550 ± 35 BP	4446-4419 calBC	4433 BC	4454-4342 calBC	4398 BC
Cx.01, □D, Sk 9, ▼0.58m	ALN #28	Poz-77265	5650 ± 40 BP	4536-4451 calBC	4494 BC	4556-4365 calBC	4461 BC
Cx.01, □D, Sk 13, ▼0.60m	ALN #29	Poz-77266	5580 ± 40 BP	4449-4369 calBC	4409 BC	4488-4347 calBC	4418 BC
Cx.01, □D, Sk 14, ▼0.60m	ALN #30	Poz-77267	5610 ± 40 BP	4466-4437 calBC	4452 BC	4520-4356 calBC	4438 BC

Tab. 7. Datările probelor ^{14}C din Sp. II/2015, □D, Cx01.
Sp. II/2015, □D, Cx01 ^{14}C radiocarbon dating results.

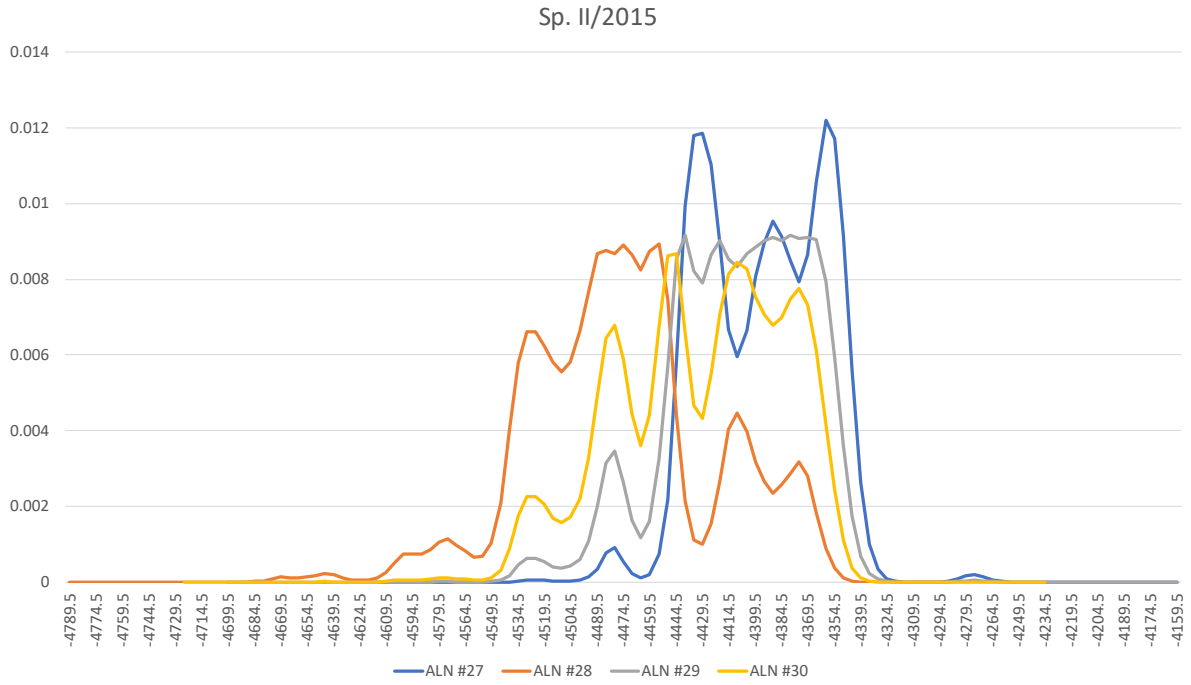

Fig. 40. Distribuţia probabilităţilor datărilor ^{14}C din Sp. II/2015. OxCal v4.4.
The Sp. II/2015 ^{14}C radiocarbon dating probability distribution. OxCal v4.4.

VII. iv. NMI, estimarea vârstei şi sexului (fig. 41-42)

$NMI_{Sp.\ II/2015}$ = 16 (Ch. Lundberg, M. Gligor 2015, p. 86-87, Tab. 2). În fig. 41-42 sunt reprezentate grafic datele privind estimarea vârstei şi sexului din Cx01 (M. Gligor, K. McLeod 2015, p. 25-26, tab. 2-8).

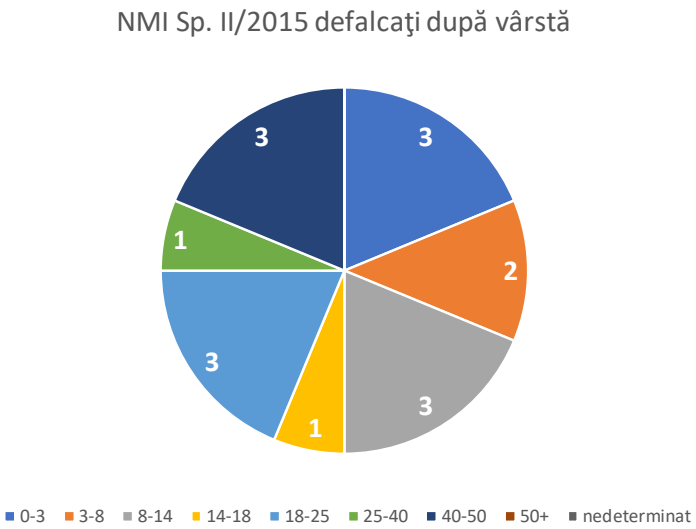

Fig. 41. NMI Sp. II/2015, defalcaţi după vârstă.
The Sp. II/2015 MNI distribution according to age.

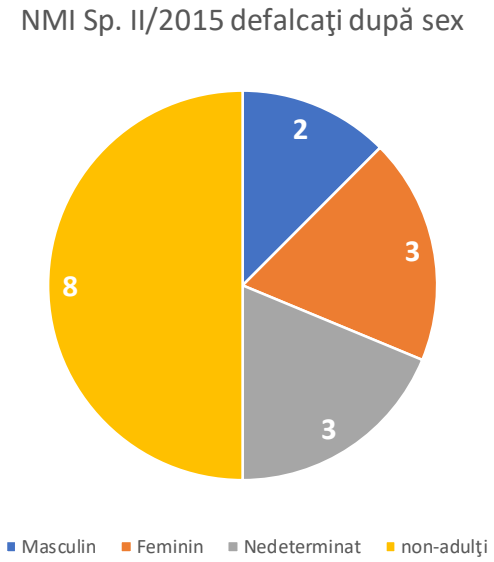

Fig. 42. NMI Sp. II/2015 defalcaţi după sex.
The Sp. II/2015 MNI distribution according to sex.

◈ VIII. Sp. II/2018 (8- fig. 7-8)

VIII.i. Contextul arheologic (fig. 43)

În caroul A, la adâncimea de 0,75 m, într-o groapă rectangulară cu colţuri rotunjite (Cx001) măsurând 0,75 × 0,45m, s-au găsit resturile umane deranjate ale unui non-adult, notat M1. Fragmentele scheletale sunt orientate pe direcţia NV-SE. Conexiunea anatomică a putut fi observată *in situ* la unul dintre braţe, după recuperarea calotei craniene aflată în stare fragmentară. Resturi faunistice, un mic număr de fragmente ceramice de uz comun şi bucăţi de chirpici au putut fi recuperate de asemenea din contextul funerar, dar nu le putem considera expresia unui ritual funerar. Descoperirea funerară se află în proximitatea gropii unui bordei atribuit grupului Foeni, marcat ca B1 (A. Fetcu *et alii* 2020a, p. 26, Pl. II-III). Descoperirea funerară din Cx001 este probabil o înmormântare secundară.

Fig. 43. M1, □A, Cx001, ▼0,75m, Sp. II/2018 (*apud* A. Fetcu *et alii* 2020a, pl. 3/4).
M1, □A, Cx001, ▼0.75m, Sp. II/2018 (*apud* A. Fetcu *et alii* 2020a, pl. 3/4).

VIII.ii. Plan topo (fig. 44)

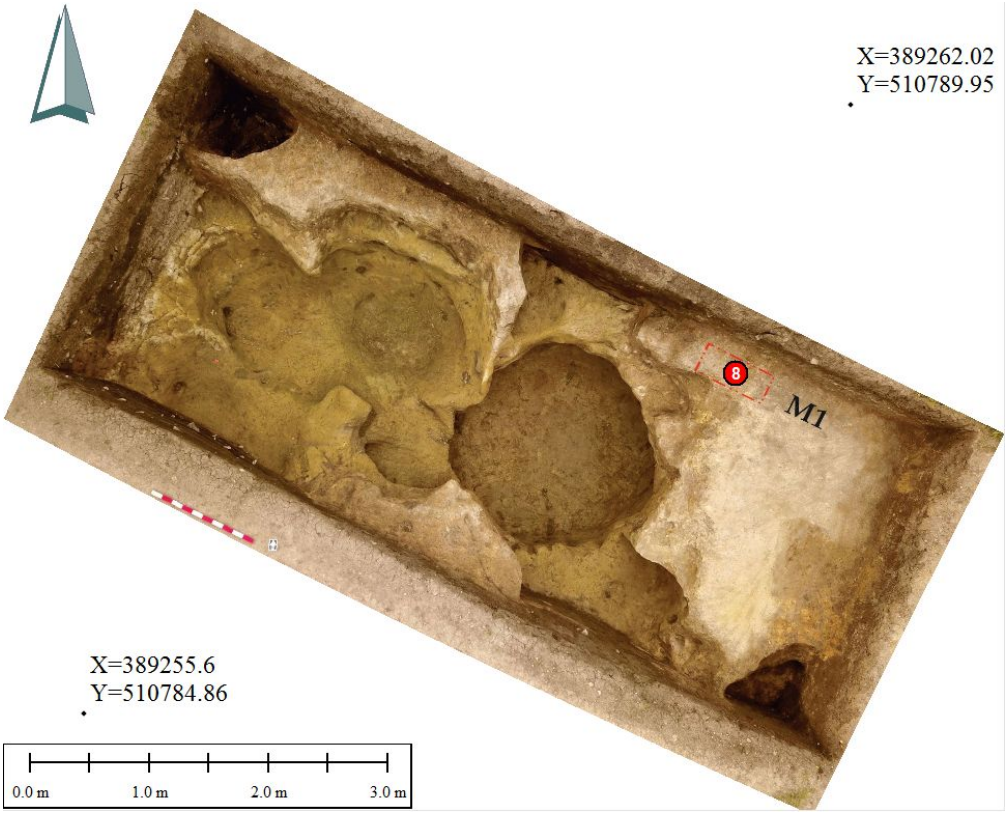

Fig. 44. Sp. II/2018, □A, M1, Cx001, ▼0,75m, pe baza A. Fetcu *et alii* 2020a, pl. 3/3. Stereo70. GlobalMapper v23.
Sp. II/2018, □A, M1, Cx001, ▼0.75m, based on A. Fetcu *et alii* 2020a, pl. 3/3. Stereo70. GlobalMapper v23.

VIII.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS a fost prelevată şi analizată 1 probă (fig. 45) din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 8.1 şi fig. 45 (A. Fetcu *et alii* 2020a, p. 26, Fig. 1).

Context Arheologic	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
□A, Cx001, M1, ▼0.75m	ALN #39	Poz–118947	5705 ± 35 BP	4586-4491 calBC	4539 BC	4619-4458 calBC	4539 BC

Tab. 8.1. Datarea probei ^{14}C din Sp. II/2018, □A, M1, Cx001.
Sp. II/2018, □A, M1, Cx001 ^{14}C radiocarbon dating result.

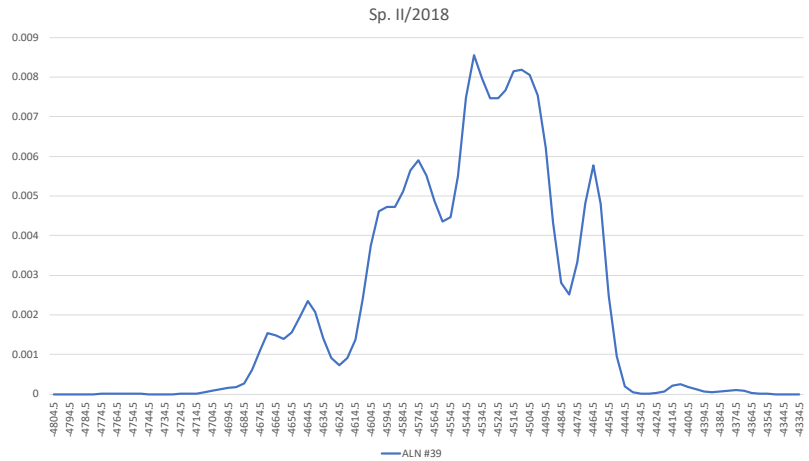

Fig. 45. Distribuţia probabilităţilor datării ^{14}C din Sp. II/2018. OxCal v4.4.
The Sp. II/2018 ^{14}C radiocarbon dating probability distribution. OxCal v4.4.

VIII. iv. NMI, estimarea vârstei şi sexului

$NMI_{Sp.\ II/2018} = 1$. În tab. 8.2 sunt prezentate datele privind estimarea vârstei M1 din Cx001 (A. Fetcu *et alii* 2020a, p. 26).

Context arh.	Vârstă
Sp. II/2018, □A, Cx001, M1, ▼0,75 m	7,5 ani

Tab. 8.2. Estimarea vârstei M1 din Sp. II/2018, □A, Cx001.
Age estimation for M1 from Sp. II/2018, □A, Cx001.

◈ IX. Sp. III/2018 (9 - fig. 7-8)

IX.i. Contextul arheologic (fig. 46-47)

În caroul B, la adâncimea de 0,87 m, au fost descoperite într-o groapă de formă aproximativ circulară (Cx001) fragmente ceramice aparţinând grupului cultural Foeni, material faunistic, pietre de diferite dimensiuni şi un craniu uman în stare fragmentară. Cx001 măsoară 2,10x2,70 m şi are adâncimea maximă de 0,96 m faţă de nivelul actual de călcare. Groapa suprapune parţial partea estică a complexului Cx005, un bordei de mari dimensiuni atribuit culturii Vinča, faza B (Fetcu *et alii* 2020b, p. 502, Pl. II/1-4, III/1-5, V/1). Este de asemenea o înmormântare secundară.

Fig. 46. Sp. III/2018, □B, Cx001,▼0,87m (*apud* A. Fetcu *et alii* 2020b, Pl. II/3).
Sp. III/2018, □B, Cx001,▼0.87m (*apud* A. Fetcu *et alii* 2020b, Pl. II/3).

Fig. 47. Detaliu Cx001, Sp. III/2018, □B, ▼0,87m (*apud* A. Fetcu *et alii* 2020b, Pl. II/4).
Cx001, Sp. III/2018, □B, ▼0.87m detail (*apud* A. Fetcu *et alii* 2020b, Pl. II/4).

IX.ii. Plan (fig. 48)

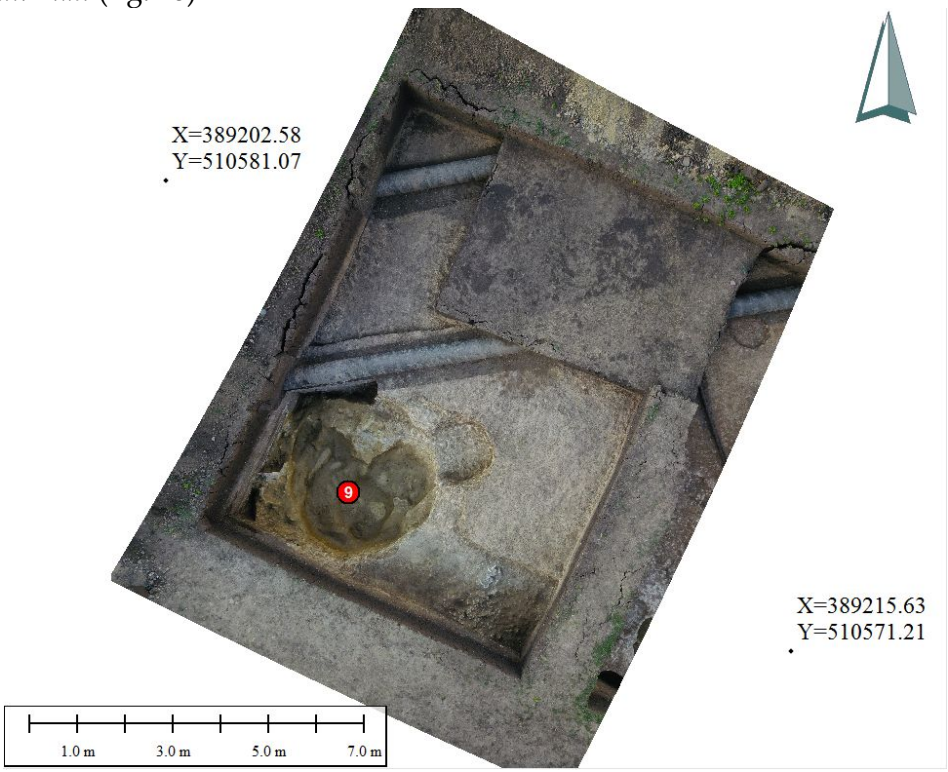

Fig. 48. Sp. III/2018, □B, imagine aeriană, georeferenţiată Stereo70. GlobalMapper v23.
Sp. III/2018, □B, Stereo 70 geo-referenced UAV image. GlobalMapper v23.

IX.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS a fost prelevată şi analizată 1 probă (fig. 49) din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 9.1 şi fig. 49 (A. Fetcu *et alii* 2020b, p. 503, Tab. 1).

Context arheologic	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
Sp. III/2018, □B, Cx001, ▼0.87m	ALN #40	Poz-118948	5585 ± 35 BP	4427-4370 calBC	4399 BC	4466-4351 calBC	4409 BC

Tab. 9.1. Datarea ^{14}C a probei din Sp. III/2018, □B, Cx001.
Sp. III/2018, □B, Cx001 ^{14}C radiocarbon dating result.

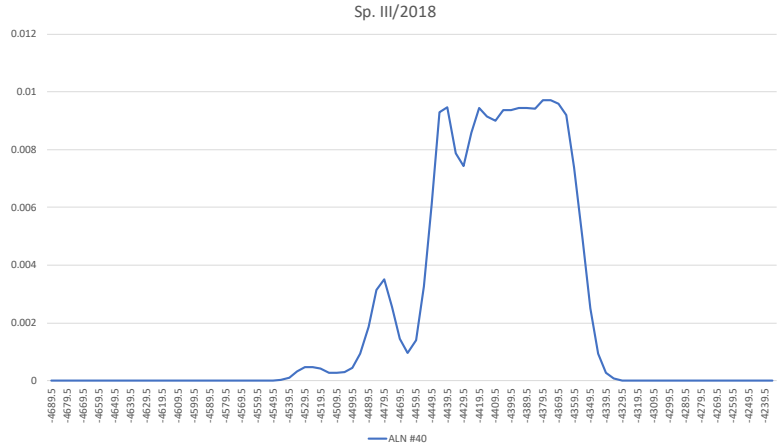

Fig. 49. Distribuţia probabilităţilor la datarea ^{14}C din Sp. III/2018. OxCal v4.4.
The Sp. III/2018 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

IX. iv. NMI, estimarea vârstei şi sexului

$NMI_{Sp.\ III/2018}$ = 1. În tabelul 9.2 sunt prezentate datele privind estimarea vârstei decedatului. Astfel, pe baza dentiţiei, analizele indică un individ non-adult, care la momentul decesului avea o vârstă cuprinsă între 4 şi 5 ani şi jumătate (A. Fetcu *et alii* 2020b, p. 501, 504).

Context arh.	Vârstă
Sp. III/2018, □B, Cx001, ▼0,87m	4 - 5,5 ani

Tab. 9.2. Estimarea vârstei defunctului din Sp. III/2018, □B, Cx001.
Age estimation for the deceased from Sp. III/2018, □B, Cx001.

