# Mousterian lithic assemblage from Vinica cave (Hrvatsko zagorje, Croatia).
## New insights into regional Middle Paleolithic technological behavior

# Musterjenska kamena industrija iz jame Vinica (Hrvaško Zagorje).
## Nova spoznanja o regionalni srednjepaleolitski tehnologiji

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**Izvleček**

V prispevku predstavljamo tehnotipološko in surovinsko analizo musterjenskega kamnitega inventarja iz jame Vinica (Hrvaško Zagorje), pridobljenega med izkopavanji ob koncu prejšnjega in začetku tega tisočletja. Kamniti artefakti so bili najdeni v dveh musterjenskih plasteh, v plasti c in d, katerih starost je določena z radiokarbonskim datiranjem po metodi AMS. Rezultati datiranja vzorca iz plasti d kažejo, da je starejši od 50.300 let BP. Kalibrirana starost vzorca iz plasti c je 36–34,5 ka BP. V obeh plasteh med surovino prevladuje kremen, sledijo različni roženci. Kremenove prodnike so obdelovali na najdišču. Vsaj nekateri artefakti iz rožanca niso bili odbiti v jami, ampak so bili vanjo prineseni kot odbitki in orodja. Med maloštevilnimi orodji prevladujejo strgala. Skromen kamniti inventar obeh plasti kaže, da je jama v srednjem paleolitiku neandertalcem služila kot kratkotrajno zatočišče.

**Ključne besede:** Hrvaška; jama Vinica; srednji paleolitik; musterjen; kamena industrija; surovina; radiokarbonsko datiranje; metoda AMS; kratkotrajna poselitev

**Abstract**

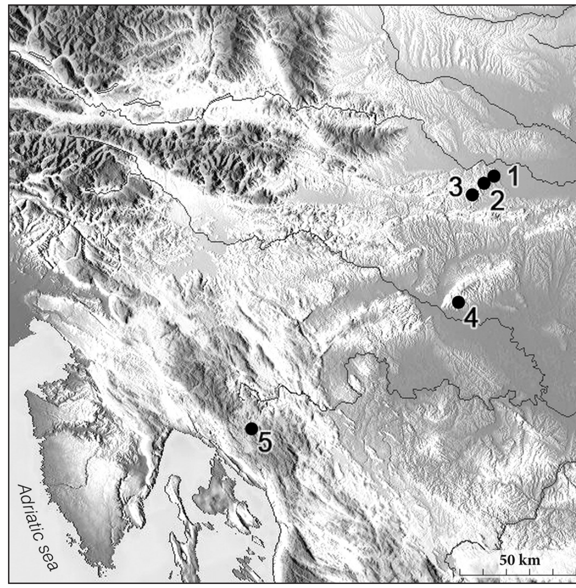
In this paper we present techno-typological and raw material analysis of the Mousterian lithic assemblage from Vinica cave (Hrvatsko zagorje, Croatia) excavated during late 1990s and early 2000s. Lithic artefacts are found in two Mousterian layers, c and d, whose age is determined by $^{14}C$ AMS dating. Sample from layer d brought indefinite age older than 50,300 years BP while calibrated age for the sample from layer c is 36–34.5 ka BP. Quartz is predominant raw material in both layers followed by different cherts. Quartz cobbles were knapped on-site while at least some chert artefacts were not flaked in the cave but brought from elsewhere as blanks and tools. Among small number of tools, scrapers are the most frequent. Small lithic assemblages from both layers suggest that cave was used as short term Neandertal camp during Middle Paleolithic.

**Keywords:** Croatia; Vinica cave; Middle Paleolithic; Mousterian; lithic industry; raw material; $^{14}C$ AMS dating; short-term occupation

Middle Paleolithic record of Northwest Croatia is very well known primarily on account of Krapina and Vindija caves where Neandertal fossils, lithic industries and faunal remains were found (e.g., Smith 1976; Simek, Smith 1997; Wolpoff 1999; Miracle 2007; Cartmill, Smith 2009; Karavanić, Smith 2013; Janković et al. 2016). However, there are also Veternica and Velika pećina caves that did not yield human fossils but have lithic and animal remains (Karavanić, Smith 1998; Banda, Karavanić 2019). Radiometric dates for Krapina and Vindija showed that Neandertals lived in this area potentially from 160 ka BP until ca. 45 ka cal BP (Rink et al. 1995; Wild et al. 2001; Devièse et al. 2017; Karavanić et al. 2021). Fossil remains from Vindija cave played a key role in sequencing Neandertal genome (Green et al. 2010) while unique assemblage composition in Vindija layer G1 where Neandertal fossils are found with split and massive base osseous points resulted in different, often confronted interpretations of this association in the context of Middle-Upper Paleolithic transition (for recent review see Karavanić, Smith 2013). Recent radiocarbon dating of Vindija Neandertals from layer G1 showed that they are much older than previously thought, around 45 ka cal BP but the age of split based point remains an open issue (Devièse et al. 2017).

Caves of Northwest Croatia were intermittently used by humans and carnivores during Upper Pleistocene, hence remains of material culture in these caves are not numerous (Miracle 1991; Karavanić, Patou-Mathis 2009). The same could be observed for Vinica cave with its small lithic assemblage that will be described and presented here. This is the first Middle Paleolithic knapped stone assemblage discovered after long-term excavation of Vindija cave finished in 1986. Radiocarbon dates for Mousterian layers of Vinica cave direct us to assess similarities and differences in lithic production with Late Mousterian sites of the region.

Vinica cave is located in the Northwest part of Croatia, in the Eastern part of Ravna gora near the village of Vinica Breg in the Varaždin area (46.326143 N, 16.127785 E) (*Fig. 1*). It is also known as Šincek cave named after biospeleologist Dubravko Šincek who discovered the site. Vinica cave was first mentioned in literature by Marina Šimek (1994). It is registered in the Speleological objects cadaster – Croatia, under number HR01417 (*Katastar 2021*). The entrance of the cave is located at 250 m above sea level. Cave is




1 Vinica 3 Velika pećina 5 Bukovac
2 Vindija 4 Veternica

*Fig. 1:* Map showing position of Vinica cave and other cave sites mentioned in the text.
*Sl. 1:* Lega jame Vinice in drugih jamskih najdišč, omenjenih v prispevku.

morphologically simple (*Figs. 2* and *3*), and prior to systematic excavations it consisted of 6 m long channel, which was 60 cm high and approximately 100 cm wide, that ended in a small round hall of 4.5 m in diameter. The cave has been formed in lithotamnian limestone. Paleontological test excavations started in 1994 with a trench in the end of the mentioned channel. Numerous well-preserved finds suggested it was justified to continue with further research, hence field research of Vinica cave began in 1997 with systematic excavations and geological analysis of the cave surroundings. The excavations of the cave were performed from 1997 to 2002 by the Department of Biology, Faculty of Veterinary Medicine, University of Zagreb in the frame of the scientific project "Research of fossil and recent large carnivores in Croatia" directed by professor Đuro Huber. Excavations were led by Goran Gužvica on a total area of 76 m$^2$. Lithic artefacts and faunal remains were recorded with three-dimensional coordinates together with data on square and layer origin.

This paper presents the results of preliminary sedimentological analyses, $^{14}$C AMS dating, petrographic and techno-typological analyses of the lithic assemblage found during excavations in the period from 1997 to 2002 (*Fig. 1; 2*). Results are considered in a regional Middle Paleolithic context.

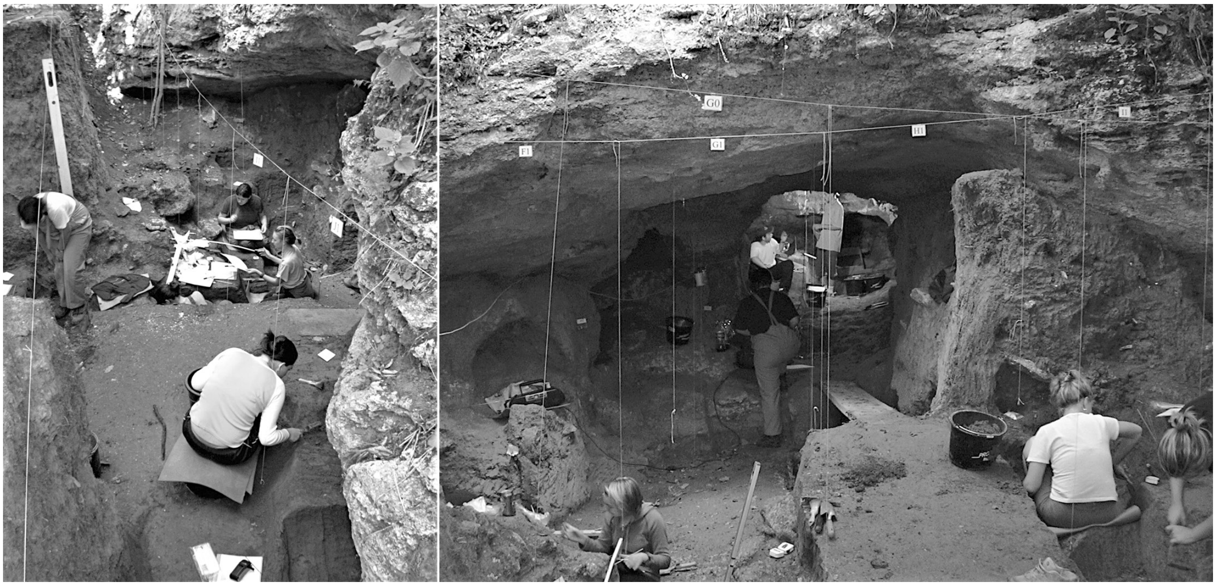


*Fig. 2:* Vinica cave during the excavation. Cave entrance viewed from east (left) and view from the entrance towards cave inside (right).
*Sl. 2:* Jama Vinica med izkopavanjem. Jamski vhod z vzhoda (levo) in pogled od vhoda proti notranjosti jame (desno).

