Prostorna analiza nalaza musterijenskih razina D2, E1, E2 i E3 Mujine pećine

Nizek, Renata; Karavanić, Ivor

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The Spatial Analysis of Finds from Mousterian Levels D2, E1, E2 and E3 at Mujina pećina

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RENATA NIZEK
Mljekarska 3
HR–10040 ZAGREB
renata.nizek@gmail.com

IVOR KARAVANIĆ
Sveučilište u Zagrebu
Filozofski fakultet
Odsjek za arheologiju
I. Lučića 3
HR–10000 Zagreb
ikaravan@ffzg.hr

Članak po prvi put donosi rezultate prostorne analize donjih razina (kompleks E3 i slojevi E2 i E1) nalazišta musterijenske kulture Mujina pećina. Prostorna horizontalna distribucija nalaza iz sloja D2 ponovno je objavljena zbog posebne važnosti te razine koja sadrži nalaze dvaju musterijenskih vatrišta te usporedbe s donjim razinama. Pojedini odsječci vertikalne distribucije nalaza prikazani su za sve slojeve čime se povećala mogućnost komparacije svih razina.

Ključne riječi: srednji paleolitik, musterijen, neandertalci, prostorna analiza, Mujina pećina, Dalmacija, Hrvatska

This paper presents the results of the spatial analysis of finds from the lower levels (complex E3 and levels E2 and E1) at the Mousterian site of Mujina pećina, Croatia. The horizontal spatial distribution of finds from level D2 is also included here since it contains the remains of two Mousterian hearths, which makes this level significant for the comparison with the lower levels. To increase the possibility of comparison of all levels at the site, particular segments of vertical dispersal of finds are also presented in the paper.

Key words: Middle Paleolithic, Mousterian, Neanderthals, spatial analysis, Mujina pećina, Dalmatia, Croatia

1. Uvod

Iako je prostorna analiza, odnosno analiza distribucije nalaza u stanišnome prostoru, vrlo važna za iščitavanje organizacije prapovijesnih skupina i staništa, ona se u Hrvatskoj još uvijek rijetko provodi. Još osamdesetih godina prošloga stoljeća rezultati takve analize objavljeni su za gornjopaleolitičko nalazište Pincevent (Leroi-Gourhan, Brézillon 1983) i srednjopaleolitičko nalazište Vaufrey (Rigaud, Geneste 1988), oba u Francuskoj. Mujina pećina ili Pećina u Trapljenim docima u Hrvatskoj istraživana je primjenom suvremenih metoda iskopavanja paleolitičkih staništa, što daje osnovu za uspješnu provedbu prostorne analize. Ustanovljeno je da svi slojevi nalazišta pripadaju razdoblju srednjega paleolitika i sadrže musterijensku materijalnu kulturu (Karavanić, Bilich-Kamenjarin 1997). Štoviše, dugogodišnjim sustavnim istraživanjima ovoga lokaliteta otkriven je bogat arheološki materijal koji je, nakon brojnih analiza, pokazao da su neandertalske skupine više puta boravile u prostoru pećine tijekom nastajanja slojeva te da su se u njemu obavljale aktivnosti poput izrade oruđa i komadanja ulovljenih životinja (Miracle 2005; Karavanić et al. 2008b). Kako bi se

1. Introduction

Even though the spatial analysis, or the analysis of distribution of archaeological finds at a site, is extremely important in understanding the organizational patterns of Paleolithic groups and sites they occupied, it is still rarely conducted in Croatia. The results of such research were published for the Upper Paleolithic site of Pincevent (Leroi-Gourhan, Brézillon 1983) and the Middle Paleolithic site of Vaufrey (Rigaud, Geneste 1988), both in France, as early as the 1980s. The research of Mujina pećina or Pećina u Trapljenim docima in Croatia was carried out with the use of contemporary archeological excavation methods for Paleolithic sites, which provides a basis for a successful implementation of the spatial analysis. It has been determined that all stratigraphic levels at the site, which contain the Mousterian material culture, were deposited during the Middle Paleolithic period (Karavanić, Bilich-Kamenjarin 1997). Furthermore, years of systematic research of the site have yielded rich archaeological material which, after numerous analyses, suggests that Neanderthals visited the cave several times during the deposition of stratigraphic levels and that activities like tool production and processing of animal meat were also performed here (Miracle 2005; Karavanić et al. 2008b).