◈ X. Sp. V/2018 (10- fig. 7-8)

X.i. Contextul arheologic

În caroul B, complexul adâncit numerotat cu Cx002a[12], conturat la ▼1,80 m faţă de nivelul actual de călcare, a oferit o triplă inhumare (M. Gligor 2020, Pl. XVI/1-2). Cx002a are o formă ovală la partea superioară, dimensiuni de 2,75x3,00 m, spre fund se restrânge treptat odată cu o cuptorire puţin pronunţată şi are adâncimea maximă ▼3,48 m (fig. 50). Cele 3 schelete în conexiune anatomică au fost descoperite la ▼2,00 m (M1), ▼2,20 m (M2), ▼3,05 m (M3). Ceramică pictată tipică grupului Foeni a fost recuperată de asemenea din Cx002a (M. Gligor 2020, p. 12, Pl. VI/2-3, IX/1a-2a, XI/1a-1b, X/1a, XVI/1-2).

X.ii. Plan (fig. 50)

Coordonate: X = 389031.067 şi Y = 510667.254

Fig. 50. Sp. V/2018, □B, Cx002a, inedită (foto Mihai Gligor).
Sp. V/2018, □B, Cx002a (photo by Mihai Gligor).

[12] Cercetările arheologice s-au finalizat la Sp. V în anul 2019.

X.iii. Datare ^{14}C

Pentru datarea ^{14}C AMS au fost prelevate şi analizate 3 probe (fig. 51) din resturi scheletice umane, iar rezultatele sunt prezentate în tab. 10 şi fig. 51 (M. Gligor 2020, p. 17, Tab. 1).

Context Arh.	Cod ALN	Cod Poznan	Datare absolută	(1σ) 68.2%	Media 1σ	(2σ) 95.4%	Media 2σ
M1, ▼2,00m	ALN #41	Poz-118950	5650 ± 35 BP	4527-4453 calBC	4490 BC	4550-4437 calBC	4494 BC
M2, ▼2,20m	ALN #42	Poz-118951	5660 ± 40 BP	4537-4456 calBC	4497 BC	4592-4438 calBC	4515 BC
M3, ▼3,05m	ALN #43	Poz-118952	5640 ± 30 BP	4519-4449 calBC	4484 BC	4542-4441 calBC	4492 BC

Tab. 10. Datările ^{14}C ale probelor din Sp. V/2018, □B, Cx002a.
Sp. V/2018, □B, Cx002a ^{14}C radiocarbon dating results.

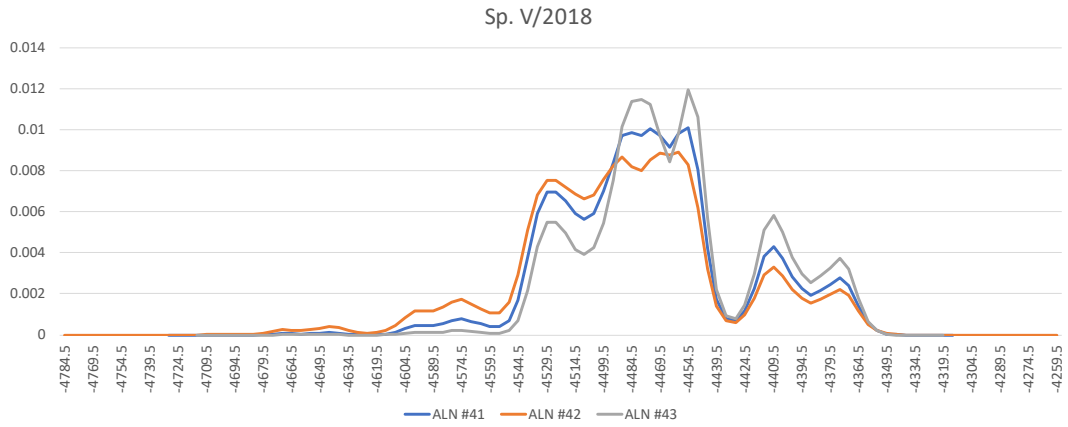

Fig. 51. Distribuţia probabilităţilor datărilor ^{14}C din Sp. V 2018. OxCal v4.4.
The Sp. V 2018 ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

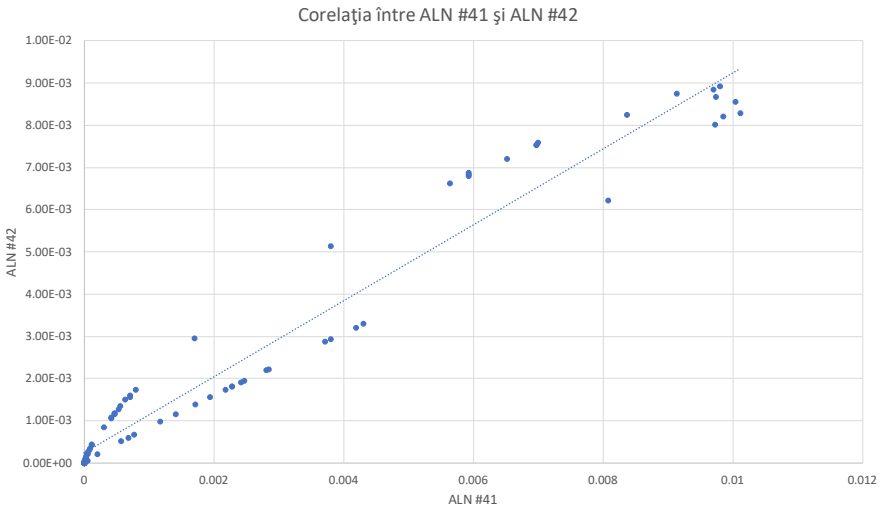

Fig. 52. Corelaţia statistică pozitivă a probelor ^{14}C ALN#41 şi ALN#42 din Cx002a, □B, Sp. V/2018.
Positive statistical correlation of the Sp. V/2018, □B, Cx002a ALN#41 and ALN#42 ^{14}C determinations.

Corelaţia statistică (fig. 52) pozitivă a datelor ^{14}C ALN#41 şi ALN#42 indică o probabilitate crescută a decesului concomitent a indivizilor M1 şi M2.

X. iv. NMI, estimarea vârstei şi sexului (fig. 53)

$NMI_{Sp.\ V/2018}$ = 3. În fig. 53 sunt reprezentate grafic datele privind estimarea sexului decedaţilor din Cx002a[13].

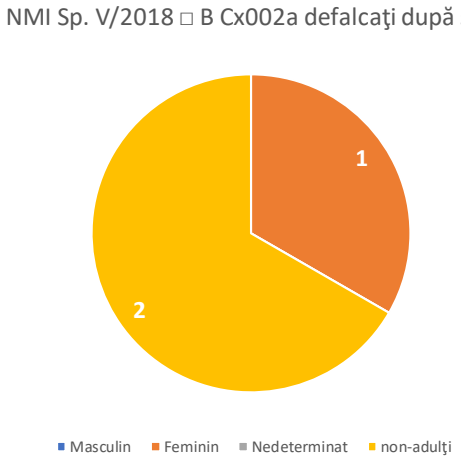

Fig. 53. NMI Sp. V/2018 defalcaţi după sex.
The Sp. V/2018 MNI distribution according to sex.

◈ Discuţii

Din datele prezentate în tabelul 11 rezultă că NMI din toate contextele funerare este 136. Fără a intra în detalii, raportat la necropolele neolitice şi/sau eneolitice din Transilvania cercetate arheologic, NMI din contextele funerare evidenţiate în interiorul aşezării de la Lumea Nouă este comparabil cu numărul indivizilor inhumaţi în cea mai mare dintre necropole. Astfel, este prezentat NMI prin raportare la cele 10 descoperiri funerare, ţinându-se seama de estimarea sexului decedaţilor (fig. 54), precum şi un grafic de distribuţie a datelor antropologice privind estimarea sexului decedaţilor cu raportare la contextul de proveniență (fig. 55). Starea fragmentară a materialului scheletal a condus în privinţa identificării sexului decedaţilor la raportarea a unui număr ridicat la categoria nedeterminat, însă cu toate acestea este ilustrativ şi relevant tabloul general în stadiul actual al cercetărilor: 28 (N-A), 29 (M), 37 (F) (fig. 56).

Context Arh./Sex	Sp. II/2003	Sp. III/2005	Sp. VI/2005	Sp. I/2011	Sp. I/2013-2014	Sp. I/2014	Sp. II/2015	Sp. II/2018	Sp. III/2018	Sp. V/2018	Total NMI/ sexe
Masculin	4	11	0	2	6	4	2	0	0	0	29
Feminin	5	23	1	3	1	0	3	0	0	1	37
Nedeterminat	4	27	0	4	0	0	3	0	0	0	38
Non-adulţi	4	0	0	9	2	1	8	1	1	2	28
Total NMI/complex	17	61	1	18	9	5	16	1	1	3	136

Tab. 11. Tabel sintetic cu descoperirile funerare de la Alba Iulia-*Lumea Nouă* cu statistica număr defuncţi defalcaţi pe complex arheologic şi pe sexe.
Synthetic table with the funerary discoveries from Alba Iulia-*Lumea Nouă* with the breakdown of deceaseds' numbers according to archaeological complex and sex.

[13] Analizele osteoarheologice au fost realizate de A. Fetcu şi fac obiectul unui studiu distinct.

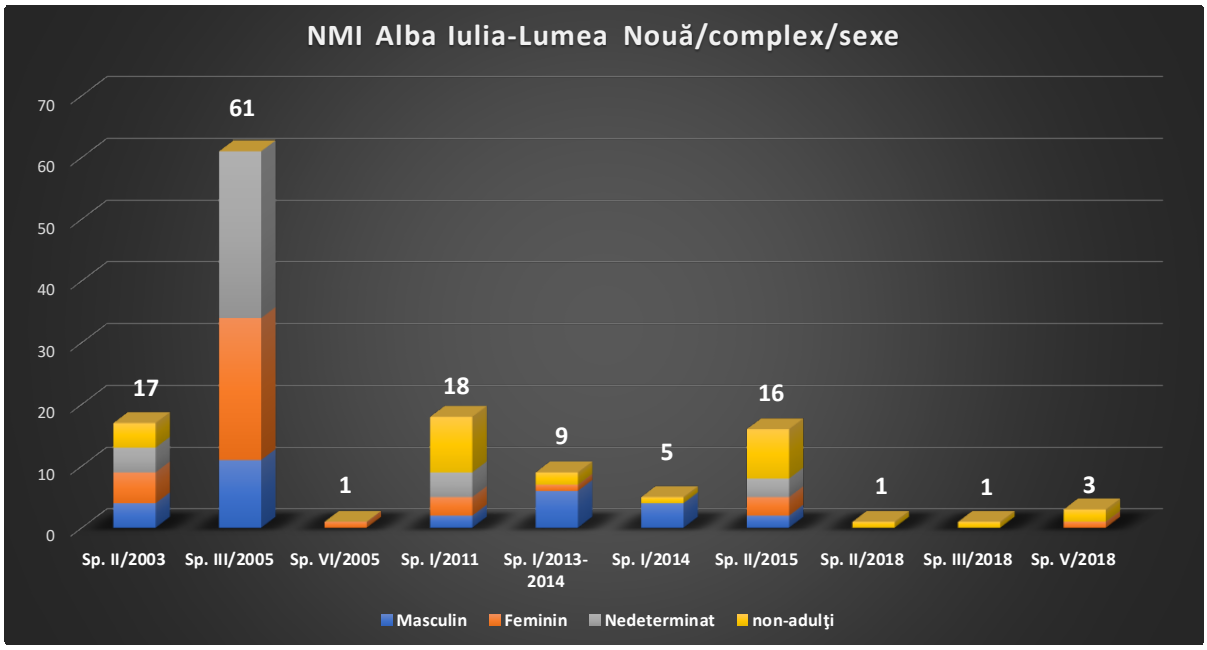

Fig. 54. NMI de la *Lumea Nouă*, descoperiri 2003-2018/complex arheologic/sex.
The 2003-2018 *Lumea Nouă* MNI distribution according to archaeological context and sex.

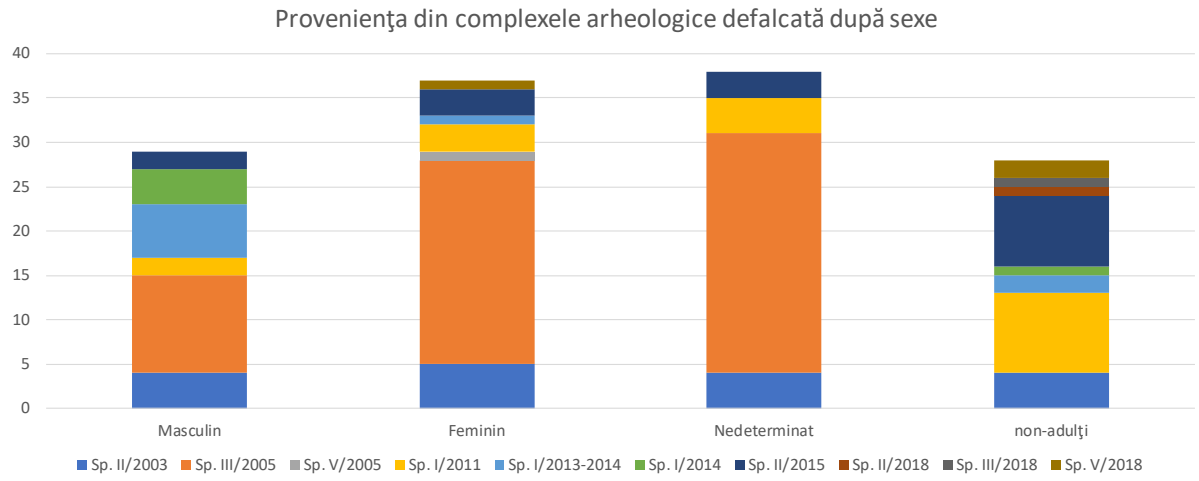

Fig. 55. Contribuţia fiecărui context funerar de la *Lumea Nouă* luând în calcul sexul decedaţilor.
The contribution of each *Lumea Nouă* funerary funerary feature based on the deceased's sex.

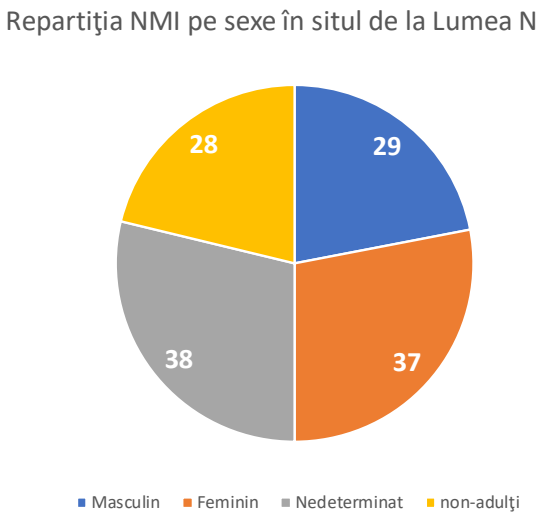

Fig. 56. Repartiţia NMI după sexul decedaților în situl de la *Lumea Nouă*.
The *Lumea Nouă* MNI distribution based on the deceased's sex.

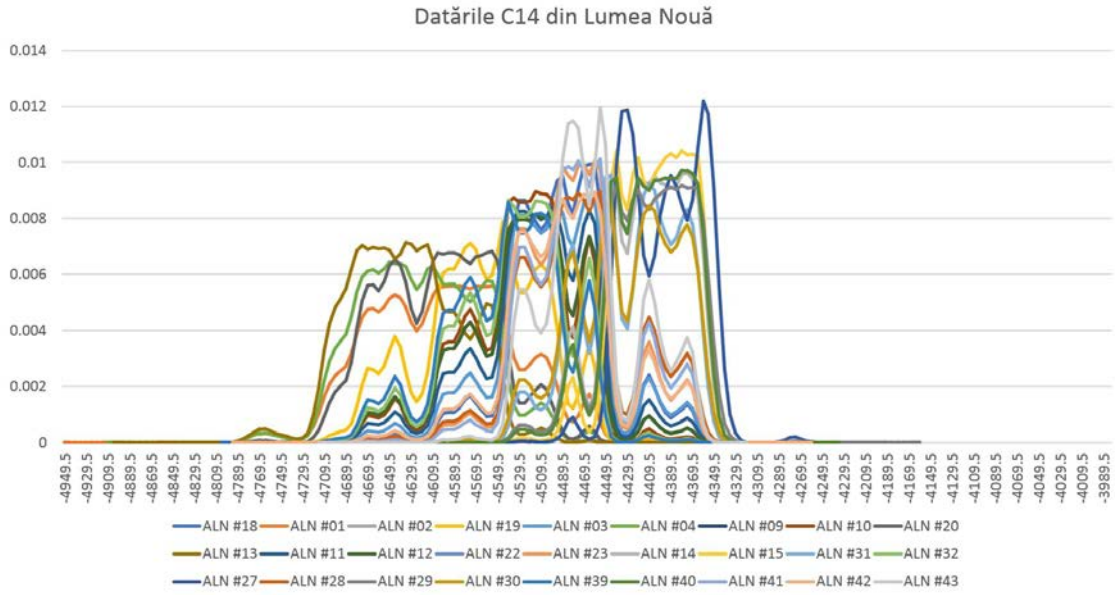

Fig. 57. Distribuția probabilităților datelor ^{14}C provenite din contextele funerare din situl Alba Iulia-*Lumea Nouă*. OxCal v4.4.
The Alba Iulia-*Lumea Nouă* site funerary funerary features' ^{14}C radiocarbon dating probability distributions. OxCal v4.4.

Prin prelucrarea în OxCal (v4.4.) a celor 27 date ^{14}C provenite din situl de la Alba Iulia-*Lumea Nouă*, a fost generată distribuţia probabilităţilor (fig. 57-58) privind palierul cronologic în care s-au petrecut practicile funerare din contextele arheologice luate în studiu.

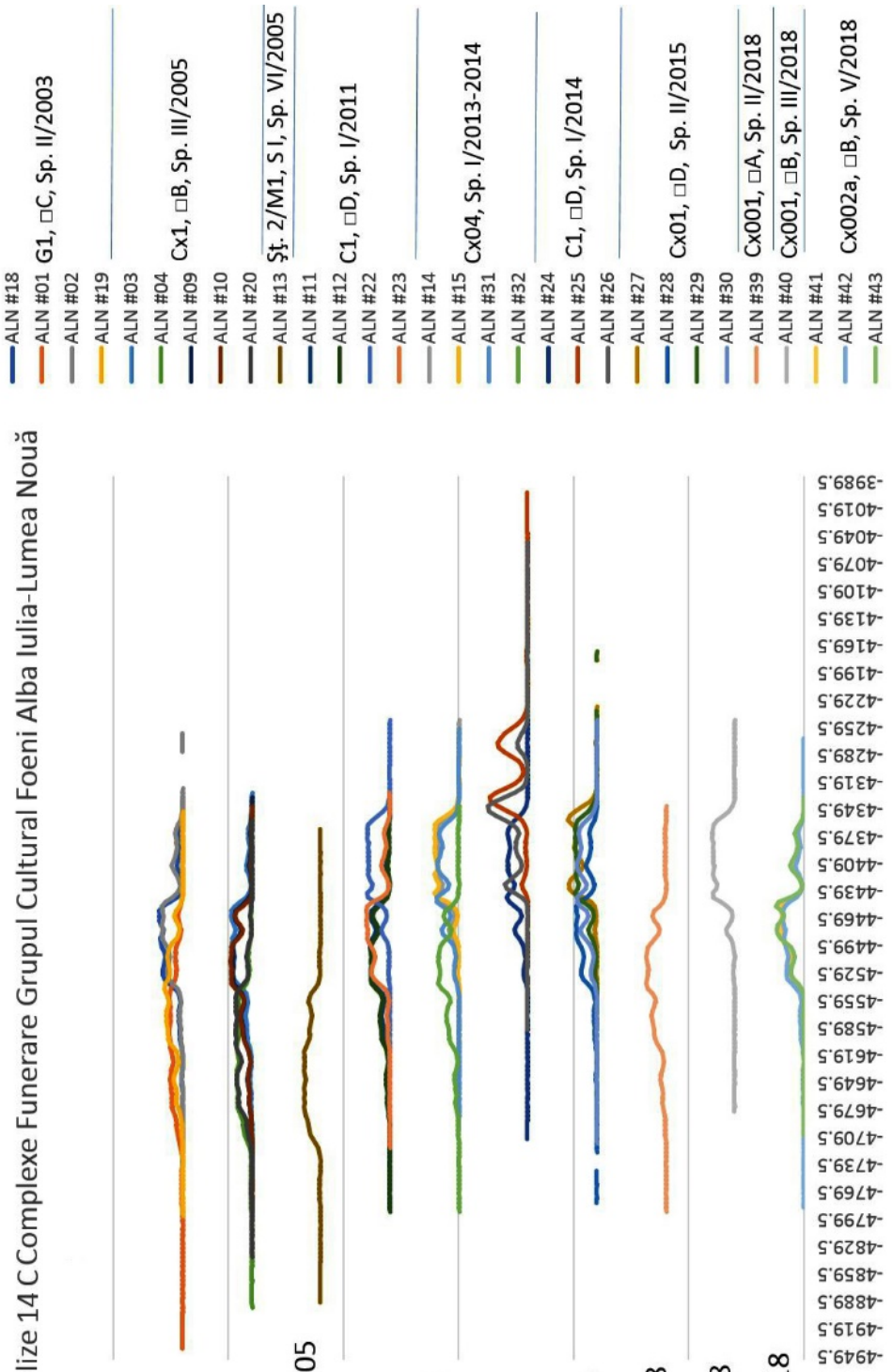

Fig. 58. Distribuția probabilităților datelor ^{14}C provenite din contexte funerare pe complexe arheologice din situl Alba Iulia-*Lumea Nouă*. OxCal v4.4.
The Alba Iulia-*Lumea Nouă* site ^{14}C radiocarbon dating probability distributions split by archaeological context. OxCal v4.4.