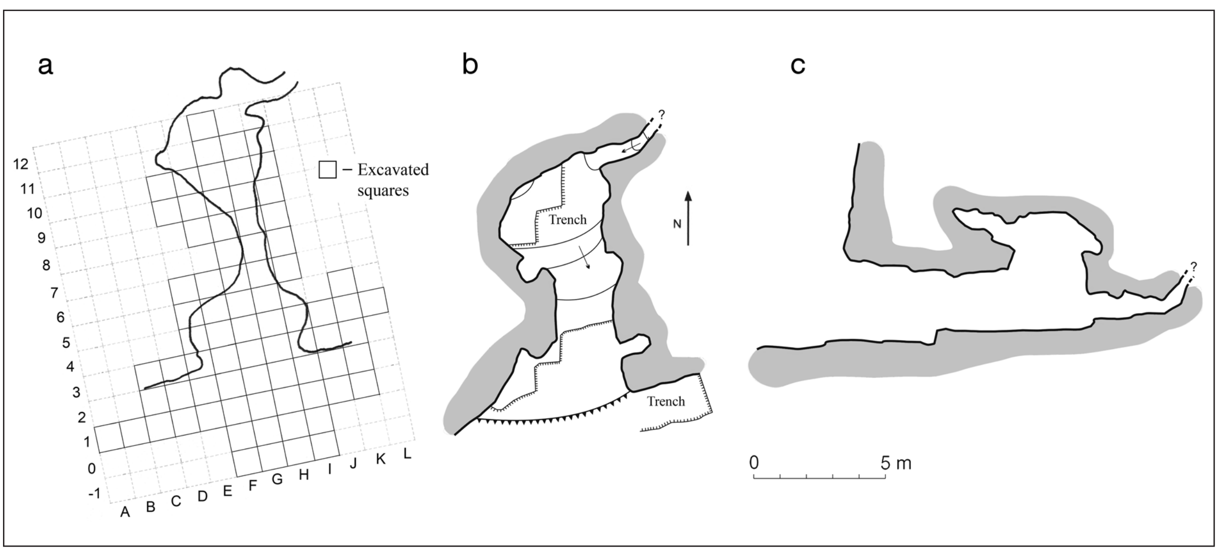



*Fig. 3:* Vinica. Sketch plan at the beginning of the excavation (1998) with positioned excavation grid (*a*); detailed plan recorded in 2007 after the excavation (*b*) and longitudinal (N-S) cross-section (*c*).
*Sl. 3:* Vinica. Skica tlorisa na začetku izkopavanj (1998) z vrisano izkopavalno mrežo (*a*); tloris, izdelan leta 2007 po izkopavanjih (*b*), in vzdolžni presek jame v smeri S–J (*c*).

## VINICA CAVE IN GEOGRAPHICAL AND GEOLOGICAL CONTEXT

Vinica cave is located in the eastern part of Ravna gora, which is, along with Ivanščica and Kalnik mountains, considered to be the eastern slopes of the Alps. The origin of the Vinica cave is associated with neotectonic movements when a cavity was formed due to the faulting and folding of the Upper Baden deposits. That cavity was expanded by later erosion and denudation processes. Triassic, Miocene, Pliocene, Pleistocene and Holocene deposits can be found in the vicinity of the Vinica cave (Malez et al. 1984).

Malez et al. (1984) state that the core of Ravna gora consists of Triassic deposits that, in the eastern part, appear in deeper stream valleys. The oldest rocks are muddy sandstones, shales and clayey siltstones that alternate multiple times. These rocks were formed during the Lower Triassic period. In the eastern part of Ravna gora, limestones and dolomites formed during the Middle Triassic period can be found in places.

According to Malez et al. (1984) after the sedimentation of Triassic deposits in the area of Ravna gora, the sedimentation was interrupted due to the emersion, which lasted until the Upper Eocene period. During the marine transgression, which progressed more and more, breccias and conglomerates were formed in the base. The breccias mainly consist of limestone and dolomite clasts, while the conglomerates are made of pebbles of quartz, chert, limestone, siltite, shale, and sometimes large andesite pebbles which are actually precipitated volcanic bombs. This is followed by lithavac rock and lithotamnian limestones with intercalations of limestone sandstones. The most common lithavac rock is yellowish and gray-yellow boulder or thick-layered rock which contains fragments of shells, algae, foraminifera, bryozoans and crinoids. In addition to lithavac rock, lithotamnium limestones formed by the accumulation of Lithothamnium algae remains, are also frequent. In the end, limestone and clay marls appear, which are also the youngest sediments of the Upper Baden period.

During the Sarmatian period there was a gradual sweetening of the basin, and in the Lower Pannonian period the basin was completely sweetened. This caused the extinction of brackish species and the emergence of freshwater species. The described changes occurred due to the severance of the connection between Tethys and Paratethys. Unlike other parts of continental Croatia where regression and sedimentation of Croatica deposits that have a regressive character occurred during the Pannonian period, Malez et al. (1984) point out that in the area of Ravna gora there occurred a smaller transgression and deposition of sands and gravels that lie concordantly on older deposits.

In the Lower Pleistocene period, the last Pliocene lakes were drained due to radial movements and the formation of the Drava basin. Tectonic movements, erosion and denudation created a relief on which the Aeolian sediment, the loess, was deposited in the Middle Pleistocene period. The thickness of the loess deposits in the area of Ravna gora does not exceed 10 m. In the upper parts of the loess deposits there are remains of terrestrial macrofauna which indicates an affiliation to the Late Würm (Malez et al. 1984).

Malez et al. (1984) state that at the beginning of the Holocene period there was a stronger erosion and the river and stream valleys took their present form. Alluvial sediment has been deposited in the riverbeds of streams and rivers, the largest of which is the Plitvica river. These sediments consist of deposits of gravel, sand and clay silt formed by the erosion of older rocks.

## MATERIALS AND METHODS

### Stratigraphy and dating

Stratigraphic sequence of the part of Vinica cave that has been explored so far, consists of four macroscopically different layers (*Fig. 4*):

*Layer a:*

loose humus with organic remains and some tiny limestone rubble, dark brown in color, three to 20 cm thick. A layer of humus was spread over the entire cave floor surface before systematic excavations were conducted. In the central part, which is a narrow and low passage leading to the larger round cavity, the layer of humus was of smaller thickness, while in the marginal parts it was up to 20 cm thick. Loose humus was also found in holes/burrows dug through layer b by animals, probably foxes and/or badgers. A larger amount of recent and subfossil bones of various animals, mainly birds and rodents, were often found in these holes/burrows filled with humus.

*Layer b:*

dense clay sediment of yellow-brown color, 23 to 156 cm thick. There are occasional lenses with fine pebbles, and even more rarely some larger lithotamnian limestone blocks. In the lower part of this layer there are frequent lenses with fine pebbles hence the layer has been classified into two horizons (b1 and b2). There is no clear boundary between horizons b1 and b2 as there is a gradual transition from one to the other. Amount of bone remains is significantly higher in horizon b2 than in horizon b1. Layer b is spread throughout the cave, with a large oscillation in its thickness. The thickness of layer b is greater in the area in front of the cave mouth and the entrance part of the cave, while it decreases towards the interior part of the cave. Also, the thickness of this layer gradually decreases from the eastern toward the western edge of the cave.

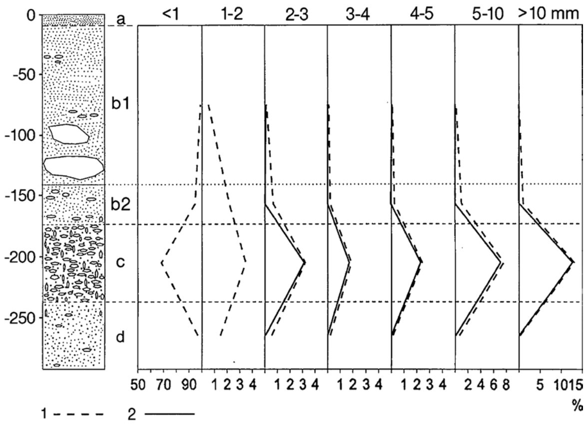



*Fig. 4:* Vinica. Stratigraphic column and percentage share of fractions of layers: total quantity of each fraction (1); quantity of rubble (2).
*Sl. 4:* Vinica. Stratigrafski stolpec in odstotni delež frakcij po plasteh: celotna količina posamezne frakcije (1); količina grušča (2).

*Layer c:*
sandy-clay sediment with a lot of rubble, reddish-brown in color, 30 to 72 cm thick. Within the layer were observed lateral changes in density and average size of the rubble, as well as in color of the sand and clay component from reddish-brown to grey-brown. There is a high number of bone remains in this layer. Layer c is also spread throughout the cave, but is more difficult to note in the area in front of the cave mouth due to the absence of rubble. In this area layer c is determined on the basis of color. The oscillations in the thickness of layer c are smaller than those in layer b. It was noticed that the thickness of layer c gradually increases from the entrance to the central part of the cave, after which it wedges due to the rise of the cave floor.
*Layer d:*
sandy-clay sediment with very little rubble, brownish-red, 42 to 57 cm thick. Layer d again spreads throughout the cave, but deeper in the interior it is wedged due to the rising floor of the cave. The oscillations in the thickness of layer d are the least pronounced compared to the oscillations of the thickness of other layers, especially layer b. There is a gradual decrease in the thickness of layer d from the entrance toward the inner part of the cave.

Samples were taken for sedimentological analysis from a profile located 3 m from the entrance on the east side of the cave. A preliminary granulometric analysis was performed according to the procedure adapted to cave sediments (Osole 1959), and the following fractions were separated: less than 1 mm, 1–2 mm, 2–3 mm, 3–4 mm, 4–5 mm, 5–10 mm and greater than 10 mm. In fractions larger than 2 mm, pebbles and rubble are separated, so that two values were obtained for larger fractions. Percentage values are shown in the diagrams (*Fig. 4*), where the dashed line indicates the gross curve, i.e. the total amount of each fraction, while the solid line indicates the net curve, i.e. the amount of rubble. Moreover, the percentage of lithic and bone components was determined in each layer.