dobio jasniji uvid u načine iskorištavanja prostora Mujine pećine, životne navike neandertalaca koji su tu boravili i organizaciju njihove zajednice, pristupilo se provedbi prostorne analize. Ona nam može odgovoriti na pitanja o veličini paleolitičkih zajednica na određenom lokalitetu, relativnom vremenu trajanja boravka tih skupina na pojedinim staništima, prirodi ekonomskih i tehnoloških aktivnosti koje su se odvijale i načinima na koje su se te aktivnosti organizirale unutar životnog prostora paleolitičkih populacija (Mellars 1996). Ipak, ovakva analiza često ne može dati potpuno pouzdane interpretacije o nekadašnjem životu prapovijesnoga čovjeka. Iznimno je teško ustanoviti koliko je puta pojedino nalazište bilo nastanjivano te radi li se o dugotrajnom boravku na nekom staništu ili je riječ o kraćim, ali intenzivnim lovnim epizodama (Conard 1996). Štoviše, očuvanost nalaza (osobito organskih) može biti različita i ovisiti o mnogo faktora, poput vremenskih uvjeta, sedimentacije, kemijskih procesa te životinjskog i ljudskog utjecaja, što može donekle utjecati na donošenje pravovaljanih zaključaka o prostornoj organizaciji i ponašanju paleolitičkih populacija. Nadalje, čak i suvremena arheološka istraživanja i načini bilježenja podataka imaju određena ograničenja koja mogu dati nepotpunu ili iskrivljenu sliku o onome što istražujemo. Usprkos svim tim teškoćama, spacijalne analize lokaliteta poput Grotte du Lazaret, Grotte Vaufrey, Les Canalettes, Arcy-sur-Cure itd. dale su vrijedne podatke o različitim ekonomskim, tehnološkim i društvenim aktivnostima na tim nalazištima (Mellars 1996). Cilj ovoga rada je na sličan način proširiti već poznate činjenice o životu neandertalaca u Mujinoj pećini na osnovi rezultata spacijalne analize donjih razina (kompleks E3 i slojevi E2 i E1), dok su analize gornjih razina (D2, D1, B) provedene ranije (Mihelić, Karavanić, u tisku). Analize obuhvaćaju sve nalaze za koje su uzete sve tri dimenzije njihova položaja u prostoru, dok nalazi iz sita (do kojih se došlo prosijavanjem sedimenta) nisu obuhvaćeni. Prostorna horizontalna distribucija nalaza iz sloja D2 bit će ponovno objavljena zbog posebne važnosti te razine koja sadrži nalaze dvaju musterijenskih vatrišta te usporedbe s donjim razinama čiji se rezultati spacijalne analize po prvi puta iznose u ovom članku. Štoviše, pojedini odsječci vertikalne distribucije nalaza bit će prikazani za sve slojeve čime se povećava mogućnost komparacije svih razina.