◈ Concluzii

Situl de la Alba Iulia-*Lumea Nouă* este poziționat la capătul vestic al unui platou cu altitudini între 243 și 244,5 m care coboară în lunca Mureșului cu o pantă lină de maxim 9%, mărginit la vest de dealul Mamut ce prezintă altitudini de până la 750 m. Un prim brâu care înconjoară stațiunea preistorică ar fi fost format în vechime de pârâul Uj (Nou), astăzi dispărut – inclusiv din memoria cartografică contemporană - care curgea la nord la cca 1 km și la est la cca 475 m depărtare de sit. Un al doilea brâu este cel format la nord de pârâul Ampoi la cca 2,8 km și la est de același pârul la cca 1,6 km distanță, iar al treilea factor protector este reprezentat de râul Mureș, care își are cursul la est de așezare la ca 3,5 km (fig. 59).

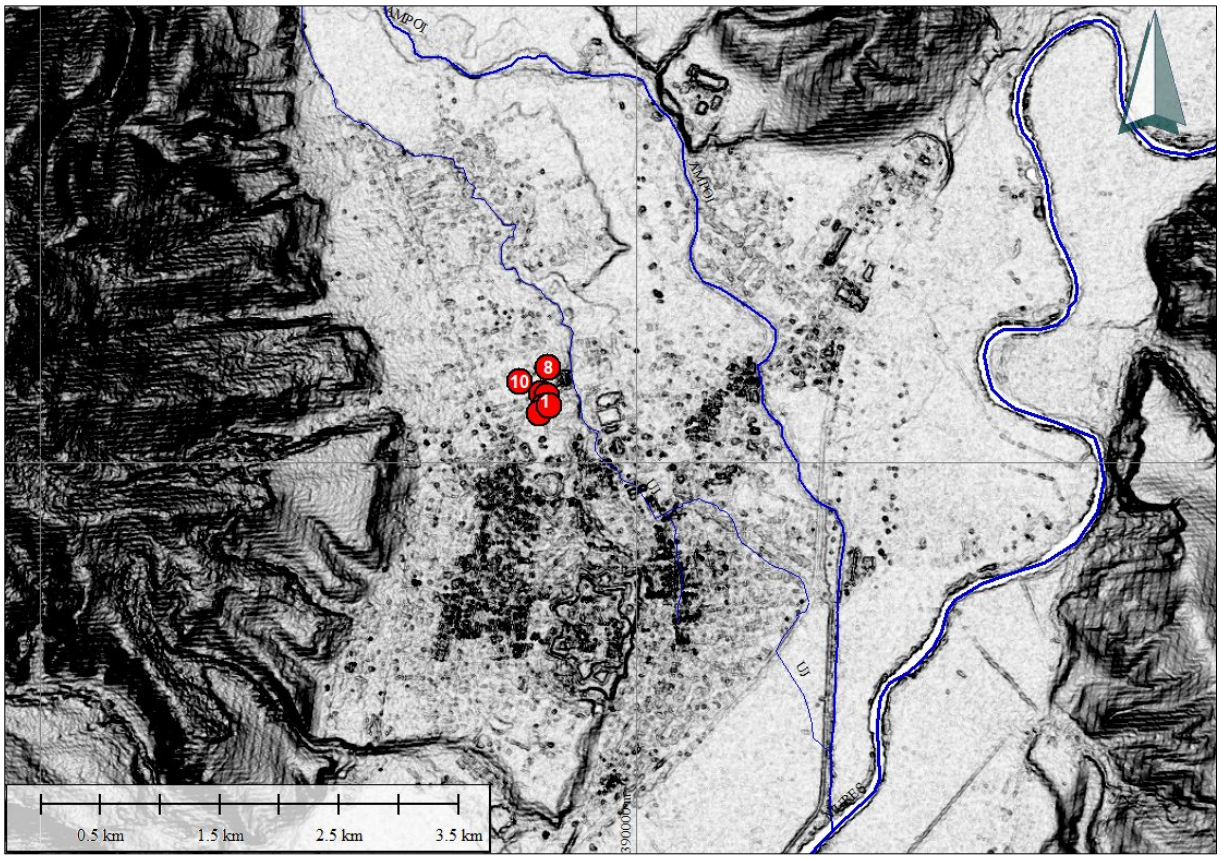

Fig. 59. Cadrul geografic lărgit cu includerea descoperirilor funerare de la Alba Iulia-*Lumea Nouă*. Fundal modelul digital de elevaţii Copernicus[14] cu rezoluţia de 10 m. Shader SlopeShader. Stereo70. GlobalMapper v23.
Enlarged geographical overview of the Alba Iulia-*Lumea Nouă* funerary discoveries. 10 m Copernicus EU DEM background. SlopeShader. Stereo70. GlobalMapper v23.

[14] A se vedea https://www.eea.europa.eu/data-and-maps/data/copernicus-land-monitoring-service-eu-dem.

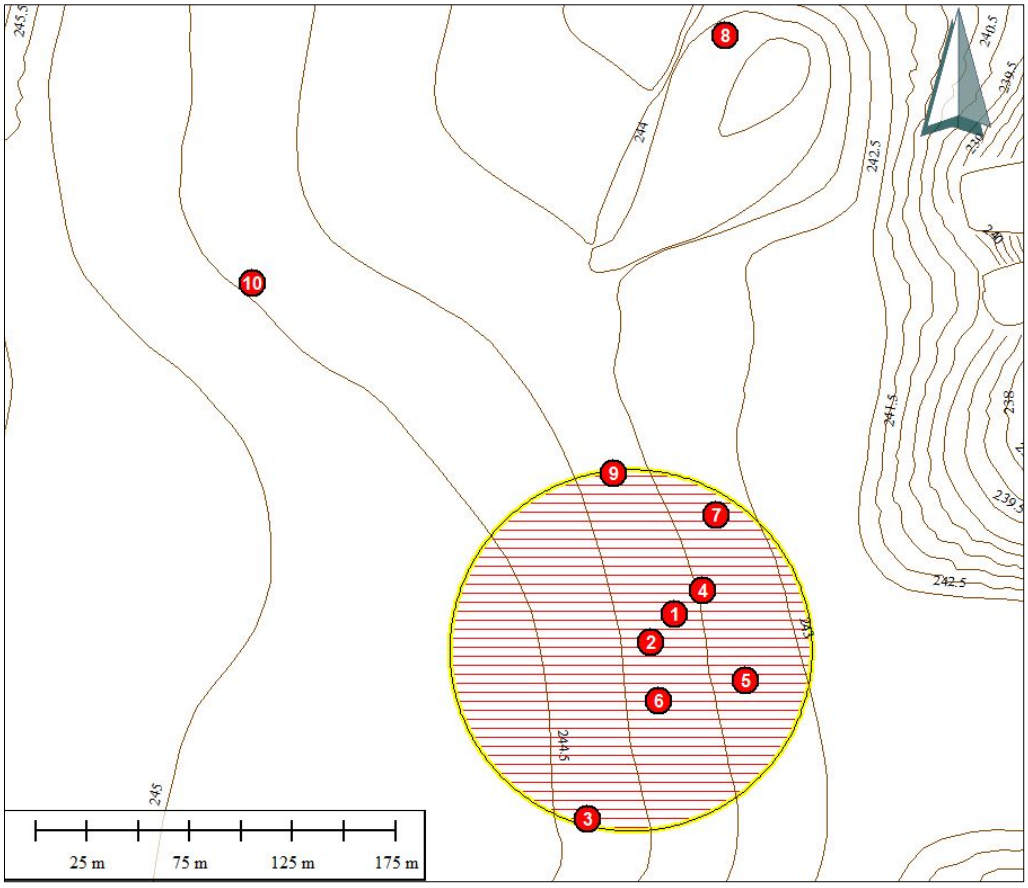

Fig. 60. Distribuţia geospaţială a descoperirilor funerare aparţinând grupului cultural Foeni de la Alba Iulia-*Lumea Nouă.*
The geo-spatial distribution of the Alba Iulia-*Lumea Nouă* Foeni Cultural Group funerary discoveries.

Aşa cum se poate observa din distribuția geospațială a descoperirilor funerare aparținând grupului cultural Foeni, în stadiul actual al cercetărilor se conturează o concentrare a acestui tip de contexte arheologice într-un spaţiu circumscris unui cerc cu diametrul de 174 m, ce include înmormântări multiple (1-2, 4, 7), înmormântări secundare (6, 9) şi înmormântări în şanţuri (3, 5), indicând şi o polarizare în jurul Sp. III/2005 (2), contextul funerar cu cel mai mare NMI (fig. 60). Înmormântarea secundară notată cu 8 şi tripla inhumare de la 10 sunt în momentul de faţă în afara zonei despre care facem vorbire. Aşa cum a evoluat nivelul cunoaşterii în ultimele două decenii referitor la fenomenul funerar identificat la Lumea Nouă, nu ar fi deloc surprinzător ca în viitorul apropiat noi contexte funerare să fie descoperite spre nord de punctele 7 şi 9 (vezi şi fig. 7-8) şi să elimine particularitatea constatată în prezent.

Dacă ținem seama de datele statistice prezentate în tab. 11, în spațiul la care facem referire în fig. 60 (contextele funerare 1-7, 9) se includ unitățile de cercetare ce au pus în evidență descoperirea resturilor scheletice aparținând a cel puțin 132 de indivizi. Agregarea analizelor antropologice cuprinse în fig. 13, 28, 41 şi tab. 5.2, 8.2, 9.2 ne oferă informații importante privind estimarea vârstei decedaților şi ne permite să tragem concluzia că sunt prezente eșantioane din toate categoriile de vârstă.

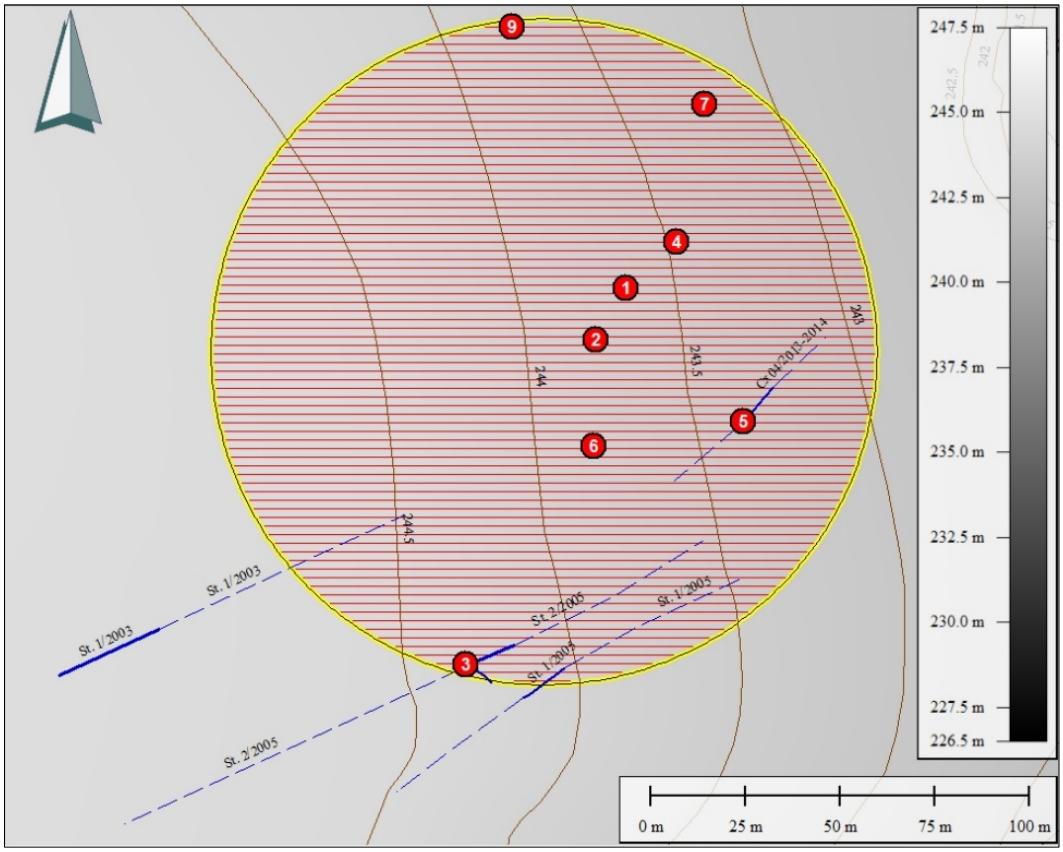

Fig. 61. Relaţia geospaţială între complexele funerare şi şanţurile aşezării preistorice.
The geo-spatial relationship between the funerary features and the prehistoric settlement's ditches.

Concentrarea descoperirilor funerare într-un spațiu bine definit, ilustrat în stadiul actual al cercetărilor printr-un cerc cu raza de cca 87 m centrat pe descoperirea funerară nr. 2, ales ca reper din motivul explicat mai sus, poate fi pusă pe seama prezenței șanțurilor descoperite cu ocazia cercetărilor din Sp. I/2003 (M. Gligor 2009, p. 31, pl. CLXXXVI/1-3) și Sp. VI/2005, descrise în prezentul studiu. Traiectele celor 3 şanţuri, forma şi dimensiunea acestora le califică ca făcând parte din sistemul defensiv al așezării în vremea locuirii Foeni, cu rol de a proteja latura sudică a sitului. Caracterul preventiv al cercetărilor arheologice a împiedicat pentru moment verificarea traseului acestora spre est şi vest. Fotografiile aeriene analizate (fig. 3, 5) nu au furnizat indiciile specifice referitoare la posibile șanțuri din perioada locuirii preistorice.

Pe baza hărții de la fig. 61, vedem cum descoperirile funerare numerotate cu 1-2, 4, 6-7 se află la nord de cele 3 şanţuri, în apropierea acestora. Chiar contextul funerar notat cu 5 în studiul nostru reprezintă o descoperire arheologică realizată pe fundul unui şanţ, a cărui utilitate nu poate fi însă precizată cu precizie date fiind datele constructive de care dispunem.

Dacă raportăm contextele funerare de la Lumea Nouă la Sp. III/2005 (2), conform fig. 62 distanţele faţă de acest punct sunt: 15,73 m (1), 92,4 m (3), 33,33 m (4), 44,67 m (5), 28,11 m (6), 68,4 m (7), 297,44 m (8), 263,97 m (10).

Comportamentul funerar atribuit comunităților Foeni de la Lumea Nouă evidențiat prin descoperirile prezentate sintetic în prezentul studiu reprezintă prin particularitățile sale ilustrarea unui fenomen unic pentru eneoliticul carpato-dunărean şi nu numai.

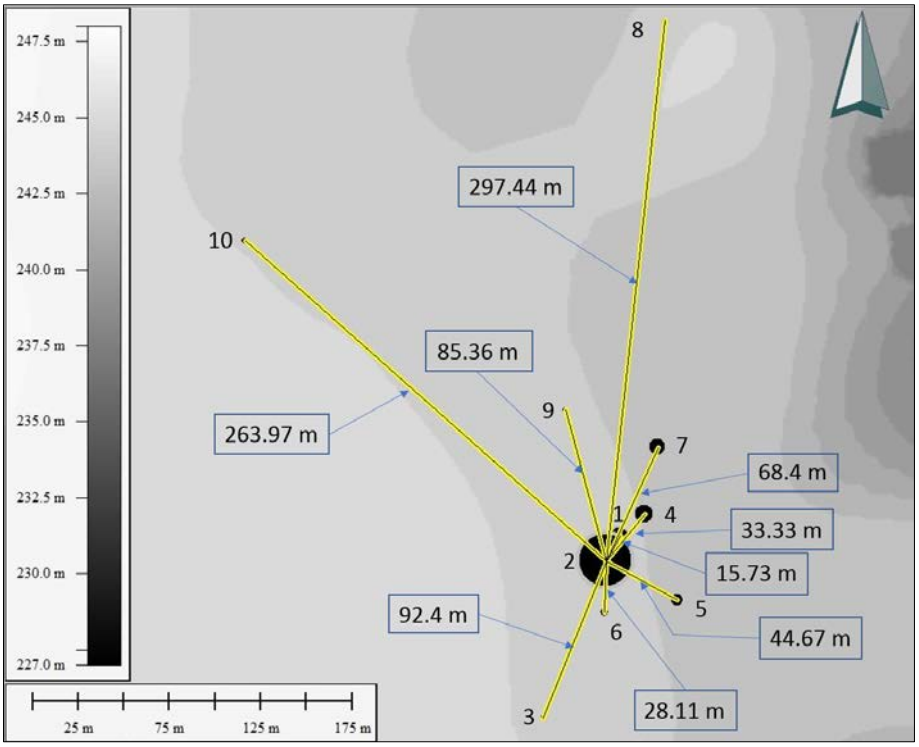

Fig. 62. Relaţia geospaţială între complexele funerare de la Alba Iulia-*Lumea Nouă*, având ca punct central Sp. III/2005.
The geo-spatial distribution of the Alba Iulia-*Lumea Nouă* funerary features centered on Sp. III/2005.

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Carbonised seeds in the Gumelnița settlement of Geangoești

Ana ILIE*, Marin CÂRCIUMARU**

Abstract: *The article deals with the results of the carpological analysis conducted on several older samples and particularly on a consistent batch of seeds found during the archaeological excavations carried out in 2019 in dwelling 4 of Geangoești, attributed to the Gumelnița culture. The caryopses recovered from vessel 118 are the most numerous and, to an overwhelming extent, have been attributed to the* Triticum dicoccum *species, and much less to the species* Hordeum vulgare nudum *and* Pisum sativum*. Barley had been attested in this settlement following the study of samples of already studied seeds. The species of seeds found in the Chalcolithic of Geangoești have been presented within the context of their attestation in the earliest settlements of Eurasia and those belonging to the Gumelnița culture in the Romanian territory. Furthermore, there have been attempts to suggest the various uses of barley, considering some finds in this regard in Romania.*

Rezumat: *Articolul prezintă rezultatele analizei carpologice asupra unor mostre mai vechi și în mod special a unui lot consistent de semințe descoperit prin săpăturile arheologice din anul 2019 în locuința 4 de la Geangoești, atribuită culturii Gumelnița. Cariopsele recuperate din vasul 118 sunt cele mai numeroase, fiind atribuite într-o proporție covârșitoare speciei* Triticum dicoccum*, iar mult mai puțin speciilor* Hordeum vulgare nudum *și* Pisum sativum*. Orzul fusese atestat în această așezare prin studiul unor probe de semințe deja studiate. Speciile de semințe descoperirile în nivelul eneolitic de la Geangoești au fost prezentate în contextul atestării lor în așezările cele mai timpurii din Eurasia și a celor din cultura Gumelnița pe teritoriul României. De asemenea, pentru orz s-a încercat sugerarea modului de utilizare, avându-se în vedere unele descoperiri în acest sens în România.*

Keywords: *Chalcolithic, the Gumelnița culture, carpology, tell, dwelling, carbonised bread.*

Cuvinte cheie: *eneolitic, cultura Gumelnița, carpologie, tell, locuință, pâine carbonizată.*

◈ Introduction

Macroscopic organic finds in prehistoric sites located in areas with temperate continental climate are quite rare. There are a multitude of factors which contribute to the degradation and destruction of organic materials and products, such as the soil activity of micro- and macro-mammals, biological oxidation, soil acidity, levigation processes, agricultural and humus maintenance works, pluviometric variations etc. (M. Kibblewhite *et alii* 2015). Tells are an exception, because provide the opportunity to discover various organic remains due to some significant anthropic deposits, the use of clay as a building material, the custom of burning dwelling structures, the storage of household waste either in specially arranged places, located on the outskirts of settlements, or through dwellings. Among such

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remains, the carbonised botanical macro-residues, sometimes stored in vessels, are of particular importance. The analysis of these discoveries and the publication of data may help, often essentially, reconstitute such concerns about how those particular communities procured the food resources and got into certain culinary habits.