Two radiocarbon dates are available for layers c and d. Both dated samples are animal bones that do not show anthropic traces, i.e., cut- or percussion-marks. Despite the lack of human modifications on bones, contextual association of dated samples with stone artefacts enables us to propose ages for deposition of layers c and d.

## Lithic analysis

Analysis of lithic assemblage included technological and typological aspect of the industry, as well as raw material use. Technological classes are defined following Inizan et al. (1999). Cut-off size for detailed analysis of stone artefacts that included set of quantitative and qualitative attributes was 20 mm. For debitage these attributes included completeness, butt type, cortex amount, cortex type, size (length, width, thickness, weight). Cores are classified according to blank type and scar direction. Tools are classified following Bordian types (Bordes 1988). However, following Debénath and Dibble (1994, 54) naturally backed knives are considered as technological class, not as tools as they do not show traces of utilization on the edge opposite to the backed margin.

Petrographic analysis was performed through combination of macroscopic observations of the samples and microscopic analysis of thin sections. A petrographic study of thin sections was carried out in plane-polarised transmitted light using Zeiss Axiolab microscope.

Lithic assemblage counts altogether 510 pieces and weights 4180,1 g. Almost three quarters of lithic assemblage are found in layer c, and one quarter in layer d (*Tab. 1*). Layer b2 could be dated to later prehistoric periods as is suggested by several dozen pottery sherds found in the layer. Great difference in age between layers b2 and c on one side, and between layer c and d on the other

| Layer | N | N % | Wt (g) | Wt % |
|---|---|---|---|---|
| **b2** | 5 | 1 | 13.0 | 0.3 |
| **b2/c** | 13 | 2.5 | 83.6 | 2.0 |
| **c** | 359 | 70.3 | 2959.2 | 70.8 |
| **c/d** | 12 | 2.3 | 43.0 | 1.0 |
| **d** | 122 | 23.9 | 1081.4 | 25.9 |
| **Total** | 511 | 100 | 4180.1 | 100 |

*Tab. 1:* Vinica. Lithic assemblage by layers.
*Tab. 1:* Vinica. Kamniti inventar po plasteh.

(see below), lead us to exclude lithic artefacts from stratigraphic unit b2 and interfaces of layer b2/c and c/d from further analysis. Therefore, in the following text only lithic assemblages from layers c and d counting 481 specimens will be presented in detail.

## RESULTS

### Stratigraphy and dating

Preliminary granulometric analysis of sediments in layers b1, b2, c and d determined gross and net curves of selected fractions (*Fig. 4*). Total amount of fraction smaller than 1 mm is the greatest in layer b1 (99.2%), somewhat smaller in layers d (96.7%) and b2 (94.7%), while it was least present in layer c (68.5%). Total amount of fraction sized 1–2 mm is the greatest in layer c (3.4%), somewhat smaller in layers b2 (2.2%) and d (1.4%), while it is the smallest in layer b1 (0.5%). Total amount of other fractions larger than 2 mm, as well as the amount of rubble in them is the greatest in layer c (1.7 to 13.1%), significantly smaller in b2 (0 to 1%) and d (0 to 0.7%), and the smallest in layer b1 (0 to 0.1%). In layer c fractions larger than 2 mm mainly consist of rubble (over 90%), while in all other layers fractions larger than 2 mm mainly consist of pebbles (79 to 100%) (*Tab. 2*). Macroscopic characteristics, the results of preliminary granulometric analysis and the composition of sediments show that layers b1, b2 and d do not contain products of mechanical wear. However, significant deviations of the net curve to the right for fractions larger than 1 mm (*Fig. 4*) for layer c indicate considerable mechanical wear. During the deposition of layer c, the cave ceiling and side rock walls were intensively crushed due to freezing, thus indicating a cold and humid climate. The sedimentological characteristics of layers b1 and b2 indicate a moderately cold and dry climate, while during the deposition of layer d a warm and humid climate prevailed.

Both dated bone samples are pretreated using ultrafiltration (Brock et al. 2010) and they provided a good quality collagen for dating as shown in *Tab. 3* (yield, %Yld and %C). δ13C values and C:N ratios (*Tab. 3*) fall within acceptable ranges (De Niro 1985; Bronk Ramsey et al. 2004). Radiocarbon conventional age of sample from layer c is 30830±380 BP, while its calibrated age is 36050–34520 cal BP. Sample from layer d brought an indefinite age older than 50,300 years BP (*Tab. 3*).

### Lithic assemblage

*Raw materials:*

The entire lithic assemblage is classified into several raw material groups: quartz, cherts and other rocks including tuffs, sandstone, etc. Of a total of seven samples that were petrographically analyzed, six are cherts and one represents quartz (*Tab. 4*).

Based on structural and textural characteristics the following varieties of cherts are distinguished:

*Variety 1* is characterized by a homogeneous, massive texture with slightly mottled appearance due to patchy distribution of microcrystalline and cryptocrystalline quartz (*Fig. 5 A*). Mottled appearance is inherited from original rock (most probably some of micritic types of limestones – mudstones, wackestones), so diagenetic origin of cherts is assumed. The samples are dark gray-black (samples D3/52; F4/243);

*Variety 2* is characterized by groundmass of micro- to cryptocrystalline quartz with scattered siliceous sponge spicules, sporadic radiolarian remains and point-shaped organic particles. The edges of thin section are brownish, indicating the presence of ferruginous, limonitic material caused by weathering (*Fig. 5B*). This variety is represented with one sample of beige-cream color (sample D3/195);

*Variety 3* is of light brown-caramel color with clearly visible silicified skeletal remains in thin section undoubtedly indicating its diagenetic origin by silicification of bioclastic limestone (*Fig. 5C*). The groundmass is of microcrystalline quartz. There are some voids which are partially filled with layers of calcedonic quartz (sample E4/166);

| Fraction | Layer | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b1 | | | b2 | | | c | | | d | | | |
| | %P | %BF | %LLS | %P | %BF | %LLS | %P | %BF | %LLS | %P | %BF | %LLS | %F |
| **2-3 mm** | 98 | 1 | 1 | 93 | 7 | - | 3 | 1 | 96 | 79 | 12 | 8 | 1 |
| **3-4 mm** | 100 | - | - | 84 | 9 | 7 | 4 | 2 | 94 | 90 | 7 | 3 | - |
| **4-5 mm** | 95 | - | 5 | 75 | 17 | 8 | 4 | 1 | 95 | 88 | 8 | 4 | - |
| **5-10 mm** | 100 | - | - | 90 | 10 | - | 7 | - | 93 | 79 | 9 | 8 | 4 |
| **>10 mm** | - | - | - | 55 | 45 | - | 4 | - | 96 | 85 | - | - | 15 |

*Tab. 2:* Vinica. Percentage of pebbles (P), bone fragments (BF), lithotamnian limestone rubble (LLS) and flakes (F) in fractions of cave layers.
*Tab. 2:* Vinica. Odstotkovni delež prodnikov (P), kostnih fragmentov (BF), grušča iz litotamnijskega apnenca (LLS) in odbitkov (F) v različnih frakcijah jamskih plasti.

| Lab. code | Layer | Square | Material | 14C BP | ± | cal BP (2σ) | Used | Yield | %Yld | %C | $\delta^{13}C$ | $\delta^{15}N$ | C/N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OxA-37087** | c | I1 | animal bone | 30830 | 380 | 36050-34520 | 689 | 28.9 | 4.2 | 45.5 | -17.8 | 4.2 | 3.3 |
| **OxA-37088** | d | H2 | animal bone | >50300 | - | - | 781 | 30.9 | 4 | 45.6 | -20.0 | 5.8 | 3.2 |

*Tab 3:* Vinica. Layers c and d. AMS dates, calibrated using OxCal v. 4.42 (Bronk Ramsey 2009) and IntCal 20 Calibration curve (Reimer et al. 2020).
*Tab. 3:* Vinica. Plasti c in d. AMS-datumi, kalibrirani z OxCal v. 4.42 (Bronk Ramsey 2009) in IntCal 20 kalibracijsko krivuljo (Reimer et al. 2020).

| Petrographic type | Sample code | Layer | Techological type | *Figure* |
|---|---|---|---|---|
| chert variety 1 | D3/52 | c | chunk | *5A* |
| chert variety 1 | F4/243 | d | flake | |
| chert variety 2 | D3/195 | c | chunk | *5B* |
| chert variety 3 | E4/166 | c | flake | *5C* |
| chert variety 4 | F5/327 | c | flake | |
| chert variety 4 | F5/329 | c/d | flake | *5D, 5E* |
| quartz | F3/143 | c | chunk | *5F* |

*Tab. 4:* Vinica. List of petrographically analysed stone artefacts. First part of sample code refers to square where artefact was found and second to artefact inventory number.
*Tab. 4:* Vinica. Seznam petrografsko analiziranih kamnitih artefaktov. Prvi del kode vzorca se nanaša na najdiščni kvadrant, drugi na inventarno številko artefakta.

*Variety 4* is laminated radiolarian chert (*Fig. 5D*) composed of microquartz groundmass and densely packed radiolarians preserved as microquartz and calcedonic quartz (*Fig. 5E*). The samples are dark gray-black (F5/327) and dark-, chocolate-brown (F5/329).

The quartz sample is polycrystalline quartz-aggregate composed of coarse elongated quartz crystals (length of the longest axis is 1–2 mm) characterized by strong undulose extinction and microsutured contacts (*Fig. 5F*).

Quartz predominates in the whole assemblage, followed by cherts. The same can be observed for separate layers c and d. However, between two layers there are differences in relative frequencies of these two main raw material categories.