The tell of Geangoești-Hulă, Dâmbovița County, lies in the Dâmbovița River meadow, right below the terrace on the left side, in a sector in which the meadow widens when the river course exits the Sub-Carpathian area, more specifically at the contact of the Cândești Piedmont with the High Plain of Târgoviște (fig. 1). The meadow is wide because, in time, the river has changed its course countless times. The terrace near the tell is high, with a relative altitude of about 15 m, whereas the area at the foot of the terrace is swampy, fed by springs with low and discontinuous flows. The site is about 2 km away from the bed of the Dâmbovița River, whose current course is located at the base of the terrace on the right versant (D. Micle, A. Stavilă 2014).

◈ The context of finds

The 1960 archaeological excavations focused on the central part of the Geangoești-Hulă settlement and materialised by the excavation of an area of about 250 square meters (G. Mihăiescu, A. Ilie 2004). Recent studies are currently being conducted within a systematic archaeological research project, for the 2015-2022 period, entitled *Cercetări arheologice în bazinul superior al râului Dâmbovița: situl Geangoești-Hulă* ('Archaeological research in the upper basin of the Dâmbovița River: the Geangoești-Hulă site'). The aim is to reconstruct the spatial and chronological evolution of the site, the succession of anthropic activities, as well as the identification of cultural networks and contacts (O. Cîrstina *et alii* 2016).

In 2017-2019, an area of about 500 square meters, comprising the entire southern half of the settlement, was opened for excavation. This area was divided in two zones, by preserving a 2-meter-wide outlier.

The burnt dwellings in the upper levels in the southwestern quarter of the settlement were researched in the 2019 campaign (A. Ilie *et alii* 2020) (fig. 2). Dwelling 4 is the best preserved, whereas dwellings 1 and 2 were affected by many disturbances which occurred mainly after the abandonment and burning of the built structures. On the other hand, dwelling 5 was largely affected by the archaeological sections traced in 1960.

The Gumelnița tell of Geangoești-Hulă has offered many surprises in terms of the finds of organic materials, such as cords and string dolls, plant-fibre braids, probably from the roof of houses, most often carbonised. Carbonised seeds are also present and are the subject of this study.

Dwelling 4, though slightly affected post-depositionally, has largely preserved the initial aspect previous to the burning to which it was subjected, such as, among other things, a number of upset vessels on the floor next to the hearth (fig. 3).

The seeds associated to vessel 118, a bitronconic bowl with a volume of 3.3 litres, broken *in situ*, were found opposite the burning structure in dwelling 4 (fig. 4). Vessel 137 (fig. 3), which provided several carbonised seeds, was in the immediate vicinity.

The carbonised caryopses associated to vessel 118 were taken together with the sediment that was part of the house floor. Initially, the entire material, i. e. seeds, sediment, burnt adobe fragments etc., occupied a volume of 9.3 litres, but, after a first separation, there were 1,323 grams of seeds and a little less residue of sediment, charred earth etc. left.

Vessel 137 was lifted without being emptied of sediment. After the flotation carried out in the laboratory, about 10 grams of seeds and other organic residues remained.

◈ The carpological study

A batch of about 2,000 carbonised seeds attributed to the *Hordeum vulgare nudum* species (fig. 5/1) was identified in a level belonging to the Gumelnița B (III) culture in the settlement of Geangoești, the 'Hulă' point, many years ago (M. Cârciumaru 1996). The seeds were recovered from a pot outside dwelling A, and its dating revealed the age of 5352 ± 30 B.P. (6211-6107 cal. B.P. – 48.5 %, RoAMS 573.33). At the time, these were the only mentions regarding the agriculture of Gumelnița communities from Geangoești.

The average dimensions of the caryopses recovered are as follows: length = 5.0 mm; width = 3.1 mm; height = 1.9 mm (tab. 1).

	Maximum	Average	Minimum
Length	5.5	5.0	4.5
Width	3.5	3.1	2.0
Height	2.1	1.9	1.5

Tab. 1. Dimensions in mm of the *Hordeum vulgare nudum* seeds.

The 'Princely Court' National Museum Complex in Târgoviște resumed the archaeological investigations in the Geangoești tell, thus creating the premises for recovering a significant amount of carbonised seeds in certain contexts, such as the vessels attributed to this culture.

The material gathered from the site also contained some sediment and minuscule remains of pottery, adobe, plant residues etc. Most of the seeds were largely fragmented (fig. 6/1), most likely due to the flotation process.

Vessel 118 provided a significant quantity of carbonised seeds. Over 5,000 intact caryopses of *Triticum dicoccum* were separated, but their number was actually much larger, so the amount should be multiplied 3-4 times (fig. 7/1, 8). Although many of them are fragmented, they certainly belong to the same wheat species (fig. 6/2).

The largest unbroken caryopses are generally 5.9 mm long, 3.3-3.0 mm wide and 2.9-2.7 mm high. As regards those of very small sizes, the length varies between 4.0 and 3.5 mm, the width is between 2.4 and 2.2 mm and their height does not exceed 2.1 mm (fig. 8/1). Many caryopses preserve sediment impregnated on their surface, and, due to calcium carbonate precipitation, this sediment got embedded in the structure of the seed surface (fig. 8/2), whereas a small part of them suffered slight deformations. The carbonisation of seeds was medium, therefore the structure of only a few specimens was deeply affected.

31 seeds of *Hordeum vulgare nudum* were also separated in vessel 118 (fig. 5/2), having similar morphology and dimensions to those already mentioned in another context in the Geangoești settlement (fig. 5/1).

The list of species in this vessel is completed by 5 carbonised seeds of *Pisum sativum* cf. ssp. *arvense* (fig. 9/1). Their diameter ranges from 4.0 to 4.6 mm.

Only 4 seeds of *Pisum sativum* cf. ssp. *arvense* (fig. 9/2), 2 *Triticum dicoccum* caryopses and about 15 undetermined seeds were found in vessel 137.

In addition, 10 seeds of *Pisum sativum* cf. ssp. *arvense* (fig. 9/3) and only one *Hordeum vulgare nudum* seed were gathered from the floor of that dwelling, between vessel 118 and vessel 137.

In conclusion, through recent research, it has been possible to add a second cereal of the *Triticum* genus, the *dicoccum* species, to the only one known until recently in the settlement of Geangoești, namely that attributed to the *Hordeum vulgare nudum*. Moreover, the first species of legumes, the *Pisum sativum*, most likely the *arvense* subspecies, was attested. The significant

amounts of seeds of *Hordeum vulgare nudum* and *Triticum dicoccum* entitle us to believe that these two species of cereals were systematically grown by the members of the Gumelnița community near the Geangoești settlement.

◈ Discussions

Triticum dicoccum is the best represented species in the Gumelnița settlement of Geangoești. As is known, it is one of the most common species in the early settlements of the Near East. It is also present at Beidha in Jordan, Catal Hüyük and Hacilar in Anatolia, Ali Kosh in Iran, Ghediki and Achilleion in Thessaly etc. (H. Helbaek 1959, 1964, 1966a; J.M. Renfrew 1969). In Romania, carbonised seeds of *Triticum dicoccum* were found in the Vinča culture at Liubcova and Parța; it was described in the settlements of Hârșova and Vlădiceasca in the Boian culture; this species is widespread in the Boian-Gumelnița transition period, as found in the settlements of Radovanu, Ipotești and Izvoarele. As regards the Pre-Cucuteni, significant amounts were found at Poduri, where, alongside the *Triticum aestivum*, it was the most important cereal (M. Cârciumaru 1996; F. Monah 1999). As for the Gumelnița culture, *Triticum dicoccum* carbonised seeds were mentioned at Bordușani (R. Hovsepyan 2008), Hârșova (F. Monah, 1999; R. Hovsepyan *et alii* 2020), Lișcoteanca (M. Cârciumaru 1996).

The second cereal species identified is the *Hordeum vulgare nudum*. The earliest attestations of this species are those in the aceramic settlements of Hacilar and Catal Hüyük in Anatolia (J.M. Renfrew 1973). In Romania, this species is encountered starting with the Vinča culture at Parța, at Grădiștea Ulmilor in the Boian culture and at Poduri, the Pre-Cucuteni, where it was highly valued by those communities. As regards the Gumelnița culture, the *Hordeum vulgare nudum* is mentioned in the eponymous settlement attributed to this culture (M. Cârciumaru 1996), Hârșova (R. Hovsepyan *et alii* 2020), Bordușani (R. Hovsepyan 2008); it is also present in the settlements of Frumușica and Bălăneasa, the Cucuteni culture. In the Sălcuța culture, it was certainly grown by the communities of Curmătura and Valea Anilor (M. Cârciumaru 1996).

There have been many hypotheses and arguments regarding the use of barley in prehistoric times, including its role in the preparation of beer as early as the 6th century CE in Sweden and the 1st century CE in Denmark (H. Helbaek 1966b; J.M. Renfrew 1969).

As regards the Romanian territory, we should note the use of barley for the preparation of bread. One of the earliest mentions is the discovery of carbonised bread remains in a pit arranged in a dwelling dated to the period of transition from the Chalcolithic to the Bronze Age in the tell of Sucidava-Celei (*Celei cultural aspect*), for which there is a date, namely C-14: 4225 ± 60 B.P. (B1n 2014). The carbonised bread remains were in the form of an aggregate about 1-1.5 cm thick and 15-20 sq. cm. Following the fragmentation of a small quantity, 22 integral barley seeds (*Hordeum vulgare*), 3 dock seeds (*Rumex crispus*) and one flax seed (*Linum usitatissimum*) were recovered (fig. 10). The presence of the intact barley seeds may be the consequence of their being used to obtain an ingredient necessary for the preparation of bread, more specifically some kind of leaven that helped with the fermentation (M. Cârciumaru 1996). In fact, halves of barley seeds were recovered from the 'buns' found in the lake settlements in Switzerland, such as Robenhausen or Wangen (J.M. Renfrew 1973). As this discovery dates to the period of transition from the Chalcolithic to the Bronze Age, one might assume that such practices regarding the use of barley may be rooted precisely in the Chalcolithic and, why not, in the Gumelnița culture communities.

Barley probably had a symbolic role for those communities because barley spikes were found lying at the base of a pillar supporting another dwelling in that particular tell (M. Cârciumaru 1983, 1996).

The only legume found so far in the settlement of Geangoești belongs to the species *Pisum sativum* cf. ssp. *arvense.* It is one of the legumes known as early as 8450-7950 B.P., when it was grown in the aceramic settlement of Jarmo (Iran) (H. Helbaek 1959), at Can Hasan and Cayőnű (Turkey) (J.M. Renfrew 1968; W. Van Zeist 1972), at Tell Aswad (Syria) (W. Van Zeist and J.A.H. Bakker-Heeres 1979), Jericho (Jordan) (M. Hopf 1983) etc. Closer to our territory, the *Pisum sativum* was attested in Greece after 7450 B.P at Nea Nikomedeia (W. Van Zeist, S. Bottema 1971), as well as in the aceramic settlements of Ghediki, Sesko and Soufli (J.M. Renrew 1966; H. Kroll 1981); in Bulgaria, it occurs after 6200 B.P. at Tell Azmak (M. Hopf 1973).

In Romania, the earliest occurrence of the species *Pisum sativum* ssp. *arvense* is in the Dudești-Vinča culture at Cârcea, where the seeds were placed in a ritual stove. In the stage of transition from the Boian culture to the Gumelnița culture, the pea is documented at Radovanu, but especially at Ipotești, where significant amounts have been found, pointing to particular preoccupations with its cultivation. *Pisum sativum* seeds, not mixed with other species, have been recovered, in large quantities, from Văleni, the Cucuteni culture (M. Cârciumaru 1996).

The plant species found in the Eneolithic settlement of Geangoiești complete the image of interests of the communities attributed to the Gumelnița culture in the Romanian territory. The Geangoești tell is another Gumelnița site where *Triticum dicoccum* has been found, alongside those of Lișcoteanca, Hârșova and Bordușani. *Hordeum vulgare nudum* has also been uncovered here as well as at Gumelnița, Hârșova and Bordușani. The species *Pisum sativum* ssp. *arvense* is one of the important mentions regarding the Gumelnița culture in the Romanian territory, being the only discovery of a significant number of carbonised caryopses which attest the interest of those communities for this legume species.

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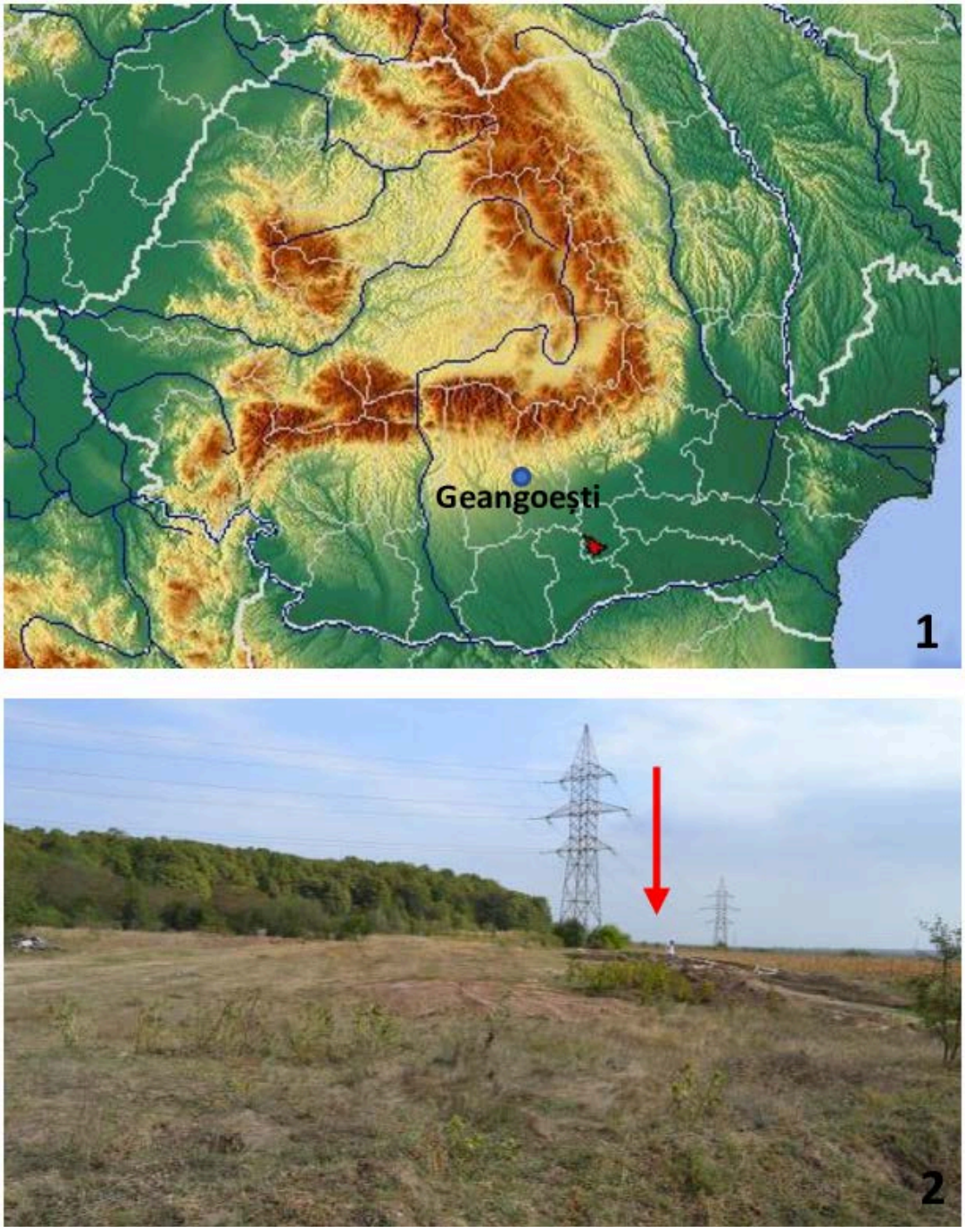

Fig. 1. Geographic location of the Eneolithic settlement of Geangoești.
Poziția geografică a așezării eneolitice de la Geangoești.

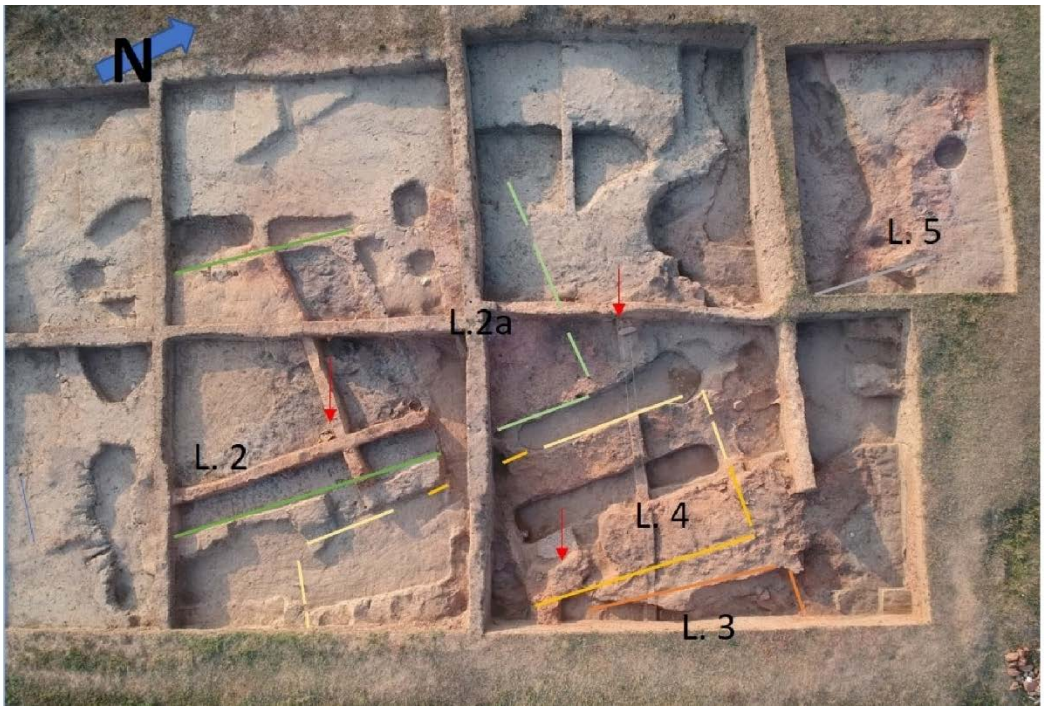

Fig. 2. A number of recently unveiled dwellings in the Geangoești settlement attributed to the Gumelnița culture (the arrows mark burning areas).
O serie din locuințele dezvelite recent în așezarea din cultura Gumelnița de la Geangoești (săgețile marchează zone de combustie).

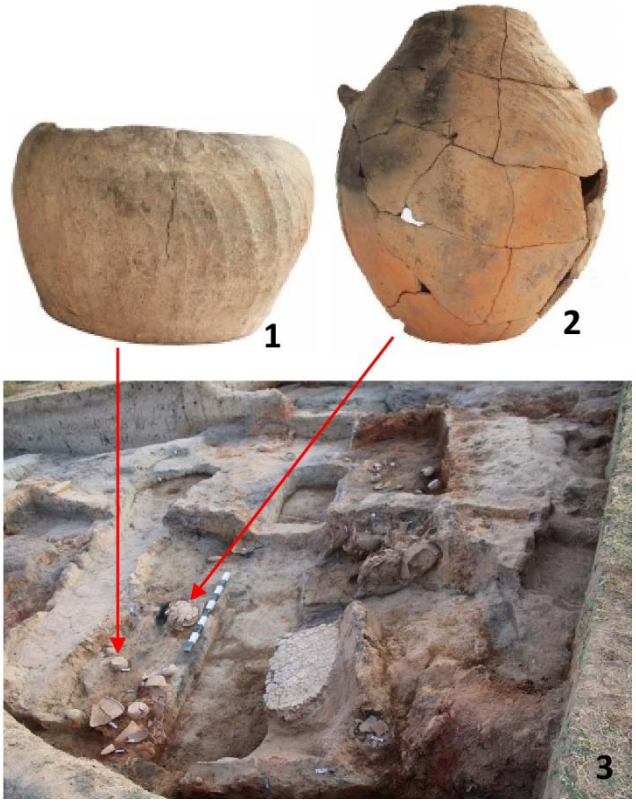

Fig. 3. Vessels in which carbonised seeds were kept in dwelling 4 (1 - vessel 137; 2 - vessel 118; 3 - the position of vessels in dwelling 4).
Vase în care s-au păstrat semințe carbonizate din locuința numărul 4 (1 - vasul numărul 137; 2 - vasul numărul 118; 3 - poziția vaselor în cadrul locuinței numărul 4).

Fig. 4. Vessel 118 and the carbonised seeds scattered near it.
Vasul numărul 118 și semințele carbonizate răspândite în preajma sa.

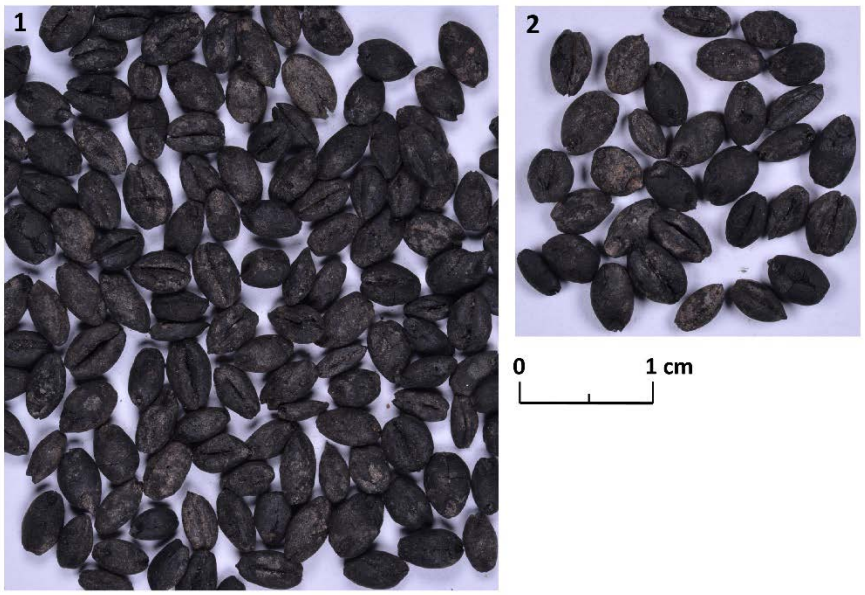

Fig. 5. *Hordeum vulgare nudum* in the settlement of Geangoești (1 - seeds recovered from a Gumelnița B (III) level during older excavations: 2 - seeds resulted from recent archaeological excavations - vessel 118).
Hordeum vulgare nudum din așezarea de la Geangoești (1 - semințe recuperate dintr-un nivel Gumelnița B (III) prin săpături mai vechi; 2 - semințe care provin din săpăturile arheologice recente - vasul nr. 118).

Fig. 6. Appearance of the raw material in vessel 118 before selection (1) and fragmented seeds of *Triticum dicoccum* (2) (1 - image obtained by means of the Hayer microscope; 2 - photo).
Aspectul materialului brut din vasul 118 înainte de selectare (1) și semințe fragmentate de *Triticum dicoccum* (2) (1 - imagine obținută cu microscopul Hayer; 2 - imagine foto).

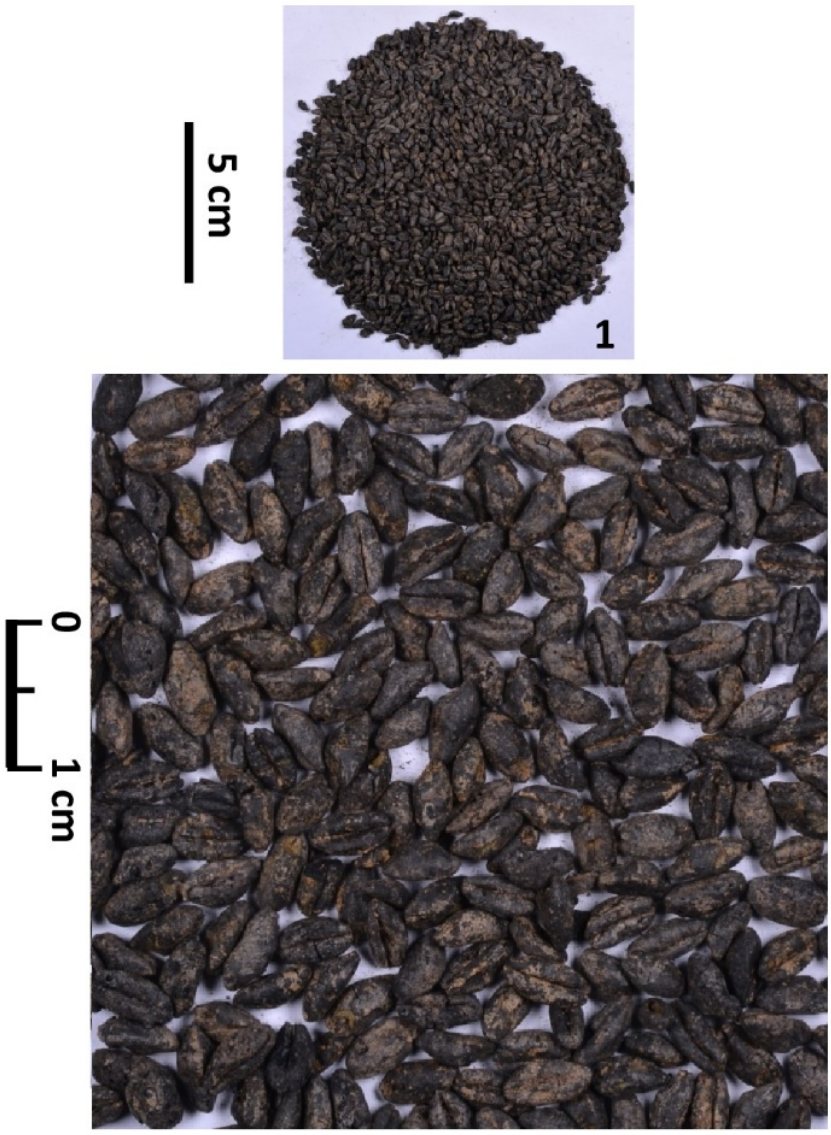

Fig. 7. Photos of *Triticum dicoccum* in vessel 118. 1 - overview of the approximately 5,000 caryopses; 2 - detail regarding the seed morphology.
Imagini foto cu *Triticum dicoccum* din vasul 118. 1 - privire de ansamblu a celor circa 5.000 de cariopse; 2 - detaliu privind morfologia semințelor.

Fig. 8. *Triticum dicoccum* caryopses of various dimensions (1) and with sediment impregnated on the seed surface (2) (images obtained by means of the Hayer microscope).
Cariopse de *Triticum dicoccum* de dimensiuni diverse (1) și cu sediment imprimat pe suprafața semințelor (2) (imagini obținute cu microscopul Hayer).

Fig. 9. *Pisum sativum* cf. ssp. *arvense* (1 - seeds in vessel 118; 2 - seeds in vessel 137; 3 - seeds recovered from the dwelling floor).
Pisum sativum cf. ssp. *arvense* (1 - semințe din vasul 118; 2 - semințe din vasul 137; 3 - semințe recuperate de pe podeaua locuinței).

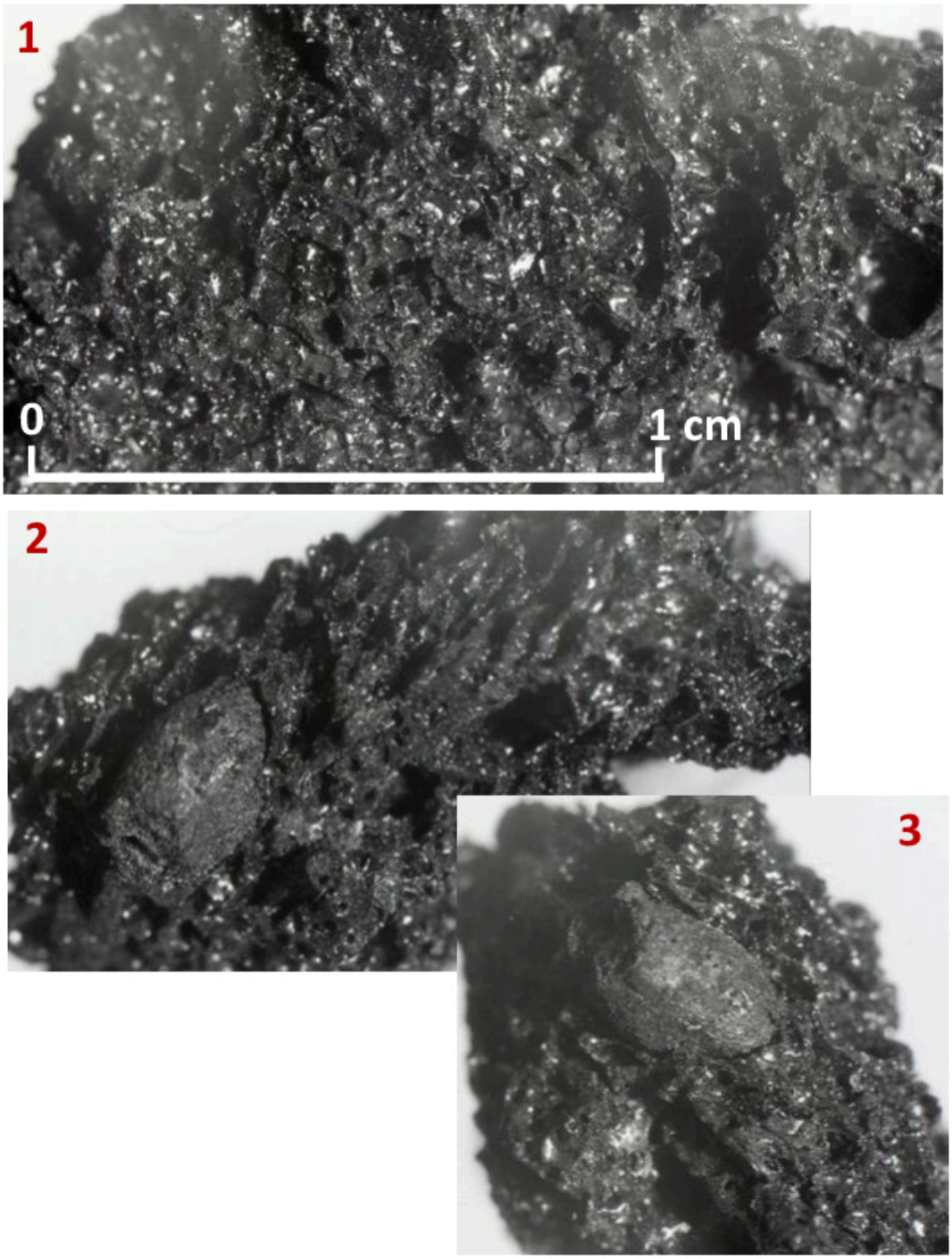

Fig. 10. Carbonised bread with barley seeds in its structure, found in a tell at Celei, dating to the period of transition from the Eneolithic to the Bronze Age. 1 - bread structure; 2-3 barley seed in the bread structure (after Cârciumaru 1996).
Pâine carbonizată cu semințe de orz în structura sa descoperită într-un tell din perioada de tranziție de la Eneolitic la Epoca bronzului de la Celei. 1 - structura pâinii; 2-3 sămânță de orz prinsă în structura pâinii (după Cârciumaru 1996).

Intercultural relationships in South-East of Iran during the late 4th and 3rd Millennium BC: Tepe Keshari as a key site in Baluchestan region

Hossein SARHADDI-DADIAN*

Abstract: *The present research tries to studying an archaeological key site in south-east of Iran, which is located beside Sarbaz River. Sarbaz River is one of the most important rivers in the Baluchestan area. It flows between the Iranian Makran Mountains (Sarbaz County) and finally spilling into the Oman Sea. During the archaeological survey which has been done by the authors in 2009 Tepe Keshari has been identified in the southern parts of the riverbed of the Sarbaz, in front of Hassan Village. The studies have shown that Sarbaz's river in the 3rd millennium BC had important contributed to the formation and expansion of the settlement. It has had the interregional trading in south eastern region of Indo-Iranian borderlands that during the third millennium BC acted positively as a dynamic factor in the vast region of south eastern Iran to Oman Sea shores and southern Persian Gulf. Recent studies in this area show that the Keshari region has been dynamic commercial area between central Baluchestan, Makran and southern Persian Gulf and Oman Sea shores during third millennium BC.*

Rezumat: *Acest studiu încearcă să prezinte un sit arheologic cheie din sud-estul Iranului situat lângă râul Sarbaz. Râul Sarbaz este unul dintre cele mai importante râuri din zona Belucistan. Străbate Munții Makran iranieni (regiunea Sarbaz) și se varsă în cele din urmă în Marea Oman. În timpul sondajului arheologic care a fost efectuat de autori în 2009, Tepe Keshari a fost identificat în zona sudică a albiei râului Sarbaz, în fața satului Hassan. Studiile au arătat că râul Sarbaz în mileniul III î.Hr. a contribuit în mod important la formarea și extinderea așezării. S-a realizat un comerț interregional în regiunea de sud-est a granițelor indo-iraniene, care în timpul celui de-al treilea mileniu î.Hr. a acționat pozitiv ca un factor dinamic în vasta regiune din sud-estul Iranului până la țărmurile Mării Oman și sudul Golfului Persic. Studii recente în această zonă arată că regiunea Keshari a fost o zonă comercială dinamică între centrul Belucistanului, Makran și sudul Golfului Persic și țărmurile Mării Oman în timpul mileniului al treilea î.Hr.*

Keywords: *Baluchestan, Sarbaz River, Indo-Iranian borderland, Tepe Keshari, trade, 3rd millennium BC.*

Cuvinte cheie: *Belucistan, râul Sarbaz, zona de frontieră Indo-Iraniană, Tepe Keshari, comerț, milenniul III BC.*

◈ Introduction

Sistan and Baluchestan is located in a vast territory in the south-east of Iran (H. Moradi 2014; H. Moradi *et alii* 2013; H. Sarhaddi-Dadian 2013; H. Sarhaddi-Dadian *et alii* 2015a, 2015b, 2017a, 2017b, 2020 and 2021; B. Mutin *et alii* 2017; N. Miri *et alii* 2020) and Sarbaz County is located in the southern half of this province. This county is neighbor to the Iranshahr County in the north (H. Moradi *et alii* 2014), Nikshahr County in the west, Chabahar County in the south, and with Pakistan in the east (H. Moradi *et alii* 2013). This area is a mountainous region with complete chain mountains, and this compaction in this area is higher than other areas, and it continue to the Dashtiyari plain in Chabahar county (S.M.S. Sajjaddi 1995). The

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agglomeration of mountains has been one of the important obstacles in the formation of large human settlements in this part during the different times, but the permanent river of the Sarbaz has had a large influence in the environmental conditions, geography and human settlements (fig. 1) Sarbaz River is considered the most important water source for this area, with its origin from Khash Mountains in the north. The river covers a large part of the county from north to the south. The river goes to the border of Chabahar in the south, and then in this part the density of mountain has reduced, and has increased on the flat land. In this area the seasonal river of the Lashar and Kaju flow to the Sarbaz River in the Hodar place that originated from Nikshahr Valley in the west, and makes its way over to south-east. Then with the name of Bahu Kalat gush in the flat desert and fertile alluvial of Dashtiyari, finally, the Sarbaz River flow into the Oman sea (Makran) near the Gulf of Goater on the border of Iran and Pakistan in the east.

◈ Archaeological background of south-east of Iran

This history of archaeological discoveries in the southeastern region of the Iranian and Pakistani Baluchestan began almost eight decades ago with Stein's field work conducted throughout Iran and Pakistan (A. Stein 1937). Afterwards, Caldwell conducted the first excavation at Tele Iblis (J.R. Caldwell 1967). Contemporary with Tele Iblis, Beatrice De Cardi conducted an excavation at Tepe Bampur in the Iranian Baluchestan (B. de Cardi 1970) and then, Lamberg Karlovsky excavated at Tepe Yahya in Kerman (C.C. Lamberg-Karlovsky 1970). In the Pakistani Baluchestan, French mission teams conducted significant archaeological fieldwork at a neolithic site at Mehrgrah (J.F. Jarrige, M. Lecherallier 1979) and in Miri Qalat and Shahi Tump in the Kechi plain of the Baluchestan province in Pakistan (R. Besenval, P. Sanlaville 1990; R. Besenval 1997).

The fourth millennium BC in the southeastern part of the Iranian Plateau is described by some remarkable sites including Tele Iblis (J.R. Caldwell 1967), Tepe Yahya (T.W. Beale, C.C. Lamberg-Karlovsky 1986) located in the Kerman region and Chah Husseini in the Bampur valley (A. Stein 1937). It is worth noting that aceramic Neolithic period, evident throughout the Iranian and Pakistani Baluchestan, was also found in Mehrgrah I-II (J. F. Jarrige *et alii* 1995). In southeastern Iran, in the Kerman region and Bampur valley, the fifth and fourth millennium BC is characterized by black on buff or red and Lapui wares (B. Mutin 2013, p. 255). The first sample of buff ware emerged in Yahya VI period in the late fifth millennium BC. It argued that it was imported from Fars and is related to fifth millennium BC Bakun ceramics (T.W. Beale, C.C. Lamberg-Karlovsky 1986, p. 58-88). Therefore, black on buff ware was produced during Period VB, and was used into Period VA in the fourth millennium BC (Ibid). However, in period VA, black on buff wares were replaced by black on red (T.W. Beale, C.C. Lamberg-Karlovsky 1986, p. 67-80). This pottery has been distributed throughout a vast area from Tele Iblis in Kerman (J.R. Caldwell 1967; M.R. Sarraf 1981) to the Bampur valley in the Iranian Baluchestan (A. Stein 1937; H. Moradi *et alii* 2014). The dating for these periods is supported by radio carbon dating which indicates the first quarter of the fourth millennia BC for VB and for VA the periods between 3700 and 3300 BC (T.W. Beale, C.C. Lamberg-Karlovsky 1986, p. 10, 13), (tab. 1). Recently, in southeastern Iran, approximately 70 sites were discovered in the Bampur valley ranging in date from the fourth to the third millennium BC (H. Moradi 2014, p. 169). Various kinds of black on red ware related to Yahya VA samples were identified at 18 sites (H. Moradi *et alii* 2014).

In Pakistani Makran, the first half of the fourth millennium BC is referred to as Kech-Makran, Period II, and represents the first appearance of pottery in this region. The main ceramic type in Period II, is Miri ware. Miri ware is a fine painted ware that includes several types of forms in buff, tan and grey. Decoration is mostly comprised of geometric designs, although a stylized ibex is also a common motif. These vessels were made by coiling and were then shaped and smoothed. Other kinds of pottery in Miri II are basket ware, formed inside baskets, and coarse ware. Miri II ware has also been found in the Bampur valley, Fanuch, the Iranian and Chah Husseini by A. Stein (B. Mutin 2014, p. 253). Numerous fragments of Miri pottery have been found recently in the Bampur Valley by Iranian archaeologists (H. Moradi *et alii* 2014). Pottery from Kerman provides the best comparative analysis, particularly regarding certain vessels from Aliabad (Iblis IV) and Tepe Yahya VI-V in the Soughan valley in Kerman (B. Mutin 2014, p. 254). These similarities only relate to certain types of form and decoration. Many types from both regions display their local characteristics.