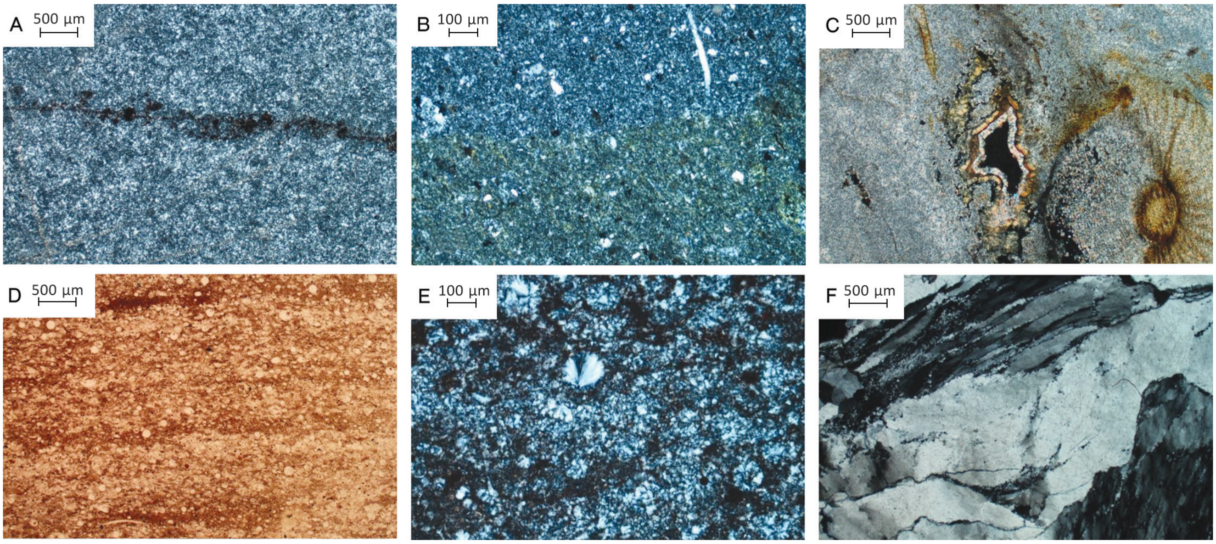



*Fig. 5:* Vinica. Photomicrographs of petrographically analyzed samples. – ***A:*** Chert of massive micro- and cryptocrystalline quartz groundmass with weakly expressed mottled appearance (variety 1). – ***B:*** Micro – cryptocrystalline chert with siliceous sponge spicules in different cross sections. The edge (lower half) is brownish colored due to weathering processes (variety 2). – ***C:*** Diagenetic chert with clearly visible silicified fossil remain (most probably coral). In the center is a void partially filled with calcedonic quartz (variety 3). – ***D:*** Laminated radiolarian chert showing densely packed radiolarians (variety 4). – ***E:*** Enlarged part of *fig. D* showing radiolaria preserved as calcedonic quartz (variety 4). – ***F:*** Polycrystalline quartz aggregate composed of elongated quartz grains with strong undulose extinction. [*A–C,E,F* crossed polars; *D* plain-polarised light].
*Sl. 5:* Vinica. Mikroposnetki petrološko analiziranih vzorcev. – ***A:*** Roženec z vključki masivnega mikrokristalinskega in kriptokristalinskega kremena s slabo izraženim motnim videzom (različica 1). – ***B:*** Mikrokristalinski in kriptokristalinski roženec z različnimi preseki spikul silicijevih spongij. Rob (spodnja polovica) je zaradi procesov preperevanja obarvan rjavkasto (različica 2). – ***C:*** Diagenetski roženec z jasno vidnimi silificiranimi fosilnimi ostanki (najverjetneje koral). V sredini fotografije je votlina oz. razpoka, delno zapolnjena s kalcedonom (različica 3). – ***D:*** Laminirani roženec, ki ga v celoti gradijo skeleti radiolarijev (različica 4). – ***E:*** Povečan odsek *slike D*, ki prikazuje kalcedonizirane skelete radiolarijev (različica 4). – ***F:*** Polikristalni kremen sestavljen iz podolgovatih kremenovih zrn, z močno izraženo valovito potemnitvijo). [*A–C,E,F* navzkrižni nikoli; *D* vzporedni nikoli].

| **Petrographic group** | **Layer c** | | **Layer d** | |
|---|---|---|---|---|
| | N | N% | N | N% |
| **quartz** | **262** | **73.0** | **73** | **59.8** |
| **cherts** | **93** | **25.9** | **46** | **37.7** |
| chert variety 1 | 8 | 2.2 | 6 | 4.9 |
| chert variety 2 | 5 | 1.4 | 6 | 4.9 |
| chert variety 3 | 2 | 0.6 | 0 | 0 |
| chert variety 4 | 42 | 11.7 | 19 | 15.6 |
| patinated cherts | 7 | 1.9 | 3 | 2.5 |
| other cherts | 29 | 8.1 | 12 | 9.8 |
| **other rocks** | **4** | **1.1** | **3** | **2.5** |
| **Total** | **359** | **100.0** | **122** | **100.0** |

*Tab. 5:* Vinica. Layers c and d. Frequencies of raw material groups. *Other cherts* group also includes the only artefact with clear burning traces coming from layer c.v
*Tab. 5:* Vinica. Plasti c in d. Zastopanost surovinskih skupin. Skupina "other cherts" vsebuje tudi edini artefakt s termičnimi poškodbami v plasti c.

*Fig. 6:* Vinica. Layer c. Selected quartz flakes. Specimens 2, 4, 6 and 7 have cortical butts.
*Sl. 6:* Vinica. Plast c. Izbrani odbitki iz kremena. Primerki 2, 4, 6 in 7 imajo talon pokrit s korteksom.

In layer c quartz accounts for almost three quarters of all raw material, while in layer d quartz frequency is lower. Small number of artefacts were produced from rocks other than quartz and cherts, i.e., tuffs, sandstone etc. (*Tab. 5*).

Cherts of similar characteristics as those described above were recorded in the outcrops of the Middle Triassic, Jurassic and Cretaceous deposits on Ivanščica, Ravna gora and Kalnik mountains (Šimunić et al. 1981). Quartz is omnipresent in the region and originates from hydrothermal quartz veins that are numerous in the field (Šimunić et al. 1981).

*Layer c lithic assemblage:*

Layer c counts 359 lithic artefacts. Assemblage breakdown by main artefact classes and raw material groups is shown in *Tab. 6*. Lithic assemblage from layer c is flake based industry with only few blade and bladelet specimens (*Fig. 6*). The most common butt type on proximal flake fragments and complete flakes (N=73) made of quartz is plain (N=30), followed by cortical butt (N=23). Fragmented butts have also high incidence (N=20). Average length for complete quartz flakes is 34.3 mm (min: 13.9; max: 77.6; sd: 11.9) and average width is 28.9 mm (min: 13.5; max: 55.8; sd: 8.7). The most frequent butt type among chert flakes (proximal and complete specimens count 33 specimens) is flat (N=17), followed by small number of cortical (N=4), linear (N=3) and diedric (N=1). It was not possible to determine butt type in eight cases because it was fragmented. Average length of complete chert flakes (all cherts varieties taken together) is 29.5 mm (min: 10.8; max: 51.8; sd: 10.9) and width 27.6 mm (min: 15.4; max: 56.1; sd: 9.7).

Seven cores have been found (2% of total assemblage). Five cores are made of quartz and two of chert. Maximum linear dimension of cores varies

| Artefact class | Quartz | Chert var. 1 | Chert var. 2 | Chert var. 3 | Chert var. 4 | Other cherts | Patinated cherts | Other rocks | Total (N) | Total (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cobble** | **2** | - | - | - | - | - | - | - | **2** | **0.6** |
| **Flake** | **96** | **3** | **2** | **2** | **20** | **12** | **4** | **2** | **141** | **39.3** |
| Primary flake | 3 | - | - | - | - | 2 | - | - | 5 | 1.4 |
| Secondary flake | 48 | - | - | - | - | 3 | - | 1 | 52 | 14.5 |
| Naturally-backed knife | 4 | - | - | - | - | - | - | - | 4 | 1.1 |
| Flake | 41 | 3 | 2 | 2 | 20 | 7 | 4 | 1 | 80 | 22.3 |
| **Secondary blade** | **1** | - | - | - | - | **1** | - | - | **2** | **0.6** |
| **Bladelet** | - | - | - | - | - | **1** | - | - | **1** | **0.3** |
| **Core maintenance flake** | - | - | **1** | - | - | - | - | - | **1** | **0.3** |
| **Cores** | **5** | - | - | - | **1** | **1** | - | - | **7** | **2.0** |
| Core without cortex | 1 | - | - | - | 1 | - | - | - | 2 | 0.6 |
| Core with cortex | 4 | - | - | - | - | 1 | - | - | 5 | 1.4 |
| **Chunk** | **63** | **1** | **1** | - | **3** | **4** | - | **1** | **73** | **20.3** |
| Chunk without cortex | 34 | 1 | 1 | - | - | 2 | - | - | 38 | 10.6 |
| Chunk with cortex | 29 | - | - | - | 3 | 2 | - | 1 | 35 | 9.7 |
| **Small chunk (<2cm)** | **65** | - | - | - | **3** | **4** | - | **1** | **73** | **20.3** |
| Small chunk without cortex | 56 | - | - | - | 3 | 2 | - | 1 | 62 | 17.3 |
| Small chunk with cortex | 9 | - | - | - | - | 2 | - | - | 11 | 3.0 |
| **Small flake (<2cm)** | **19** | **2** | - | - | **11** | **5** | **1** | - | **38** | **10.6** |
| Small flake without cortex | 18 | 2 | - | - | 10 | 5 | 1 | - | 36 | 10.0 |
| Small flake with cortex | 1 | - | - | - | 1 | - | - | - | 2 | 0.6 |
| **Unidentified** | **10** | **1** | - | - | **2** | - | **1** | - | **14** | **3.9** |
| **Tool** | **1** | **1** | **1** | - | **2** | **1** | **1** | - | **7** | **1.9** |
| **Total** | **262** | **8** | **5** | **2** | **42** | **29** | **7** | **4** | **359** | **100.0** |

*Tab. 6:* Vinica. Layer c. Frequencies of main artefact classes by raw material groups.
*Tab. 6:* Vinica. Plast c. Zastopanost glavnih kategorij artefaktov po surovinskih skupinah.

from 29.1 mm to 70 mm (mean: 46.4; sd: 13.9). All cores were used for flake production. Flakes were knapped mostly unidirectionally (N=5), in one case centripetally and in one bidirectionally. The striking platform was facetted in only one case (a chert core), while on other core specimens no platform preparation was noticed. The morphology of the single centripetal quartz core found is comparable to discoid cores with one flaking surface. This is the largest core in the assemblage (*Fig. 7*).