In the third millennium BC, the most controversial aspect of archaeology is concentrated on interaction spheres or relationships between the Indus civilization and Mesopotamia. Most scholars believe that the pathway of this connection traversed from the south-east of the Iranian plateau. However, interaction spheres in the southeastern region of Iran are supported by excavations at key sites including Tepe Yahya and Shahr I Sokhta (C.C. Lamberg-Karlovsky, M. Tosi 1973). Recent discoveries in the Halil Rud basin in Kerman evaluated these hypotheses (Y. Madjidzade 2007) raising this topic once again. Some scholars argue that interactions between Shahr I Sokhta and Harappa were established during the third millennia. Some remarkable materials seen at Shahr I Sokhta, Pakistani Makran, Baluchestan and Harappa sites including Nusharo (E. Cortesi *et alii* 2008) support this hypothesis. Objects include 'only few Nal sherds, most of them found in Shahr-I Sokhta 3I and one from Tepe Yahya, a canister jar from Shahr-I Sokhta, two so-called Kot Dijian jars, one from the Central Quarters of Shahr-I Sokhta and the latter from Mundigak and last but not least an unfired terracotta female figurine, like the Zhob type found in Shahr-I Sokhta' (M. Tosi 1983). While the material evidence of exchange and contacts is indeed scanty (E. Cortesi *et alii* 2008, p. 5-35) recently, other archaeologists have rejected this idea (J.F. Jarrige, A. Didier 2011).

◈ Tepe Keshari location

Tepe Keshari as a main site in the southestern part of Iran. It is located in Keshari plain at Pishin area, which is the part of Sarbaz region in Iranian Baluchestan (fig. 1). In this area, Keshari plain as a terminal domain of the mountainous region reaches to the flat lands of Dashtiyari in the north of Oman Sea in Iranian coasts (H. Sarhaddi-Dadian, H. Moradi 2009). Sarbaz river as a permanent river in this area, flows from north and continues to the Oman sea in the south. Geographically, flat lands and permanent source water have provided suitable conditions for formation of human settlements during the chalcolithic period and Bronze age (4th and 3rd millennium BC). Tepe Keshari has a significant height of about 3 meters over the surrounding grounds and also a diameter of about 50 meters (fig. 2), which other sites around it have no height more than 1 meter.

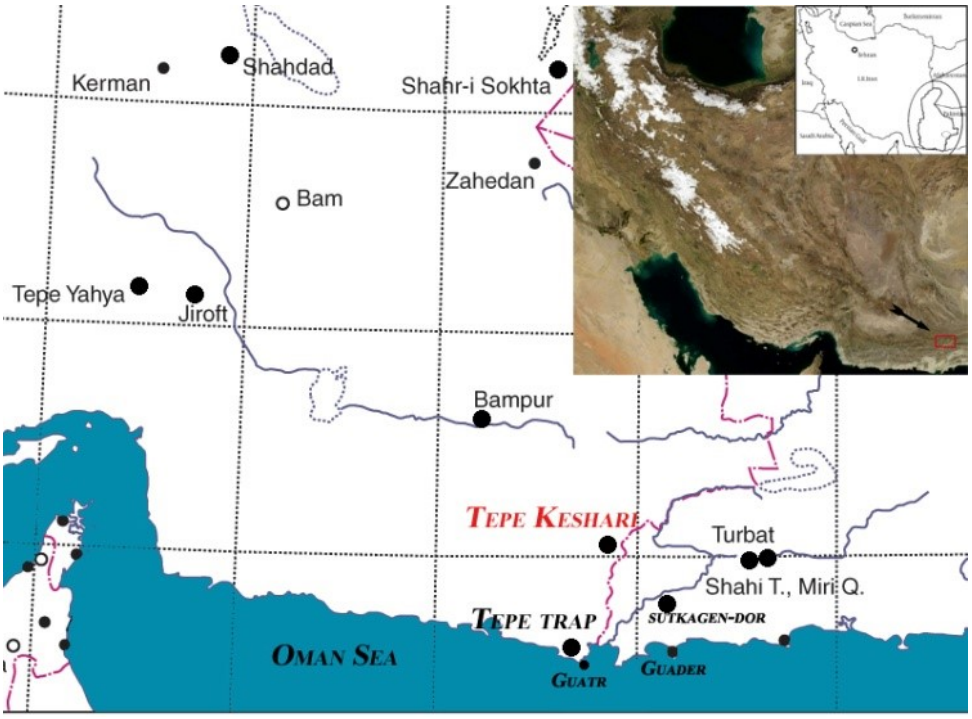

Fig. 1. Tepe Keshari and other adjacent sites.
Tepe Keshari și siturile invecinate.

Fig. 2. Tepe Keshari from south.
Tepe Keshari dinspre sud.

◈ Cultural material of Tepe Keshari

In the first season of archaeological survey at Sarbaz region that held by authors, the surface of Tepe Keshari covered by different kinds of potsherds and cultural materials that surprised us because there was no site with such diversity in the surface phenomena in Sarbaz region in the borderlands of Iranian – Pakistani Baluchestan. Painted black on red and black on gray potsherds along with stone tools such as bifacial micro blades and other kinds of stone blades, shells, alabaster vessels and bronze objects widely scattered on the surface of the site that suggests broad spectrum household activities. Moreover, many lithic objects with delicate slices and various forms suggest dynamic agricultural activities alongside hunting on the riverbank of Sarbaz (fig. 3). The red and grey shards are painted with geometric designs which include series of hatched triangles, super imposed zigzag parallel lines, mutual hatched triangles and etc. Among gathered material from the surface of Tepe Keshari we have the vast chrono - cultural range of material which starts from 4th millennia and continues to the middle of third millennium BC. Most of them are comparable with Miri ware (Miri II-IIIa) in 4th millennium BC (B. Mutin *et alii* 2017), Miri Qalat IIIB-C about 2700 to 2300 BC in Kech – Makran in Pakistanian Baluchestan (R. Besenval 1994; R. Besenval, A. Didier 2004; A. Didier 2007) and with the Bampur sequences in Iranian Baluchestan about 2900-2600 BC (B. de Cardi 1970; H. Moradi *et alii* 2014) and also with Yahya VB-A(in 4th millennium BC) and IVB-C (beginning of 3rd millennium BC) in Kerman and Shahr i Sokhta period I.9-8 beginning of 3rd millennium BC in Iranian Sistan. These similarities could be interpreted as wide cultural interactions with adjacent areas in the fourth and third millennium BC. (fig. 4).

As Thomas Beale mentioned, a large part of the valuable objects for commercial aims have been brought from the Iranian plateau to the different part of Indo-Iranian borderlands (T.W. Beale 1973; H. Sarhaddi-Dadiand *et alii* 2020). Accordingly, two pieces of the soapstone or chlorite vessels also have been found on the surface. This type of raw and finished materials are considered as a key factor for long distance trade during the third millennium BC (P.L. Kohl 1979) whereas, their sources were both in Kerman and Oman peninsula (P.L. Kohl *et alii* 1978). By now, there are no evidence of chlorite mines or sources in Baluchestan area. Otherwise, we collected numerous pieces of alabaster vessels, which was another characteristic signs of inter-regional and long distance trade (fig. 5).

◈ Conclusion

According to the analysis of cultural materials in Keshari plain, they indicate a cross-regional relationships which had short geographical distances to sites in Kech-Makrani in the east, coastal sites in Oman Sea in the south (R. Besenval, A. Didier 2004), Bampur valley and Dowlat Abad plain in Kerman in the west and Sistan in the north.

In Keshari region two factors had been important to shape some settlements. First, its distance as a regional commercial center to the Oman Sea in the one hand, and the placement of this region between Bampur valley and Kerman region in Iran and Kechi plain in Pakistan on the other hand. It is worth noting that in the coast of Goatr in Chabahar in the south of Keshari plain, we found a 3rd millennia coastal site named Tepe Trap[1]. The permanent river and fertile plain along with flat lands were considered as a second factor that provided both food based on agriculture and an easy access to long distance destinations. Therefore, Tepe

[1] The archaeological survey of Oman sea was held by Hossein Moradi , Rouhollah Shirazi and Behzad Ali Talesh in different years from 2010 to 2012.

Keshari should be an example of a commercial intermediary site among Iranian's Baluchestan in the west, Oman Sea in the south and the Kech-Makran plain in the east.

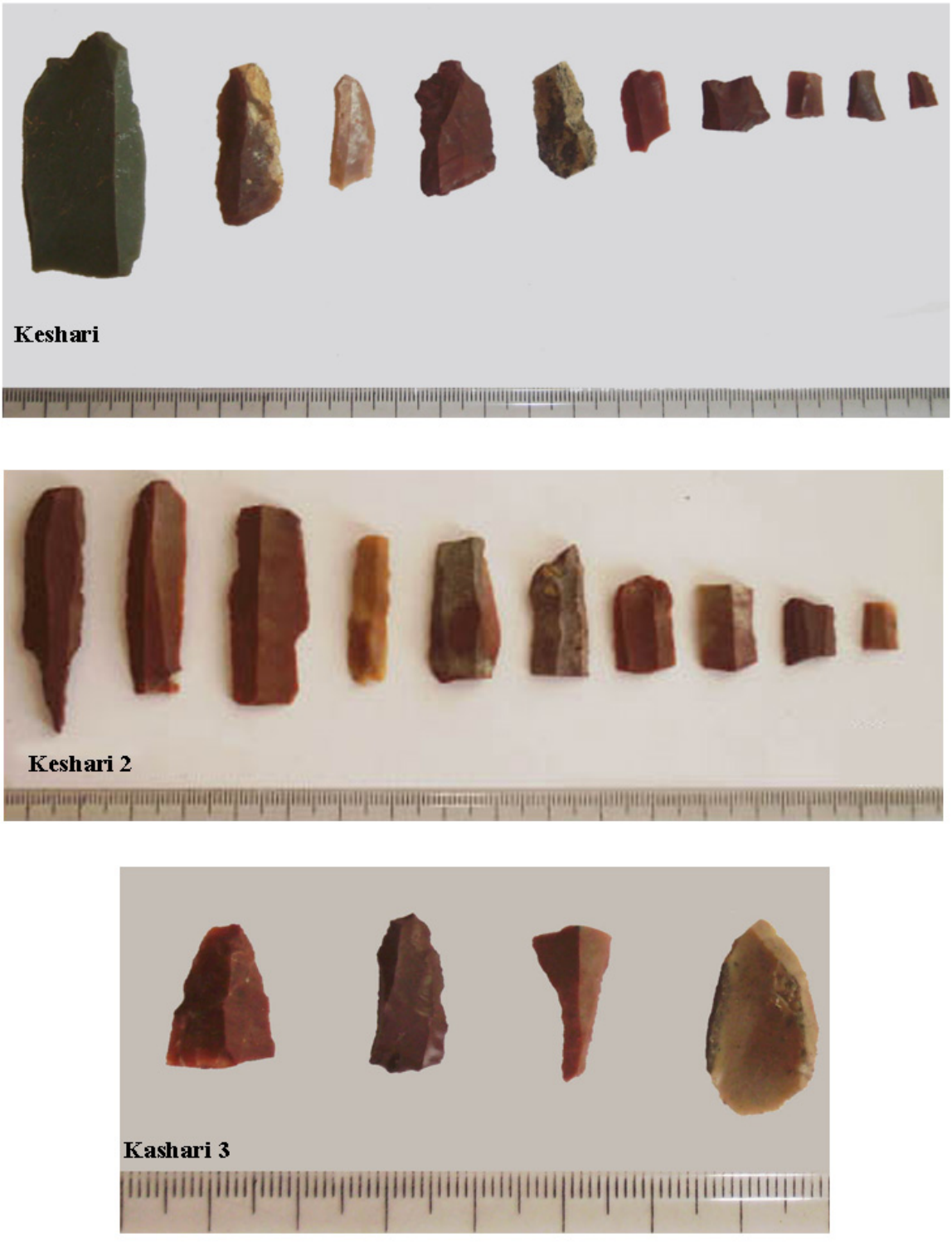

Fig. 3. Stone tools with different functions from Keshari region.
Unelte de piatră cu diferite funcționalități din regiunea Keshari.

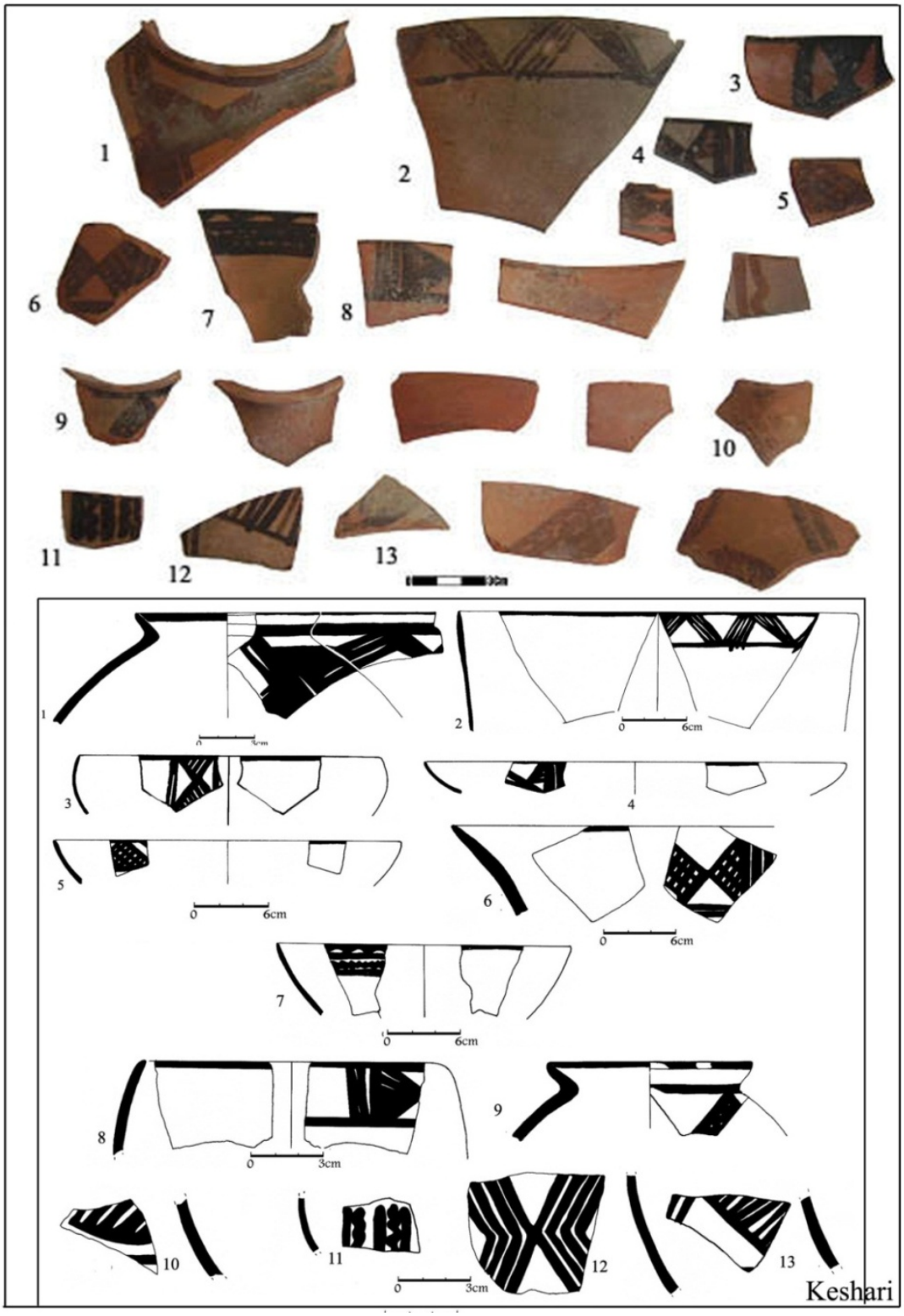

Fig. 4. Pottery of Tepe Keshari.
Ceramică de la Tepe Keshari.

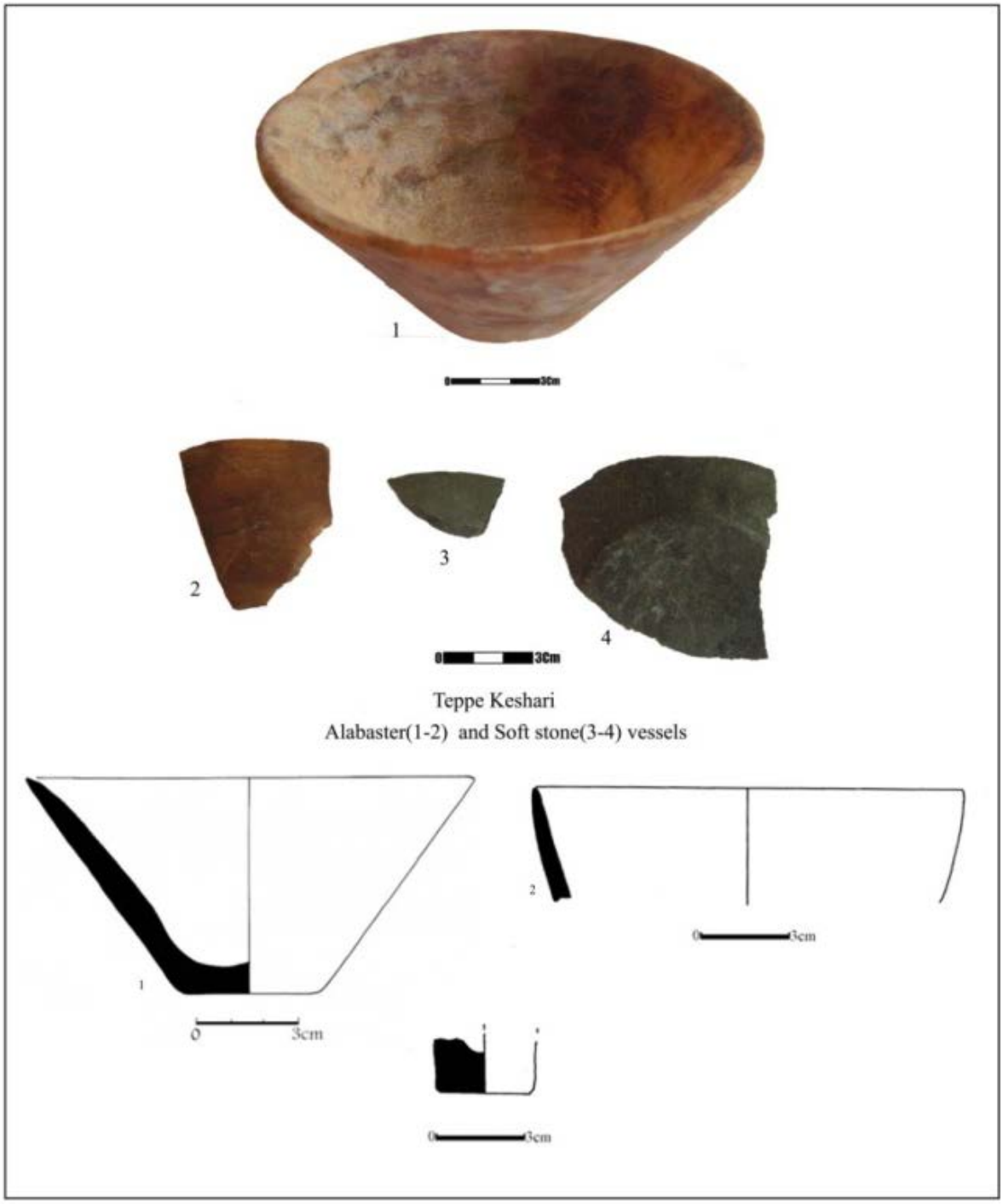

Fig. 5. Chlorite and alabaster vessels from Tepe Keshari.
Vase din clorit și alabastru de la Tepe Keshari.

In general, we can suggest that the motifs of Keshari's pottery show visible multi-regional effects as well as the Bampur valley and Kechi plain. It is a sign of cultural dynamic in the Keshari plain during the fourth and third millennium BC, which was located near the Oman Sea. The presence of Keshari region in the chalcolithic period and Bronze Age indicates regional interaction based on commercial trading of materials between Iran and Pakistan Baluchistan. Diversity of the characteristic cultural materials on the site may reflect both the commercial activities and the presence of merchants in these areas that have been transferring

their goods to the Oman sea specially at the middle of third millennium BC (J.R. Alden 1982). So far further information will be inferred from more field works.

Keshari (number of shard)	**Bampur Iran**	**Kech- Makran Pakistan**	**Sistan Iran**	**Kerman Iran**
1		Miri II (chalcolithic) B. Mutin 2007, fig. II.58.18		
2			Shahr I Sokhta I.9 Beginning of 3rd millennium R. Biscione1981, fig. 10.15	Yahya IVC (4th -3rd millennium) D.T. Potts *et alii* 2001, fig. 1.44.c
3	Miri II ware from Tomp i Qasimabad B. Mutin 2013, fig. 14.4.4	Miri II (chalcolithic) B. Mutin 2007, fig. II.41.17		
4		Miri II (chalcolithic) B. Mutin 2007, fig. II		
5			Shahr I Sokhta I.9 Beginning of 3rd millennium R. Biscione 1981, fig. 10.9	Yahya IVC (4th -3rd millennium) D.T. Potts *et alii* 2001, fig. 1.12
6				Yahya VB-A (5th -4th millennium) B. Mutin 2012, fig. 8.6
7		Miri IIIa (4th -3rd millennium) B. Mutin2013, fig. 14.15.16	Shahr I Sokhta I.9-8 Beginning of 3rd millennium	
8		Miri II (chalcolithic) B. Mutin 2007, fig. II.61.11		
11		Miri II (chalcolithic) B. Mutin 2007, fig. II.42.5 and fig. II. 73.7-8		Yahya VA (4th millennium) T.W. Beale, C.C. Lamberg-Karlovsky, 1986, fig. 4.39.c

Tab. 1. Cultural interactions and pottery connections between Keshari region and other third millennia sites in Indo- Iranian borderlands.
Interacțiuni culturale și conexiuni privind ceramica între regiunea Keshari și alte situri din mileniul trei din zonele de graniță indo-iraniene.

◈ Acknowledgement

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Excavation at Barkamran Tepe (Piranshahr) north–western Iran, 2019. First preliminary report

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Abstract: *Barkamran Tepe is located 22 km of Piranshahr city in north-western Iran. This site with about 400 square meters of land area is located on a natural mound. The first excavation season of the site was created as a stratigraphic trench to determine the sequence status of the cultural layers of this site. The results of the excavation in this site led to the identification of three cultural periods including: Barkmaran I belonging to the Bronze Age, which is known as the pottery of Hassan Ali. Barkmaran II belongs to the first millennium BC with pale goldenrod-colored pottery and Barkmaran III belongs to the Islamic period which has been used as a cemetery. Regarding the excavation of the stratigraphic trench, the first settlement in this hill can be considered to belong to the Bronze Age, and is known for its colorful pottery which is more commonly known as the culture of Hassan Ali or Nineveh V. The excavation results of the first season of this site have an important place in presenting the chronology of Lavin River basin.*

Rezumat: *Barkamran Tepe se află la 22 km de orașul Piranshahr în nordvestul Iranului. Acest sit cu o suprafață de aproximativ 400 de metri pătrați este situat pe o movilă naturală. În primul sezon de săpături a fost realizat un sondaj stratigrafic pentru a determina secvența straturilor culturale ale acestui sit. Rezultatele săpăturilor din acest sit au condus la identificarea a trei perioade culturale printre care: Barkmaran I aparținând epocii bronzului, care este cunoscut sub numele de ceramica lui Hassan Ali. Barkmaran II aparține primului mileniu î.Hr. cu ceramică de culoarea vergea de aur pal, iar Barkmaran III aparține perioadei islamice care a fost folosită ca cimitir. În ceea ce privește sondajul stratigrafic, prima așezare din acest sit poate fi considerată ca aparținând epocii bronzului și este cunoscută pentru ceramica sa colorată, cunoscută mai frecvent sub numele de cultura lui Hassan Ali sau Ninive al V-lea. Rezultatele săpăturii din primul sezon al acestui sit au o contribuție importantă la cunoașterea cronologiei bazinului râului Lavin.*

Keywords: *noth-western Iran, Barkamran Tepe, excavation, preliminary report.*
Cuvinte cheie: *nordvestul Iranului, Barkamran Tepe, săpături, raport preliminar.*

◈ Introduction

The site of Barkamran Tepe is located near the city of Piranshahr and about 50 meters south of the Lavin River. This site has taken its name of a village of the same name. This hill has dimensions of 100 x 44 meters and a height of about 15 meters from the river floor. Part of the site's northern slope has been washed away and destroyed by the Lavin River over time. The surface of the site has been used as a village cemetery in the Islamic period; and today,

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relics of Islamic tombs can be clearly seen on the surface of the site. In the 2006 archaeological survey, this site was included in Iran National Heritage List with the number 16821. The first chapter of archeological excavations in this site was conducted to answer basic questions including the status of the cultural structure of this part of Piranshahr plain in prehistoric and historical times. Along with the questions raised for this excavation, it seems necessary to mention a few things: one is that the site of Barkamran Tepe is one of the suitable sites for stratigraphy of the Lavin River basin that can study the cultural situation of the region during the prehistoric period, especially the Bronze Age; another is that, by doing excavations in this area, the colorful pottery of the Bronze Age, similar to it obtained in Hassan Ali site (A. Kroll *et alii* 2004, p. 691), Vaziri Castle of Salmas, Aliabad Tepe in Bukan (N. Faraji *et alii* 2015), Silveh tepe in Piranshahr (A. Abedi, Q. Ebrahimi 2018, p. 245) to study the cultural situation and the existing relations between the northwest of Iran and the Mesopotamian societies in Bronze Age.

◈ Background of archaeological studies of Piranshahr County

Due to its geographical location, Piranshahr plain is adjacent to the areas of Lake Urmia's basin and the northern region of Mesopotamia; Accordingly, this region is considered as one of the communication way of north-western Iran to Mesopotamia. In this region, archeological excavations have been carried out by Iranian and non-Iranian groups and a general understanding of the situation of the settlement periods of this region has been published. Stephen kroll and Wolfram Kleiss have identified evidence from the Neolithic period with pottery to the Urartu period by surveying the area (W. Kleiss, S. Kroll 1979). Subsequent surveys were mostly conducted by Iranians, including Ebrahim Kharazi in 2006, Behrouz Khan Mohammadi in 2008, Nasrin Taifeh Ghahremani in 2015, surveying Silveh Dam by Afrasiab Gravand, and Lavin River basin and Kani Dam by Reza Heidari. In the surveys conducted on different sites in this area, we can refer to archeological excavations in the site of Lavin Tepe (A. Binandeh 2008), excavation of the site of Silveh tepe (A. Abedi, Q. Ebrahimi 2018), Sarbaz tepe (K. Haji Mohammadi 2017), Kasegaran 2 (E. Bodaqi 2019) and so on. Evidence from copper and stone period to Islamic period has been identified in these excavations. The Barkamran site was surveyed for the first time in 2006 and then it was archaeologically resurveyed by Reza Heidari and was registered as a site related to the first millennium BC (R. Heidari 2017). This site was first archaeologically excavated by Ebrahim Bodaqi in 2019 and the results of this excavation have an important place in recognizing the cultural layers of the site.

◈ Field methodology

In order to accurately record the excavation stages, the basis of the excavation was based on the locus-locus system. In such a way that by changing the nature, appearance or tangible feature in cultural accumulations or phenomena, a locus was assigned to each of these changes, starting from 1000. Also, based on different Locus and dates, the Registry Number method, which was abbreviated as RN for each finding and started from the registration number 100, was used. For specific findings, in addition to assigning a RN, photography was performed at the site, and length, width, and depth (X.Y.Z) were used for each finding.

Geographical location. The site of Barkamran Tepe (45°13'28.28"E - 36°41'33.96"N) is located at an altitude of 1300 meters above sea level in the plain between the mountains of the

Lavin River basin in north-western Iran (fig. 1). This area has formed on a natural mound. The area is 100 meters long in the east-west direction and 44 meters long in the north-south direction and 15 meters above the river level. The northern part of the site has been destroyed by seasonal flooding of the Lavin River. The location of the Lavin River on the north side of this site was probably one of the most important water sources for the inhabitants of Barkamran Tepe. The surface of the site has been used as a cemetery for the residents of Barkamran village during the Islamic era. Geographically, this site is located in a suitable location, so that it is closely related to the north of Mesopotamia and the main site of north-western Iran such as Hasanlu, Dinkhah, Lavin and can provide more information in prehistoric studies, especially in relation to Hassan Ali type pottery in the north-western region of Iran.

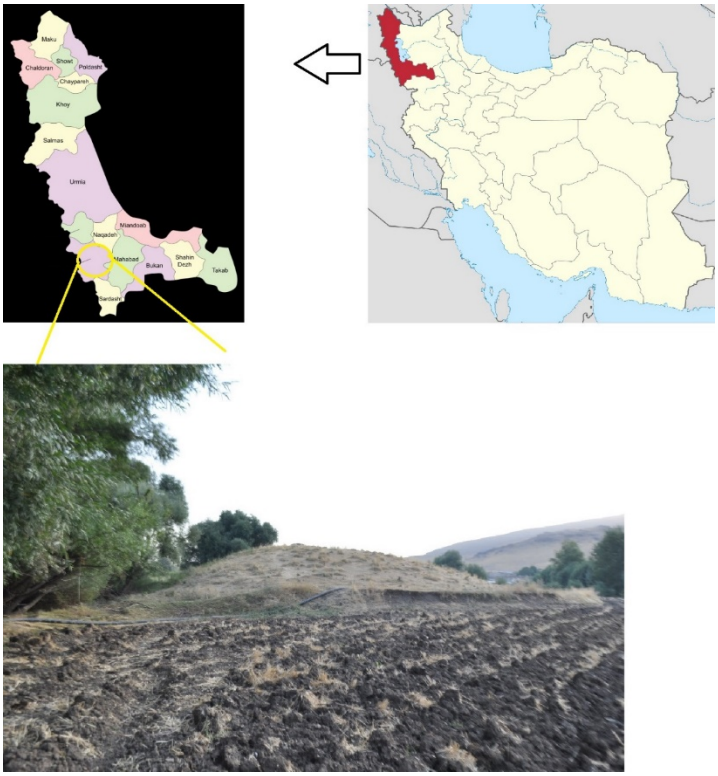

Fig. 1. Geographical location of the site of Barkamran Tepe.
Localizarea geografică a sitului Barkamran Tepe.

◈ Excavation in Trench I

After a surface survey of the site by the excavation group, a suitable site was selected for creating the stratigraphic trench. The stratigraphic trench was created on the western side of the site and the western façade of the trench was towards the Little Zab River (Lavin). It was created at the highest part of the site to provide more information about the site. It was 3 meters wide and its length varies according to the topography of the site. At first it was 2 meters, which gradually increased and in general the final length of the trench reached 10 meters (fig. 2). The highest part of trench is east corner (point A) which is used as the BM point for measuring trench depths. The other points with clockwise order include: the point B in southern corner is located at a depth of -10 relative to the fixed point, point C at a depth of -

510 cm in the western corner and point D at a depth of 515 cm relative to the fixed point of the trench. In this trench, a set of 21 Locus (locus 1001 to 1021) was identified and explored. The identified layers, from bottom to top, are: old Bronze, Historical Period and Islamic Period, respectively; These periods were named in the area of Barkamran Tepe with the names of Barkamran I (early Bronze), Barkamran II (first millennium BC) and Barkamran III (Islamic period, cemetery), respectively.

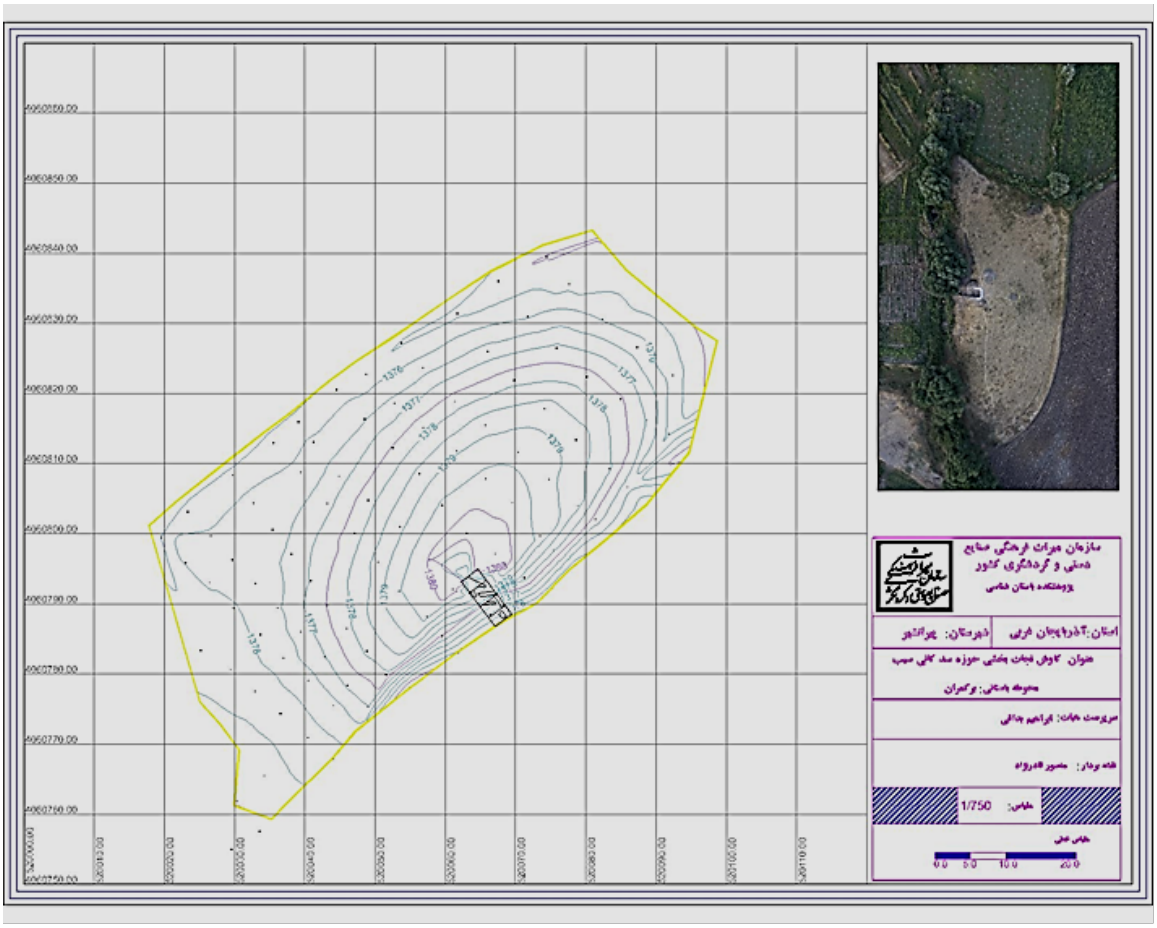

Fig. 2. Location of trench I at the surface of Barkamran Tepe.
Poziția șanțului I în cadrul sitului Barkamran Tepe.

◈ Barkamran I

This period was identified in Locus 108 to 121 to a depth of 520 cm from the BM point of the trench surface. During the excavation of these Locus, green and light brown accumulations were identified. Evidence of ash and clay remainders was identified in the contents of these accumulations. Locus 115, 117, 118, 120 and 121 were assigned as part of the cairn architectural structures. These structures are in the form of cairn with river type stones in different dimensions that have been made of dry masonry. The stones have been transported to this place from the Lavin River and have been used by the residents in the architectural structures of the site. The average width of the walls is 50 to 60 cm (fig. 3).

The remainders of broken bricks were identified of this period. These bricks are light brown in color and have a straw temper. Due to the fact that the bricks are broken, their exact dimensions are not known; However, it seems that the bricks are in the dimensions of

30 x 8.30 cm. In terms of clay data, Barkamran I is comparable to the specimens found in the site of Vaziri Castle in Salmas, Hassan Ali in Oshnavieh (A. Kroll *et alii* 2004, p. 691), Aliabad Tepe in Bukan (N. Faraji *et alii* 2015, p. 335-336) Silveh Tepe in Piranshahr (A. Abedi, Q. Ebrahimi 2018, p. 245), and Gerd Akhuran 2 Tepe (M. Sharifi 2018). Based on the absolute chronology of ^{14}C of the site of Hasanlu VII and Kul Tepe IV of Julfa, the date 3000-2500 BC can be considered for this period. This period, known as early Bronze Age in archaeological studies of north-western Iran, contains local pottery which is bounded by the Oshnavieh-Solduz valley and possibly southeast of Lake Urmia (B. Omrani 2006, p. 325). During this period, it seems that our trade-economic relations existed between the communities of north-western Iran, especially the southern basin of Lake Urmia and north of Mesopotamia, and the discovery of Uruk-type pottery in this region (A. Abedi *et alii* 2019, p. 179) strengthens this hypothesis.

Fig. 3. Architectural structures identified in Barkamran I.
Structuri de locuire identificate în nivelul Barkamran I.

◈ Barkamran II

This period was identified in Locus 104 to 107. These Locus are located at a depth of 170 cm from the highest level of the trench. This period has been reused after a two-thousand-year interruption from the Barkamran II period. The layers identified from this period are similar to an accumulation of light brown soil; Inside them, the grains of lime are visible. The remainders of some part of the architectural structures that are in the form of a cairn wall were identified from this period. The walls have a stone structure and the stones are of cobblestone type of river. The average width of the walls is about 60 cm. From this period, part of a pavement was identified (fig. 4). Interesting specimens of this type of pavement has been identified in the site of Rabat Tepe in Sardasht in the distance about 65 km of this site belongs to the first millennium BC (B. Kargar, A. Binandeh 2009, p. 122-123). The potteries of this period are more similar to the potteries of the first millennium BC in the region. It seems that this period has been reused by the inhabitants of the region after a interruption of about two thousand years.

This period generally includes 1000 to 1 BC in Iranian archeological studies. During this period, we see the formation of a large empires such as Urartu and Mana in north-western

Iran, evidence of which has remained in areas such as Hasanlu IV, V (O.W. Muscarella 1971), Aqrab Tepe (O.W. Muscarella 1973), Rabat Tepe (B. Kargar, A. Binandeh 2009), Qalatgah (M. Van loon 1975) Bardineh Castle (Y. Hassanzadeh 2009) and so on. The first millennium BC in north-western Iran is considered as one of the most important periods of study in Iranian archeology. So that this region was attacked by Assyrians during this period, especially in 714 BC. Identification of evidence from the first millennium BC in this site indicates the position of Piranshahr plain in the political developments in north-western Iran and Mesopotamia.

Fig. 4. Part of the pavement of Barkamran II.
O parte din pavajul din nvelul Barkamran II.

◈ Barkamran III

The last period of the site of Barkamran Tepe is related to the structure of the graves of the Islamic period. This period was identified in Locus 101 to 103. The graves are located at a depth of 80 cm from the highest level of the trench. These graves have been used as the village cemetery after the formation of the current Barkamran village near the site of Barkamran Tepe (fig. 5). Due to their Islamic nature, the graves were created in the east-west direction so that the face of the corpse was toward the south (Kaaba / Qibla). The graves have a stone structure and have no burial gifts. Until about 20 years ago, this area was the only village cemetery, which gradually a new place was chosen as a cemetery. However, some of the graves has been known to the villagers. Barkamran III is considered as the last period of Barkamran Tepe site and after this period, the site is completely abandoned.

Fig. 5. Islamic grave of Barkamran site; Barkamran period III.
Mormânt islamic din situl Barkamran; perioada Barkamran III.

Early Bronze Age of north-western Iran is part of a vast culture known as the Kura-Araxes culture (R. Rezalou, N. Zabanband 2015, p. 17). However, recent excavations, including stratigraphic excavation of Barkamran site shows that a local culture has been formed in the southern parts of Lake Urmia in the Bronze Age, which is different from other parts of this region. The excavation of the stratigraphic trench on Barkamran at a depth of 5.20 m from the BM point of the trench, provided a general understanding of the condition of the cultural layers of the region (fig. 6). Based on this trench, the condition of architectural and pottery structures was obtained. In early Bronze Age, this region was part of the cultural field of Hassan Ali pottery (Nineveh V); This region seems to have been influenced by the cultures of northern Mesopotamia in the Bronze Age.