Almost all cortical pieces in the layer c assemblage have pebble cortex suggesting exploitation of allochthonous lithic raw material sources, both quartz and cherts. Nodular cortex is present only on two chert artefacts attesting to occasional exploitation of autochthonous raw material sources (*Tab. 7*).

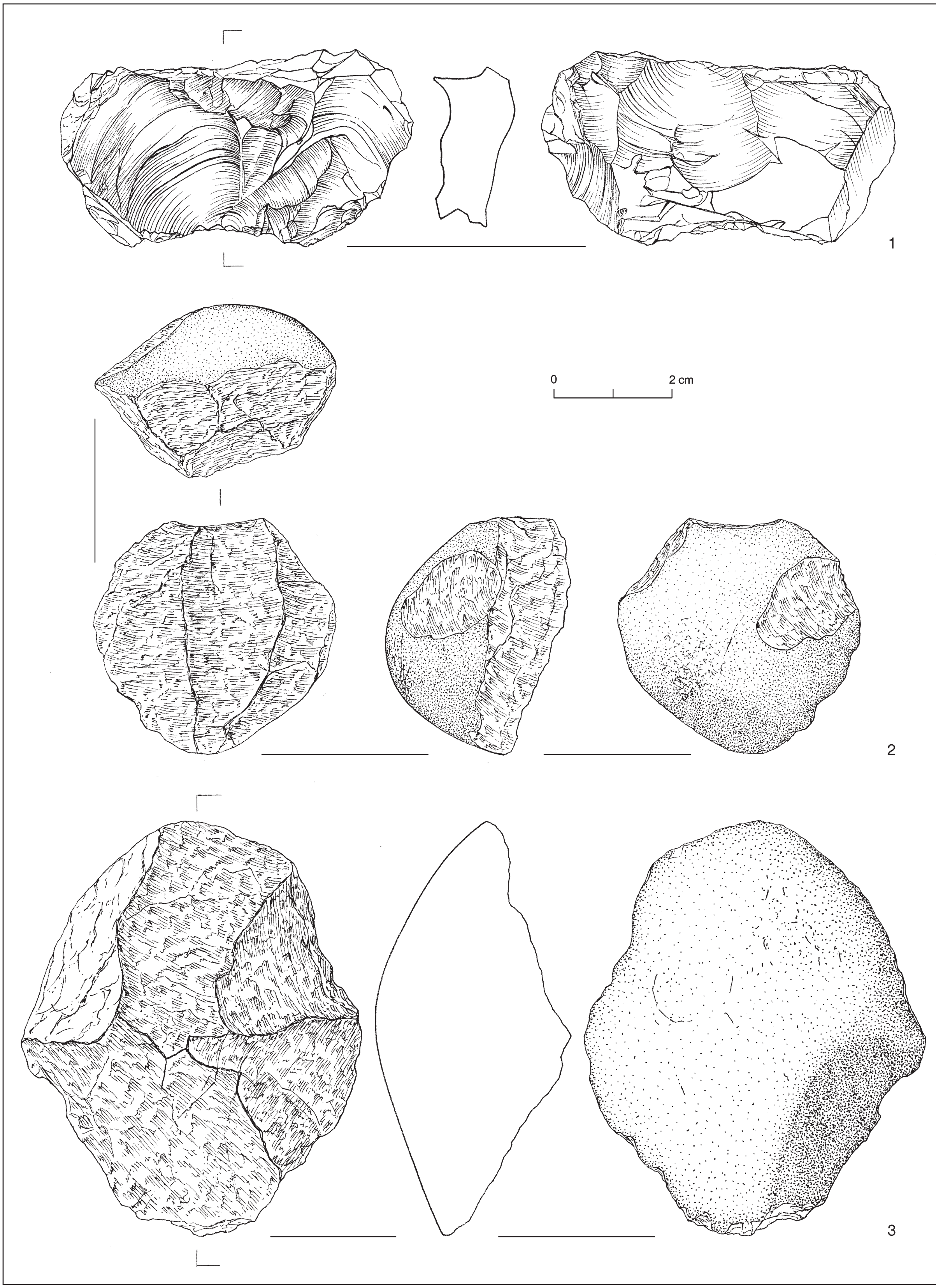



*Fig. 7:* Vinica. Layer c. Selected cores. 1 – bidirectional core (chert); 2 – unidirectional core (quartz); 3 – discoid core (quartz).
*Sl. 7:* Vinica. Plast c. Izbrana jedra. 1 – bipolarno jedro (roženec); 2 – unipolarno jedro (kremen); 3 – diskoidno jedro (kremen).

| | Layer c (n=125) | Layer d (n=41) |
|---|---|---|
| Nodular cortex | 2.4 | 0 |
| Pebble cortex | 97.6 | 100.0 |

*Tab. 7:* Vinica. Percentage frequency of cortex types. Number in brackets refers to number of cortical pieces in particular layer.
*Tab. 7:* Vinica. Odstotkovna zastopanost obeh vrst korteksa. Številke v oklepaju se nanašajo na število kortikalnih primerkov v posamezni plasti.

Over 70% of lithics are made of quartz. Quartz has been transported to the site in the form of cobbles that were knapped on-site. Opening cortical flakes, secondary flakes, cores, and other artefact classes show that long reduction sequence was conducted on quartz cobbles (*Tab. 6*). Reduction sequence is shorter for cherts. For chert variety 1 we can suppose that this raw material was brought to the site in the form of blanks and tools. Chert variety 2 was probably brought to the site as a core. However, the core was not found but we can make this conclusion from the presence of one core maintenance flake in this raw material group. Several flakes were knapped from the core that subsequently could be taken off-site. For chert variety 4 we can suppose a similar pattern that included prepared core transfer to the site where it was flaked for blanks/tools. Other raw material groups will not be discussed in the frame of reduction stages because they are mixture of other cherts and other raw materials.

Seven tools are found in the assemblage (1.9% of total assemblage count from layer c). All except one are made on flakes, and one tool is made on core on flake. Four tools are scrapers. Among them one is double straight-convex scraper (Bordes type 13), one straight transverse scraper (Bordes type 22), one convex transverse scraper (Bordes type 23) and one is scraper on interior surface (Bordes type 25). Other tools include endscraper (Bordes type 30), notch (Bordes type 42) and partially retouched flake. One endscraper (Bordes type 30) is the only Upper Paleolithic type. It is core on flake that was transformed into endscraper (*Fig. 8*). Partially retouched flake is not on the Bordes' list, and here we followed Banda and Karavanić (2019) who added this type in their analysis of Veternica Mousterian assemblage. The only notched tool is made on quartz, while other tools are made of cherts.

*Layer d lithic assemblage:*

In this layer 122 lithic artefacts have been found. Almost half of all artefacts are flakes followed by chunks. There is only one blade in the assemblage (*Tab. 8*). Complete quartz flakes (N=23) and proximal flake fragments (N=2) show cortical (N=10) and plain (N=8) butts, while in seven cases butts are fragmented. Mean length and width values for complete quartz flakes are 33.8 mm and 29 mm respectively (length min: 21.8, max: 60.4, sd: 9.8; width min: 15.4, max: 48.3, sd: 10.3). Among chert flakes plain butts have the highest frequency (N=19). One flake has facetted and one linear butt. Three flakes have fragmented butts. Average length of chert flakes is 29.1 mm (min: 12.3, max: 57.3, sd: 10.6), and average width is 25.2 mm (min: 15.3, max: 53.4, sd: 9.9).

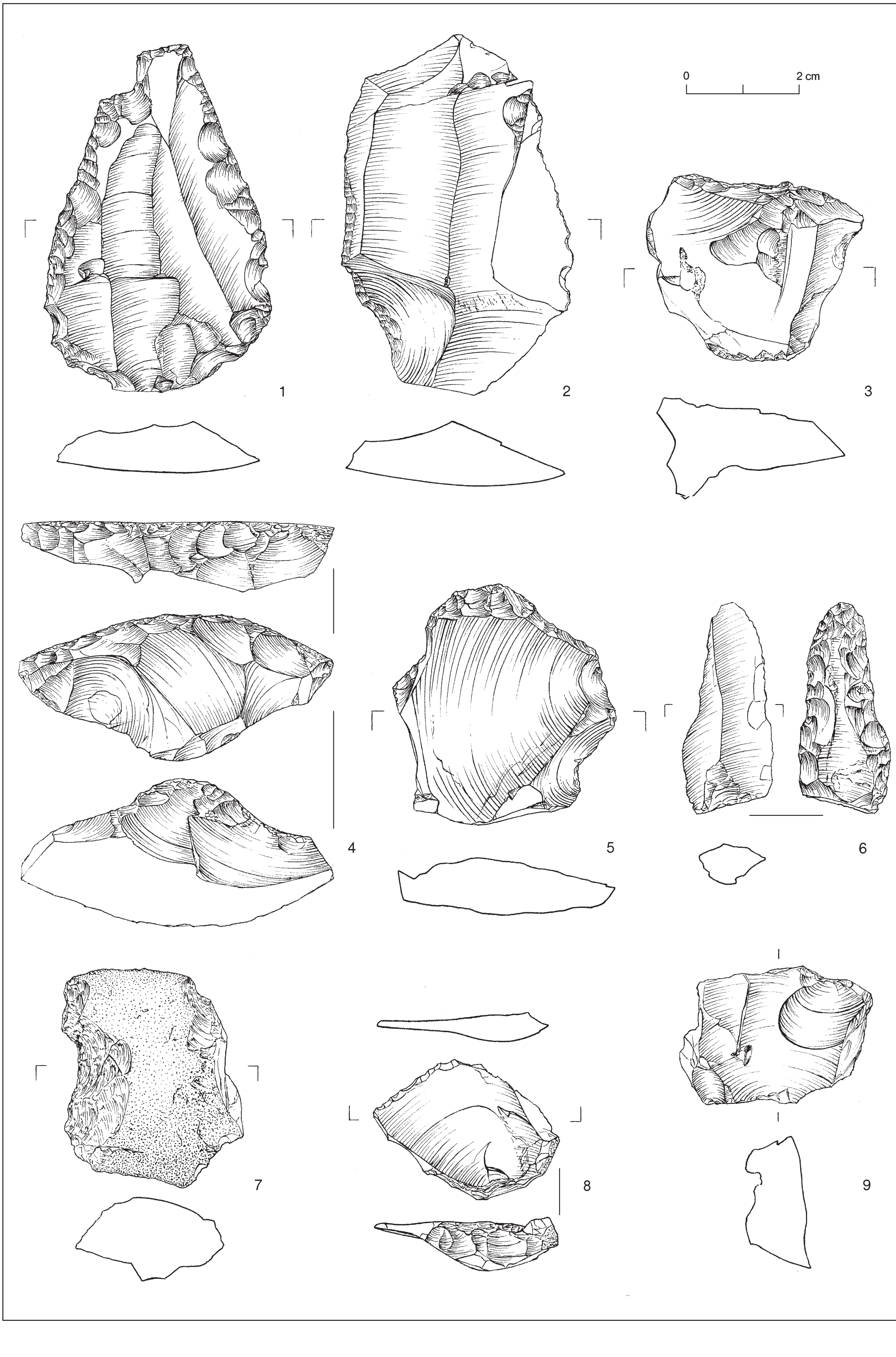
Only two cores are found in layer d assemblage. Both are flake cores made of quartz that show unidirectional scar pattern without platform preparation. Maximum linear dimensions of cores are 29.1 mm and 50 mm.

All cortical pieces have pebble cortex (*Tab. 7*) showing that both quartz and cherts were procured from secondary deposits.

Almost 60% of the assemblage belongs to quartz raw material group. Different stages in the lithic production, as can be concluded from frequency of certain artefact classes, were conducted on-site, i.e., from decortication of quartz cobbles to tool discard (see *Tab. 8*). Although cores are not present among cherts, we can suppose that at least some flakes were struck from chert cores that could be subsequently taken out from the site. This could be supposed after presence of cortical flakes and chunks. There is also a possibility that chert blanks and tools were brought to the site.

There are nine tools in layer d lithic assemblage. All tools are made on flake blanks. Cherts were used for majority of tools (seven out of nine).

→
*Fig. 8:* Vinica. Layer c. Selected lithic artefacts. 1 – Double straight-convex scraper; 2 – partially retouched flake; 3 – straight transverse scraper; 4 – convex transverse scraper; 5 – endscraper on core; 6 – scraper on interior surface; 7 – notch; 8 – core maintenance flake; 9 – core. 1–6,8,9 cherts; 7 quartz.
*Sl. 8:* Vinica. Plast c. Izbrani kamniti artefakti. 1 – ravno izbočeno strgalo; 2 – delno retuširan odbitek; 3 – prečno ravno strgalo; 4 – prečno izbočeno strgalo; 5 – praskalo na jedru; 6 – strgalo na trebušni strani; 7 – izjeda; 8 – jedrni odbitek; 9 – jedro. 1–6,8,9 roženci; 7 kremen.


0
2 cm
1
2
3
4
5
6
7
8
9

| Artefact class | Quartz | Chert var. 1 | Chert var. 2 | Chert var. 4 | Other cherts | Patinated cherts | Other rocks | Total (N) | Total (%) |
|---|---|---|---|---|---|---|---|---|---|
| **Flake** | **31** | **4** | **2** | **9** | **10** | **2** | **1** | **59** | **48.4** |
| Secondary flake | 10 | - | 1 | 4 | 3 | - | - | 18 | 14.8 |
| Naturally-backed knife | 3 | 1 | - | - | - | - | - | 4 | 3.3 |
| Flake | 18 | 3 | 1 | 5 | 7 | 2 | 1 | 37 | 30.3 |
| **Blade** | - | - | - | - | - | - | **1** | **1** | **0.8** |
| **Core with cortex** | **2** | - | - | - | - | - | - | **2** | **1.6** |
| **Chunk** | **21** | **1** | - | **2** | - | - | - | **24** | **19.7** |
| Chunk without cortex | 13 | 1 | - | - | - | - | - | 14 | 11.5 |
| Chunk with cortex | 8 | - | - | 2 | - | - | - | 10 | 8.2 |
| **Small chunk (<2 cm)** | **10** | - | - | - | - | - | **1** | **11** | **9.0** |
| Small chunk without cortex | 7 | - | - | - | - | - | - | 7 | 5.7 |
| Small chunk with cortex | 3 | - | - | - | - | - | 1 | 4 | 3.3 |
| **Small flakes (< 2 cm) without cortex** | **3** | - | **1** | **5** | **2** | **1** | - | **12** | **9.8** |
| **Unidentified** | **4** | - | - | - | - | - | - | **4** | **3.3** |
| **Tools** | **2** | **1** | **3** | **3** | - | - | - | **9** | **7.4** |
| **Total** | **73** | **6** | **6** | **19** | **12** | **3** | **3** | **122** | **100.0** |

*Tab. 8:* Vinica. Layer d. Frequencies of main artefact classes by raw material groups.
*Tab. 8:* Vinica. Plast d. Zastopanost glavnih kategorij artefaktov po surovinskih skupinah.

There is one Mousterian point (Bordes type 6), five scrapers, one notch (Bordes type 42) and two denticulates (Bordes type 43). In scraper group of tools there is one single straight scraper (Bordes type 9), two single convex scrapers (Bordes type 10), one straight transverse scraper (Bordes type 22) and one scraper with bifacial retouch (Bordes type 28) (*Fig. 9*).

## DISCUSSION

### AMS $^{14}$C chronology

Two AMS dates are available for layers c and d. While AMS result for animal bone from layer d brings only minimum age of 50 ka BP, the result for sample from layer c gave an unexpectedly recent result of ca. 35 ka cal BP for Late Mousterian. As was mentioned before, this result should be taken with caution as dated sample does not bear traces of anthropic modification and it shows great discrepancy with Late Mousterian ages in the region. Further dating is necessary to establish more reliable chronology of the site and to confirm such a late presence of Mousterian technology in Northwest Croatia. On the regional level the closest site with well dated Late Mousterian sequence is Vindija cave (Smith et al. 1999; Higham et al. 2006). The most recent $^{14}$C dating results for Vindija Neandertals from layers G3 and G1 used pretreatment based on the extraction of the amino acid hydroxyproline and gave much older ages for Neandertal fossil remains than previously thought. According to these analyses, Neandertals from layers G3 and G1 predate 44 ka cal BP (Devièse et al. 2017). There is a discrepancy of 10 ka between Vinica layer c and Vindija results. This can be a result of applying less rigorous pretreatment chemistry methods in