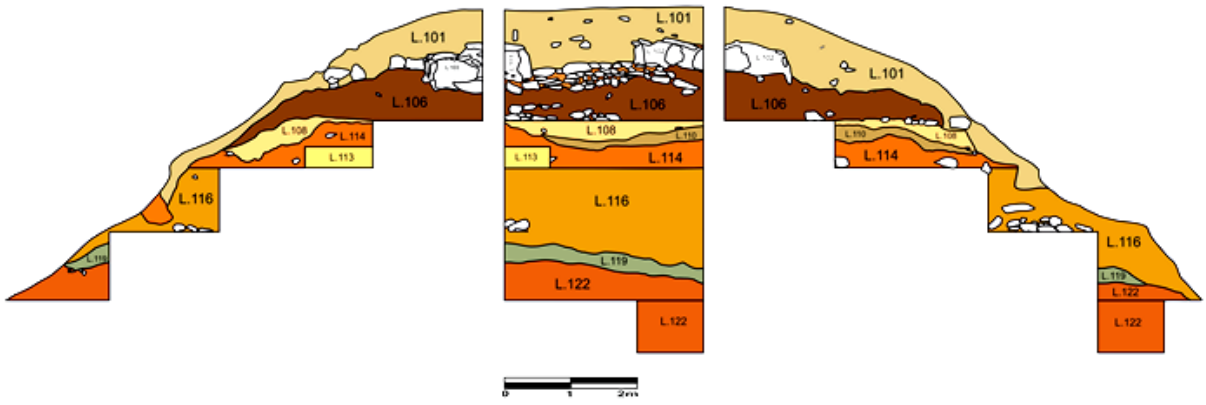

Fig. 6. The design of stratigraphic trench walls.
Stratigrafia sitului după profilurile șanturilor.

◈ Identified cultural data from the layers of Barkamran site

Pottery

The pottery of Barkamran site belongs to early Bronze Age and the first millennium BC (fig. 7). The potteries of the first millennium of the site was not very significant and distinctive. However, early Bronze pottery of the site is of the type of Hassan Ali pottery of the north-western region of Iran. These potteries were identified in the period of Barkamran I and are comparable with the specimens found in the site of Vaziri Castle in Salmas, Hassan Ali in Oshnavieh (A. Kroll *et alii* 2004, p. 691), Aliabad Tepe in Bukan (N. Faraji *et alii* 2015, p. 335-336), Silveh Tepe in Piranshahr (A. Abedi, Q. Ebrahimi 2018, p. 245). This type of pottery with painted decorations is wheel-making (tab. 1).

Fig. 7. Distinctive potteries of early Bronze Age (Hassan Ali) in Barkamran Tepe.
Ceramică specifică epocii bronzului (Hassan Ali) de la Barkamran Tepe.

No.	Part	Thickness	Diameter	Construction technique	Temper	Inside color	Temper color	Outside color	Inside covering	Outside covering	Motif
1	Edge	0.1	9	Wheel maker	Mineral	Pale goldenrod	Pale goldenrod	Pale goldenrod	Thick earthen	Thick earthen	Strip
2	Edge	0.2	_	Wheel maker	Mineral	Light brown	Light brown	Dark brown	Thick earthen	Thick earthen	Strip
3	Body	0.3	_	Wheel maker	Mineral and organic	Pale goldenrod	Pale goldenrod	Pale goldenrod	Thin earthen	Thick earthen	Geometric
4	Body	0.1	_	Wheel maker	Mineral	Brick red	Brick red	Brick red	Thick earthen	Thick earthen	Strip
5	Body	0.1	_	Wheel maker	Mineral	Brick red	Brick red	Brick red	Thick earthen	Thick earthen	Geometric

Tab. 1. Pottery features of Barkamran Tepe.
Caracteristici ale ceramicii de la Barkamran Tepe.

Stone

Five pieces of stone relics were found in the excavation of the stratigraphic trench of the site on Barkamran Tepe. The rocks are made of sand. The stone relics of the site can be classified into two categories in terms of their function including decorative relics and functional relics. Decorative relics have smaller dimensions and are mostly used as necklace. From this type of relic, two pieces were obtained in the stratigraphic trench, in which a hole with a diameter of about half a centimeter was made to pass the thread. Relics of this type are generally used for grinding grains. These stone relics have a polished surface. A hole of 10 cm deep has been created to pour liquids and sometimes grind grains on the surface of one of these stones. These stone relics were obtained from the period of Barkamran I (fig. 8).

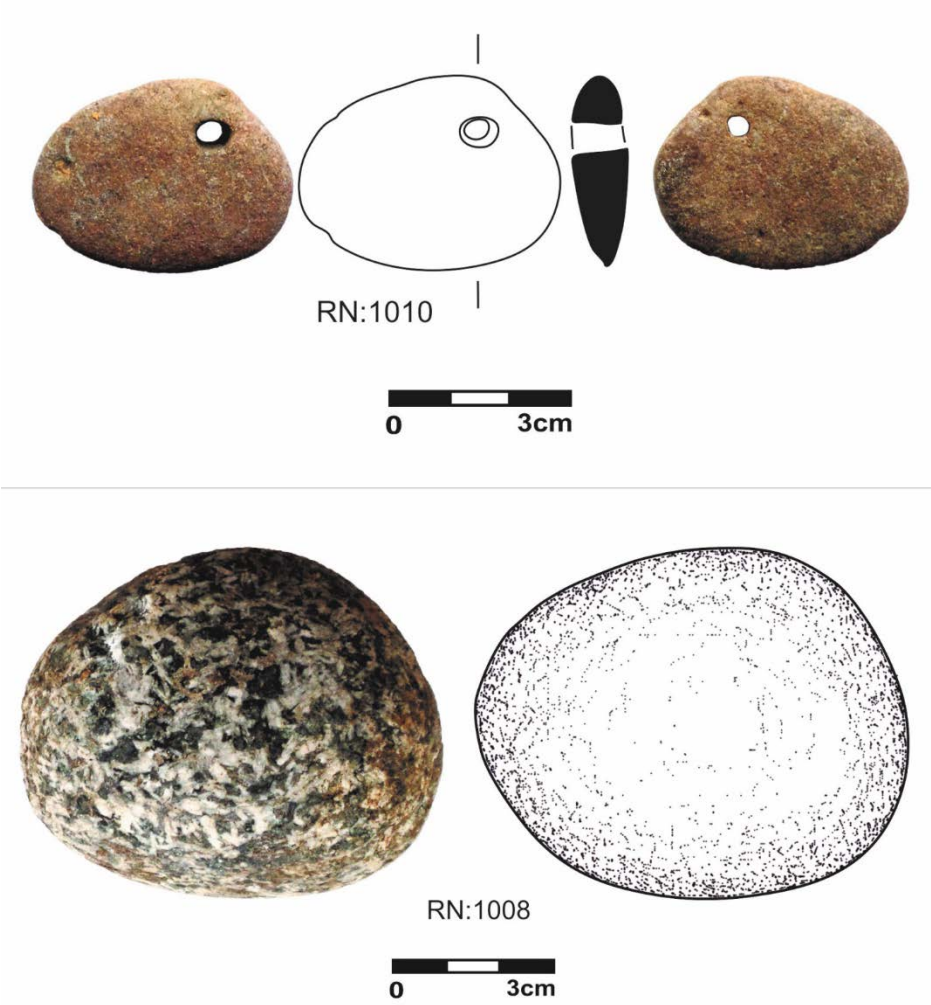

Fig. 8. Stone relics found in the stratigraphic trench of Barkamran site.
Obiecte de piatră din șanțul stratigrafic de la Barkamran.

◈ Conclusions

As mentioned, the site of Barkamran Tepe has several settlement periods; Its archeological deposits belong to the early Bronze Age, the first millennium and Islamic periods. This site is important in the archaeological studies of north-western Iran due to its proximity to the distinctive sites of Lake Urmia's basin such as Hasanlu, Haftvan, Dinkhah,

Rabat, etc. and its proximity to the areas of northern Iraq. These factors have caused the area to have a special role in the early Bronze Age and the pottery of this period is very similar to the specimens of Lake Urmia's basin in terms of decorative motifs. Due to the less information available about the status of cultural periods in Piranshahr city, the results of this research can provide a good perspective on the cultural status of the communities living in the region in prehistoric and historical times. In the first chapter, traces of the architectural structure of the communities living in the area were also obtained from the excavation which was generally focused on stratigraphy and explaining the status of the settlement periods of the site of Barkamran Tepe.

The pottery data of the type of Hassan Ali pottery obtained from the Barkamran I period increased our knowledge of the cultural status of this region in the Bronze Age. According to these potteries, the southern basin of Lake Urmia has a local culture, whose pottery has various decorations. These potteries were specific to these areas; Also, considering the proximity to Mesopotamia, it seems that in prehistoric times, there were trade-economic relations between the communities living in north-western Iran and northern Mesopotamia.

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ABREVIERI

АВУ	Археологічні відкриття в Україні, Kiev
ACMIT	Anuarul Comisiunii Monumentelor Istorice, Secţia pentru Transilvania, Cluj-Napoca
AD	Archaeological Dialogues, Cambridge
AIGR	Anuarul Institutului Geologic al României, Bucureşti
AJA	American Journal of Archaeology, Boston
AJPA	American Journal of Physical Anthropology, New York
Aluta	Aluta, Sfântul Gheorghe
Am Antiq	American Antiquity, Society for American Archaeology, Washington
AMIAP	Anuarul Muzeului de Istorie şi Arheologie Prahova, Ploieşti
AMM	Acta Musei Meridionalis, Vaslui
AMN	Acta Musei Napocensis, Cluj-Napoca
AMP	Acta Musei Porolissensis, Zalău
AMT	Acta Musei Tutovensis, Muzeul "Vasile Pârvan" Bârlad
AnB	Analele Banatului S.N., Timişoara
AO (SN)	Arhivele Olteniei (Serie Nouă), Craiova
ARCIFE	Academia RSR, Centrul de Istorie Filologie şi Etnografie, Seria Antropologică, Craiova
Argessis	Argessis, Studii şi comunicări, Piteşti
Arhiva MNIM	Arhiva Muzeului Național de Istorie a Moldovei, Chișinău
Apulum	Apulum, Alba Iulia
ArchB	Archaeologia Bulgarica, Sofia
ARCS	Annals of The Royal College of Surgeons, Londra
ArhMold	Arheologia Moldovei, Iaşi-Bucureşti
ArheologijaSofia	Arheologija. Organ na Arheologičeskija Institut i Muzej, Sofia
ARMSI	Academia Română. Memoriile Secţiunii Istorice, Seria III, Bucureşti
AS (IMP)	Archaeological Series (International Monographs in Prehistory)
АП	Археологічні пам'ятки, Kiev
B(M)SAP	Bulletin et Mémoires de la Societé d'Anthropologie de Paris, Paris
BA	Biblical Archaeologist, Atlanta
BAI	Bibliotheca Archaeologica Iassiensis, Iaşi
BAR	British Archaeological Reports, Oxford
BAR (BS)	British Archaeological Reports, British Series, Oxford
BAR (IS)	British Archaeological Reports, International Series, Oxford
BF	Before Farming, United Kingdom
BFSC	Buletinul Facultăţii de Ştiinţe, Cernăuţi
BiblThr	Bibliotheca Thracologica, Bucureşti
BMA	Bibliotheca Musei Apulensis, Alba Iulia
BMG	Bibliotheca Musei Giurgiuvensis, Giurgiu
BMN	Bibliotheca Musei Napocensis, Cluj-Napoca
BMJTA	Buletinul Muzeului Judeţean "Teohari Antonescu", Giurgiu
BMJT SA	Buletinul Muzeului Judeţean Teleorman. Seria Arheologie, Alexandria

BMSAP	Bulletins et Mémoires de la Société d'Anthropologie de Paris, Paris
BRGK	Bericht der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts, Frankfurt am Main
BSA	Annual of the British School of Archaeology at Athens, Atena
BSPF	Bulletin de la Société Préhistorique Française, Paris
BSSC	Buletinul Societăţii Ştiinţifice din Cluj, Cluj-Napoca
CA	Cercetări Arheologice, Bucureşti
CAANT	Cercetări Arheologice în Aria Nord-Tracă, Bucureşti
CCDJ	Cultură şi Civilizaţie la Dunărea de Jos, Călăraşi
CI	Cercetări Istorice, Iaşi
CIAAP	Congrès International d'Anthropologie et d'Archéologie Préhistoriques, Bruxelles
Cronica	Cronica Cercetărilor Arheologice, Bucureşti
Dacia (NS)	Dacia (Nouvelle Serie). Revue d'Archéologie et d'Histoire Ancienne, Bucureşti
DocPraeh	Documenta Praehistorica, Ljubljana
Drobeta	Drobeta, Drobeta Turnu-Severin
EJA	Journal of European Archaeology, London
ERAUL	Etudes et Recherches Archéologiques de l'Université de Liège, Liège
Eurasia	Eurasia Antiqua, Berlin
КСИА	Краткие сообщения Института археологии, Moscova
IJO	International Journal of Osteoarchaeology, Wiley Interscience.
IJNA	International Journal of Nautical Archaeology, London
INA	Institute of Nautical Archaeology, Drawer
Izvestija	Izvestija na Arheologiskija Institut, Varna
IzvestijaVarna	Izvestija na Narodnija Muzej (Izvestija na Varnenskoto Arheologičesko Družestvo), Varna
JAA	Journal of Anthropological Archaeology
JAS	Journal of Archaeological Science
JEA	Journal of European Archaeology, London
JFS	Journal of Forensic Sciences, West Conshohocken
JMA	Journal of Mediterranean Archaeology, London
JQS	Journal of Quaternary Science, Quaternary Research Association, Wiley
JWM	Journal of Wildlife Management, Texas
JWP	Journal of World Prehistory, Springer International Publishing
Materiale	Materiale şi Cercetări Arheologice, Bucureşti
MAU	Materiali z Antropologij Ukrajni, Kiev
МАСП	Материалы по археологии северного Причерноморья, Odesa
MCA (SN)	Materiale şi Cercetări de Arheologie (Serie Nouă), Bucureşti
MemAnt	Memoria Antiquitatis, Piatra Neamţ
MM	Mesolithic Miscellany, Wisconsin
MNIT	Muzeul Naţional de Istorie a Transilvaniei
OJA	Oxford Journal of Archaeology, Oxford
PA	Probleme de Antropologie, Bucureşti
PA – ND	Pervobitnaja Arkheologhija – Naukova Dumka, Kiev

PBF	Prähistorische Bronzefunde
PMMB	Publicatiile muzeului municipiului Bucuresti
PNAS	Proceedings of the National Academy of Science of the USA, Washington
PRIA	Proceedings of the Royal Irish Academy, Irlanda
PTRS	Philosophical Transactions of the Royal Society of London, Londra
PZ	Prähistorische Zeitschrift, Leipzig-Berlin
RDAC	Report of the Department of Antiquities, Cyprus, Lefkosia
RPRP	Reports of Prehistoric Research Projects, Sofia
QI	Quaternary International
QR	Quaternary Research, Cambridge University Press
RSP	Rivista di scienze preistoriche, Firenze
SAA	Studia Antiqua et Archaeologica, Iași
SAI	Studii si articole de istorie
SCA	Studii şi Cercetări de Antropologie, Bucureşti
SCIV(A)	Studii şi Cercetări de Istorie Veche (şi Arheologie), Bucureşti
SE	Sovetskaja Etnografia, Moscova
SP	Studii de Preistorie, Bucureşti
StudPraeh	Studia Praehistorica, Sofia
Tor	Tor. Tidskrift för arkeologi – Journal of Archaeology, Uppsala
VAH	Varia Archaeologica Hungarica, Budapesta

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Ian Hodder (ed.), *Religion at work in a Neolithic society: vital matters*, Cambridge, 2014, Cambridge University Press, 382 p. and 47 figs., ISBN 978-1-107-67126-3 (Radu-Alexandru DRAGOMAN)

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Pagini din istoria arheologiei românești/ Pages from the history of Romanian archaeology

Radu-Alexandru DRAGOMAN - O carte de la începuturile arheologiei moderne românești / *A book from the beginnings of modern Romanian archaeology*

Studii/Articles

Loredana NIȚĂ, Cristina CORDOȘ, Mircea ANGHELINU - Apprenticeship lithic debitage. Examples from a 27.3 ka cal BP Gravettian collection from Bistricioara-Lutărie III (Ceahlău Basin, NE Romania)

Florin DRAŞOVEAN - A *Spondylus Gaederopus* Linnaeus, 1753 spiny oyster pendant from the Neolithic settlement of Sânandrei-*Ocsăplaț* (Timiş County, western Romania)

Georgeta El SUSI - Preliminary report on the faunal remains from the Early Neolithic site (Starčevo-Criş IIIB-IVA) at Tăşnad-*Sere*, Satu Mare County

Monica MĂRGĂRIT, Camelia-Mirela VINTILĂ - Podoabe și figurine confecționate din materii dure animale descoperite în așezarea eneolitică de la Vidra (jud. Ilfov) / *Personal adornments and figurines made of hard animal materials discovered in the Eneolithic settlement of Vidra (Ilfov County)*

Ion TORCICĂ - Greutățile de lut decorate din *tell*-ul Vităneşti *Măgurice*, jud. Teleorman / *Decorated loom weights from Vităneşti* Măgurice tell *settlement, Teleorman County*

Xenia POP, Alexandru GUDEA, Aurel DAMIAN - Gospodărirea animalelor în așezarea Makó de bronz timpuriu de la Pecica-Site 14 / *Animal husbandry in the Makó bronze age settlement from Pecica-Sit 14*

Cristian Eduard ȘTEFAN - Notă asupra unui capac zoomorf neolitic de la Romula (Reșca, jud. Olt) / *Note on a neolithic zoomorphic lid from Romula (Reşca, Olt County)*

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George TROHANI - Din însemnările profesorului Gheorghe Cantacuzino (1900-1977). V. Preliminarii privind cercetarea arheologică a fostei Mănăstiri Cătălui / *Dès notes du professeur Georges Cantacuzène (1900 – 1977). V. Préliminaires Concernant les recherches archéologiques de l'ancien Monastère Cătălui*

Studii/Articles

Monica MĂRGĂRIT, Mădălina DIMACHE - Personal adornments discovered in the Boian funerary contexts: necropolis of Sultana-Valea Orbului (Călărași County, Romania)

Cristian Eduard ȘTEFAN, Ion DUMITRESCU, Aurelia GROSU, Ioan Andi PIȚIGOI - Cercetările arheologice preventive de la Slatina, str. Viorelelor, jud. Olt / *Preventive archaeological researches from Slatina, Viorelelor street, Olt County*

Radian-Romus ANDREESCU, Katia MOLDOVEANU - Looking around the tell-settlements. A view from Southern Romania

Valentin RADU, Monica MĂRGĂRIT, Adrian BĂLĂȘESCU - Unelte din mandibule de câine (*Canis familiaris*) de la Căscioarele *Ostrovel* (cultura Gumelnița) / *Dog (*Canis familiaris*) mandibles tools from Căscioarele* Ostrovel *(Gumelnița culture)*

Alin FRÎNCULEASA - The Children of the Steppe: descendance as a key to Yamnaya success

Note şi discuții/Notes and discussion

Andreea BÎRZU - Notă asupra decorului unei statuete antropomorfe neolitice descoperite la Rast, județul Dolj / *Note regarding the decoration of a Neolithic anthropomorphic figurine discovered in Rast, Dolj County*

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Monica MĂRGĂRIT, Adina BORONEANȚ, Adrian BĂLĂȘESCU, Valentin RADU - Analiza tehnologică a industriei cornului de cerb din situl Cucuteni de la Drăgușeni-*Ostrov* (jud. Botoșani) – o nouă discuție / *The technological study of the red deer antler industry from the Cucuteni site at Drăgușeni*-Ostrov *(Botoșani County) – a new discussion*

Tomasz J. CHMIELEWSKI - On the presence of the Bodrogkeresztúr culture pottery in Dąbki

Sergiu POPOVICI, Adela KOVÁCS - Complexe eneolitice de cult ale păstorilor timpurii din nordul și nord-vestul Mării Negre / *Eneolithic cult features of early shepherds in the north and northwest region of the Black Sea*