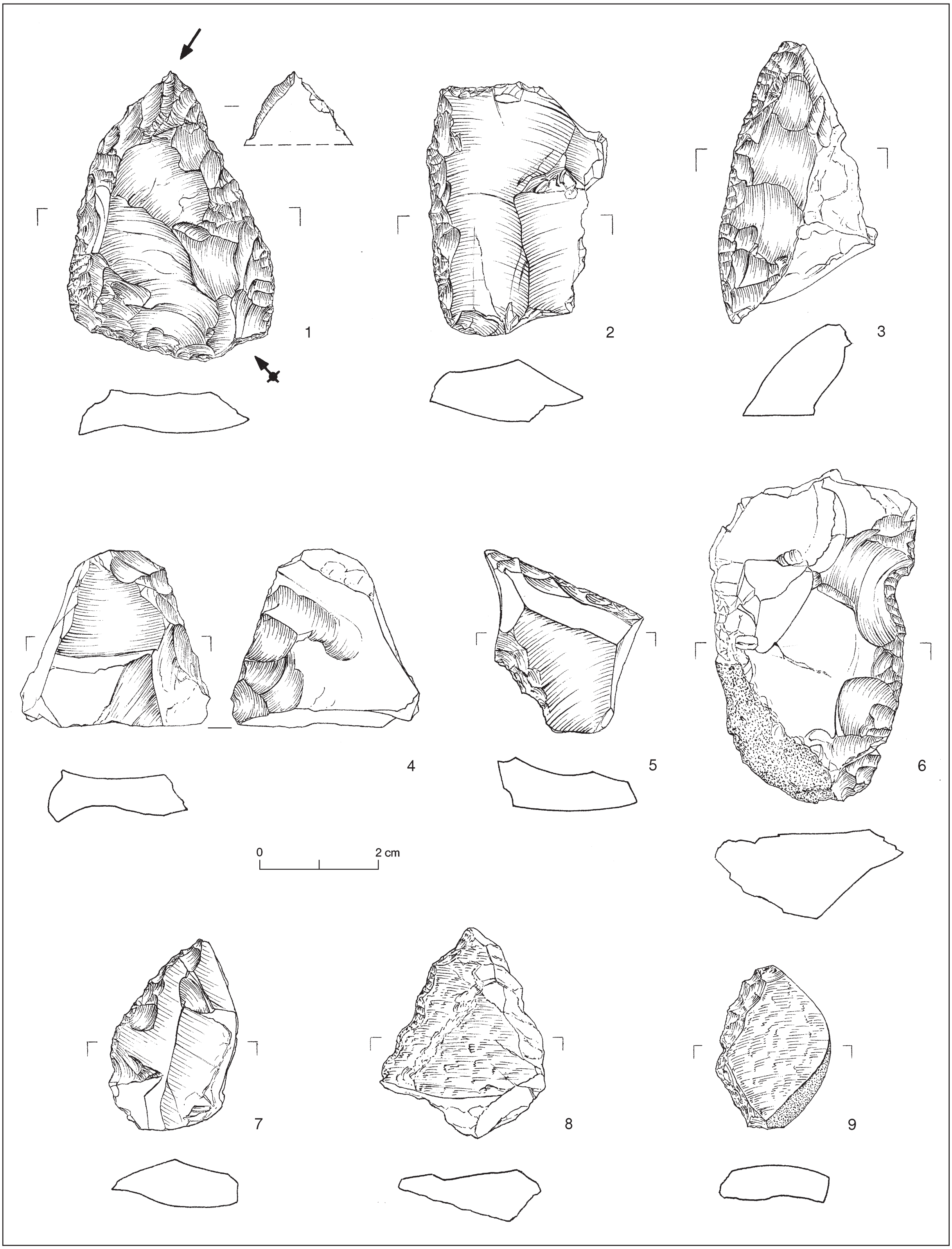



*Fig. 9:* Vinica. Layer d. Tools. 1 – Mousterian point with burin facet on its ventral side; 2 – single straight scraper; 3 and 7 – single convex scrapers; 4 – scraper with bifacial retouch; 5 – straight transverse scraper; 6 – notch; 8 and 9 – denticulates. 1–7 cherts; 8,9 quartz.

*Sl. 9:* Vinica. Plast d. Orodja. 1 – musterjenska konica z negativom vbadalovega odbitka na ventralni strani; 2 – ravno strgalo; 3 in 7 – izbočeni strgali; 4 – obojestransko ploskovno retuširano strgalo; 5 – prečno ravno strgalo; 6 – izjeda; 8 in 9 – nazobčani orodji. 1–7 roženci; 8,9 kremen.

the case of Vinica sample. An older age for Vinica sample from layer c could be expected if the same pretreatment method was applied as in the case of Vindija where samples pretreated in this way yielded systematically older ages in comparison to those with ultrafiltration pretreatment method (Devièse et al. 2017). On the other hand, such a late date for Mousterian lithic assemblage is not completely surprising if we consider the chronology of couple of sites in the eastern Adriatic. Recent U-Th radiometric dates of the flowstones from Velika pećina in Kličevica showed that Mousterian assemblages on this site are younger than 40 ka BP (Karavanić et al. 2021). Further support for presence of Neandertals after 40 ka cal BP comes from Bioče rockshelter in Montenegro where the Mousterian is recorded in layers deposited above the Campanian Ignibrite tephra (Pavlenok et al. 2017; Vishnevskiy et al. 2019).

Two radiocarbon dates were made in the 1970s for Mousterian layers I and J of Veternica cave, with minimum ages of 43.2 ka BP and 50 ka BP, respectively (Vogel, Waterbolk 1972; Malez 1981). Based on their analysis of faunal remains from Veternica and its comparison with Krapina faunal assemblage, Miracle and Brajković (2010) suggested deposition of layer J during MIS 5e, while for layers H and I they suggested MIS 5d-a or MIS 4 age (Miracle, Brajković 2010). If Vinica dates are compared with the $^{14}C$ AMS age of Bukovac cave (located ca. 150 km to the southwest) Aurignacian layer in which massive base osseous point was found (35.2–34.4 ka cal BP), there is an overlap (2σ) between Vinica Late Mousterian and Bukovac cave Aurignacian layers (Janković et al. 2018). During lithic analysis of Vinica assemblage at least one bone flake has been discovered in layer c and it will be additionally dated as a reliable indicator of human activity in the cave. Hopefully, it will provide further evidence for Late Mousterian chronology in Northwest Croatia but also for the Middle/Upper Paleolithic transition in the wider region.

## Continuities in lithic technology and cave use

Lithic assemblages from layers c and d could be both considered as deposition of single/multiple short-term occupational episodes. Quartz raw material has the highest incidence in both layers. We can suppose that quartz cobbles were locally procured and transferred to the cave where cobbles were exploited within long reduction sequence. Cherts in both layers have much lower frequencies and it seems that at least some chert artefacts were not knapped on-site but brought to the site as blanks and tools. Both quartz and cherts were collected from allochthonous sources and only a couple of cherts with nodular cortex point to occasional exploitation of autochthonous sources in layer c. Lithic production is oriented in both layers almost exclusively to flakes that were used as blanks for low number of tools. Small number of cores gives only partial insight into the debitage methods applied by Mousterian groups. In layer d flakes were only knapped from single platform cores where platform was cortical and plain. In layer c core reduction was more diverse with unidirectional pattern being most frequent. There were also discoidal and bidirectional cores found, with single example in each case. Levallois cores are not recorded in the assemblages, although one Levallois-like flake from layer c (*Fig. 8:* 2) and Levallois point (from b2/c interface) could potentially indicate occasional presence of Levallois reduction method. Core platforms were mainly plain and cortical as can also be seen from the frequency of flakes' cortical and plain butt types. High incidence of cortical butts by quartz flakes is the result of using flat surfaces of quartz cobbles as striking platforms. In both layers naturally backed knives, i.e. cortical flakes (*Fig. 10*) also attest to breaking of predominantly quartz cobbles, with occasional chert cobbles as well.

In both layers there is a clear selection of chert blanks for tools as can be seen by tools/cores ratio. In layer c this ratio for quartz and cherts is 0.2 and 3, respectively. In layer d, tools/cores ratio for quartz is 1 and for cherts it is 5:0. Low ratio values for quartz could partially be the result of hard visibility of retouch on quartz raw material that could potentially lead to underrepresentation of quartz tools in the assemblage. An alternative explanation, as previously suggested, could be that chert blanks were simply the first choice for tool production.

Although we are dealing with small number of tools in layers' assemblages, in both layers scrapers are the most frequent and they include different types. Other tool types are very few in both layers.

Spatial distribution of lithic artefacts in both layers shows that cave entrance was the main activity area through different occupational episodes (*Fig. 11*).


*Fig. 10:* Vinica. Layers c and d. Naturally backed knives. 1–4,6 quartz; 5 chert.
*Sl. 10:* Vinica. Plasti c in d. Noži z naravnim hrbtom. 1–4,6 kremen; 5 roženec.

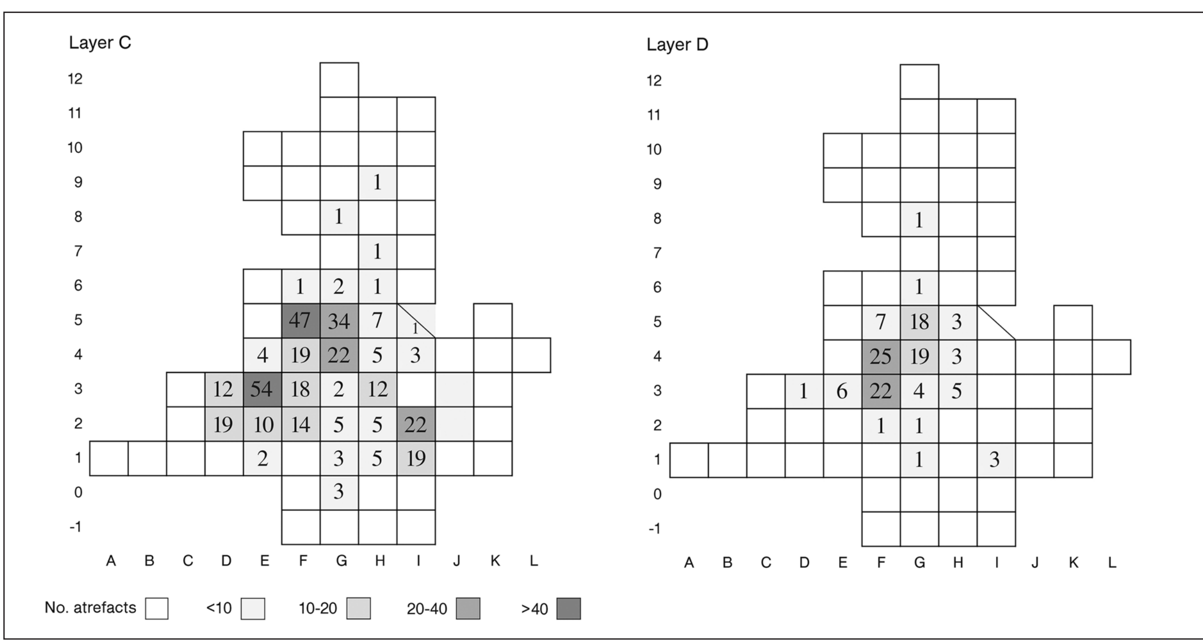



*Fig. 11:* Vinica. Layers c and d. Spatial distribution of lithic artefacts. Total number of artefacts (N=121) for layer d presented here is lower than the total number of artefacts showed in *Tab. 3* (N=122) because square data is missing for one artefact from layer d.
*Sl. 11:* Vinica. Plasti c in d. Prostorska razprostranjenost kamnitih artefaktov. Skupno število artefaktov (N = 121) v plasti d, prikazano tukaj, je nižje od skupnega števila artefaktov, prikazanih v *tab. 3* (N = 122), ker pri enem artefaktu iz plasti d ni podatkov o kvadrantu.

### Vinica lithic technology in regional context

First and most important reference points for comparison of Vinica assemblage are lithic assemblages from layers G3 and G1 of Vindija cave due to geographic proximity of the two sites and their similar ages of Late Mousterian occupation layers. Both layers from Vindija, as mentioned earlier, predate 44 ka cal BP. Raw material procurement strategies that are documented in Vindija show predominance of quartz in lithic technology (Kurtanjek, Marci 1990; Blaser et al. 2002) thus strongly resembling procurement strategies recorded in Vinica assemblage. Karavanić and Smith (1998; see also Ahern et al. 2004) reported use of quartz for Middle Paleolithic tool types in layer G3 but also use of cherts and tuffs. While Vindija assemblages from layers G3 and G1 could be described as Mousterian industries with some techno-typological Upper Paleolithic elements (Karavanić, Smith 1998), in Vinica assemblage we did not notice Upper Paleolithic traits but only Mousterian techno-typological features. Almost one third of all tools in layer G3 are scrapers and high incidence of scrapers is also recorded in Vinica. Levallois method is not present in Vindija layers G3 and G1 nor in Vinica layers c and d (Karavanić, Smith 1998).

Similar patterns of raw material procurement are recorded in Mousterian assemblage from Veternica cave where quartz too has high incidence (Banda, Karavanić 2019). Veternica cave Mousterian assemblage was recently re-analyzed by Banda and Karavanić (2019) wwho had to approach total assemblage as a single unit due to lack of precise information on artefacts' stratigraphic position. Because Veternica Mousterian layers encompass a wide time frame from MIS 5e to MIS 4 or 3, Vinica assemblage will not be compared with Veternica in this paper.

## CONCLUSION

Mousterian lithic assemblages from Vinica cave show continuity in technological behavior through long period of time. Lithic assemblages from Vinica cave are clearly Mousterian without Upper Paleolithic traits that are present in Vindija G3 and G1 assemblages. Spatial distribution of lithic artefacts exhibits same patterns in cave use through time. For Neandertal groups, both small and huge caves of Hrvatsko zagorje region, like Vinica and Vindija respectively, were attractive speleological objects that were used successively. Small lithic assemblages suggest short-term occupations in the cave and highly mobile Neandertal groups. This is in agreement with other Mousterian sites from the region where small assemblages also witness to short stays that were intertwined with carnivore use of the caves. For more comprehensive insight into human and carnivore activities in the Vinica cave zooarchaeological analysis of faunal assemblage is essential. The exploitation of locally available quartz and cherts shows similar pattern of raw material procurement to other sites in the region. While in Vindija cave long distance contacts could be proposed based on one Szeletian point made of raw material whose origin could be in central Europe (Karavanić, Smith 1998), such possibility is not detected for Vinica cave.

Results presented in this paper in addition to providing more information on Mousterian chronology and variability in Northwestern Croatia also offer further evidence of Neandertal settlement pattern and adaptation in this part of Europe. Vinica cave is the first Middle Paleolithic site that was excavated after intensive work of Mirko Malez in the region, but it should not be the last. Numerous caves of Hrvatsko zagorje region create a good perspective for future research of Middle Paleolithic.

### Acknowledgements

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# Musterjenska kamena industrija iz jame Vinica (Hrvaško Zagorje).
## Nova spoznanja o regionalni srednjepaleolitski tehnologiji

*Povzetek*

V prispevku predstavljamo tehnotipološko in surovinsko analizo musterjenskega kamnitega inventarja iz plasti c in d jame Vinice (Hrvaško Zagorje), izkopanega ob koncu prejšnjega in začetku tega tisočletja. Jama Vinica leži na severozahodu Hrvaške v bližini Varaždina (46.326143 N, 16.127785 E) (*sl. 1*). Znana je tudi pod imenom Šincekova jama, odkril jo je speleobiolog Dubravko Šincek.

Srednji paleolitik severozahodne Hrvaške je dobro poznan predvsem zaradi Krapine in Vindije, kjer kameno industrijo in živalske ostanke dopolnjujejo neandertalski fosili (e.g., Smith 1976; Simek, Smith 1997; Wolpoff 1999; Miracle 2007; Cartmill, Smith 2009; Karavanić, Smith 2013; Janković et al. 2016). V jamah Veternica in Velika pećina neandertalskih fosilnih ostankov niso odkrili, vendar kljub temu predstavljata pomembni paleolitski in paleontološki najdišči (Karavanić, Smith 1998; Banda, Karavanić 2019).

Jame na severozahodu Hrvaške so v mlajšem pleistocenu v presledkih obiskovali ljudje in zveri. Zato materialnih kulturnih ostankov v njih ni prav veliko (Miracle 1991; Karavanić, Patou-Mathis 2009). Enako velja za jamo Vinico z njenim skromnim kamnitim inventarjem, ki je predmet tega prispevka. Kamniti artefakti iz Vinice so prva srednjepaleolitska zbirka kamnitih artefaktov iz severozahodnega dela Hrvaške, odkrita po koncu dolgoletnih izkopavanj v Vindiji leta 1986.V jami Vinica so bile prepoznane štiri plasti (a–d). Plasti a in b sta holocenski, plasti c in d pleistocenski. Pridobljeni sta dve radiokarbonski dataciji, ena iz plasti c in druga iz plasti d (*tab. 3*). V obeh primerih gre za datacijo živalske kosti brez antropogenih sledov (tj. vreznin in sledov tolčenja). Čeprav brez sledov človeškega posega, pa nam datirani kosti, obe odkriti v kontekstu s kamnitimi orodji, omogočata oceniti čas odlaganja plasti c in d in čas človekove prisotnosti v jami. Vzorca sta bila predhodno obdelana z ultrafiltracijo (Brock et al. 2010) in sta dala kvaliteten kolagen za datiranje, kot je razvidno na *tab. 2* (yield, %Yld in %C). Vrednosti δ13C ter razmerje med ogljikom in dušikom (*tab. 3*) so v okviru sprejemljivih razponov (De Niro 1985; Bronk Ramsey et al. 2004). Konvencionalna radiokarbonska starost vzorca iz plasti c je 30.830 ± 380 BP, kalibrirana starost pa 36–34,5 ka BP. Rezultati datiranja vzorca iz plasti d kažejo zgolj, da je starejši od 50.300 let BP (*tab. 3*). Kamniti inventar iz plasti c in d šteje 359 oz. 122 kosov (*tab. 1*). Celoten inventar je glede na zastopano surovino razdeljen na naslednje surovinske skupine: kremen, roženci in druge kamnine (tufi, peščenjak itd.). Petrografski vzorci so bili analizirani makroskopsko in mikroskopsko. Mikroskopska petrografska analiza zbruskov je bila opravljena pod vzporednimi nikoli. V celotnem inventarju med surovino prevladuje kremen, sledijo roženci. Enako velja za posamično plast c in d. Le manjši delež artefaktov je iz tufov, peščenjaka in drugih kamnin (*tab. 5*). Kamniti inventar iz plasti c in d lahko predstavlja ostanek enega ali več kratkotrajnih obiskov neandertalcev. Domnevamo, da so prodnike kremena, ki je v obeh plasteh najbolje zastopan, pridobivali v okolici in jih prinesli v jamo, kjer so jih izkoriščali za izdelavo odbitkov. Roženci so v obeh plasteh bistveno slabše zastopani. Zdi se, da vsaj nekatere artefakte iz roženca niso izdelali v jami, temveč so jih vanjo prinesli kot odbitke in orodja. Tako kremen kot roženci so alohtonega izvora in samo nekaj rožencev s skorjo gomolja v plasti c kaže na priložnostno izkoriščanje avtohtonih virov surovine.V obeh plasteh je bila redukcija jeder usmerjena v izdelavo odbitkov, ki so jih uporabljali za izdelavo sicer maloštevilnih orodij. Majhno število jeder nam ponudi zgolj omejen vpogled v način njihove redukcije (*tab. 6* in *8; sl. 7*). V plasti d so odbitke odbijali od jeder z eno udarno ploskvijo, ki jo je predstavljala gladka, s korteksom pokrita površina prodnika. V plasti c še vedno prevladuje enosmerno odbijanje, vendar je način izkoriščanja jeder nekoliko bolj raznolik, saj sta s po enim primerkom zastopana diskoidno in bipolarno jedro. Jedra levalva niso zastopana, vendar bi na priložnostno uporabo tehnike levalva pri redukciji jeder lahko kazala levalva odbitku podobna najdba iz plasti c in levalva konica, najdena na stiku plasti b2 in c.Udarna ploskev na jedrih je bila večinoma gladka in prekrita s korteksom, kar kažejo odbitki z gladkim in s kortikalnim talonom. Visok delež talonov s korteksom pri odbitkih iz kremena je posledica tega, da so gladko površino kremenovih prodnikov uporabljali kot udarno površino. V obeh plasteh najdbe nožev z naravnim hrbtom kažejo na izrabo pretežno kremenovih prodnikov in le v manjši meri prodnikov roženca (*sl. 10*).

Čeprav je delež orodij v obeh plasteh nizek, v obeh plasteh prevladujejo strgala različnih tipov. Ostali tipi orodij so maloštevilni (*sl. 8* in *9*).

Podoben način preskrbe s surovino kot v jami Vinica odseva musterjenski inventar Veternice in inventar iz mlajše musterjenske plasti G3 in G1 v Vindiji, kjer je zastopanost kremena prav tako visoka (Kurtanjek, Marci 1990; Blaser et al. 2002; Banda, Karavanić 2019).

Musterjenski kamniti inventar iz jame Vinice kaže na kontinuiteto v tehnologiji obdelave kamna v dolgem časovnem obdobju, ko so jamo kot kratkotrajno bivališče uporabljali neandertalci. Za celovitejši vpogled v človekove in zverske aktivnosti v jami bo treba opraviti še zooarheološko analizo favne.

Kamniti inventar iz jame Vinice kaže povsem musterjenski značaj in ne vsebuje mlajšepaleolitskih elementov, ki so v Vindiji prisotni v plasteh G3 in G1.

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*Slikovno gradivo: Sl. 1* (izdelava: Marko Banda). – *Sl. 2* (foto: Goran Gužvica). – *Sl. 3* (risba: Dinko Novosel [a], Hrvoje Cvitanović [b, c] in Hrvatsko Biospeleološko Društvo; priredil: Miroslav Vuković). – *Sl. 6; 10* (foto: Miroslav Vuković). – *Sl. 7–9* (risba: Martina Rončević).