2. Podaci o nalazištu

2.1. SMJEŠTAJ I POVIJEST ISTRAŽIVANJA

Mujina pećina ili Pećina u Trapljenim docima smještena je sjeverno od Kaštela nedaleko od ceste koja vodi prema Labinu Dalmatinskom. Položaj pećine zasigurno je bio bitan pri odabiru tog mjesta za neandertalsko stanište. Pećina se nalazi na popriličnoj uzvisini (260 metara nadmorske visine), što omogućuje uspješno nadziranje okolnog teritorija te je važno u smislu zaštite od zvijeri ili drugih ljudskih skupina, a sama pećina i/ili njen predšpiljski prostor mogli su poslužiti i kao svojevrsna osmatračnica za kretanje divljači (Mihelić, Karavanić, u tisku) (sl. 1). Dimenzija je 10x8 metara (sl. 3), s otvorom pećine okrenutim k istoku, što njenu unutrašnjost čini dovoljno osvijetljenom za obavljanje raznolikih poslova tijekom cijeloga dana, dok je predšpiljski prostor otvoren i prema jugu (sl. 2). Takva orijentacija zbog prodora sunca daje i povoljan toplinski faktor, zbog kojeg je boravak u pećiTo shed even more light on the site use, behavior and organization of the Neanderthals who occupied Mujina pećina, a spatial analysis was carried out to provide answers about the size of Paleolithic communities at the site, the duration of the occupational episodes, the nature of the economic and technological activities carried out on the site and the ways in which these activities were organized within the living space of Paleolithic groups (Mellars 1996). Still, such a study often cannot result in entirely reliable interpretations about the life of the Prehistoric humans. It is very difficult to determine how many times a particular site has been occupied and whether there was only one long-term occupation or several shorter, but intensive hunting episodes (Conard 1996). What is more, the condition of finds (especially organic ones) can vary and may depend on many factors such as weather conditions, sedimentation, chemical processes and hominin and animal activities, which can in some way affect the process of coming to valid conclusions about the spatial organization and behavior of Paleolithic populations. Also, even contemporary archeological excavation methods and ways of obtaining data have certain limitations, what can result in an incomplete or distorted view of the subject of our research. Despite all mentioned difficulties, spatial analyses of sites like Grotte du Lazaret, Grotte Vaufrey, Les Canalettes, Arcy-sur-Cure etc. have yielded valuable information about various economic, technological and social activities at these sites (Mellars 1996). The aim of this paper is to contribute in a similar way to the already known facts about the life of the Neanderthals in Mujina pećina based on the spatial analysis results for the lower levels (complex E3 and levels E2 and E1). The same study for the upper levels (D2, D1, B) was conducted earlier (Mihelić and Karavanić, in press). These analyses include all archeological finds, whose three dimensions were plotted on site plans, while the finds from the mesh (obtained by dry sieving) were not used. The horizontal spatial distribution of finds from level D2 is also included here since it contains the remains of two Mousterian hearths, which makes this level significant for the comparison with the lower levels. To increase the possibility of comparison of all levels at the site, particular segments of vertical dispersal of finds are also presented in the paper.

2. About the site

2.1. LOCATION AND HISTORY OF RESEARCH

Mujina pećina or Pećina in Trapljeni doci is located north of Kaštela and not far from the road that leads to Labin Dalmatinski. The position of the cave had surely been an important factor in choosing the site for a Neanderthal habitat. The cave is placed on a substantially elevated area (260 meters above sea level), which enables a successful overlook of the surrounding territory and may provide protection from animals or hominins. The cave itself and the area in front of it could have also been used as a lookout for game hunting (Mihelić, Karavanić, in press) (Fig. 1). Mujina pećina is 10 meters long and 8 meters wide (Fig. 3), with the cave entrance facing east, which makes its interior a well-lit area where various activities may have been performed throughout the day, while the area in front of the cave is facing south (Fig. 2). Such orientation, due to sun exposure, provides a favorable heat factor, which could make the cave appear as an even more attractive habitat for Paleolithic populations (Mihelić, Karavanić, in press). Also, the niche in the northeast corner is well sheltered from the wind, whereas reptilian and amphibian remains fo-

ni mogao biti dodatno primamljiv ondašnjim paleolitičkim populacijama (Mihelić, Karavanić, u tisku). Nadalje, niša u njenom sjeverozapadnom uglu dobro je sklonište od vjetra, a nalazi reptila i vodozemaca moguć su indikator postojanja različitih mikrostaništa u okolici pećine, na temelju čega bi se moglo pretpostaviti da je u blizini nalazišta postojao stalan izvor vode (Karavanić et al. 2008a: 270).

Mujina pećina je u nekoliko navrata spominjana u stručnoj literaturi prije početka sustavnih iskopavanja. Tako Mirko Malez (1979: 248) navodi da je prilikom pregleda nalazišta 1977. godine sakupljeno mnogo kamenih rukotvorina koje su imale obilježja srednjega paleolitika, dok je kraći izvještaj o prvom probnom sondiranju 1978. godine objavio Nikša Petrić (1979). Tada je prikupljeno dovoljno materijala, poput jezgara, odbojaka, krhotina i oruđa, što je omogućilo da se samo nalazište pripiše srednjem paleolitiku, a alatke musterijenskoj kulturi. Daljnja istraživanja nastavljena su tek 1995. godine suradnjom Arheološkog zavoda Filozofskog fakulteta Sveučilišta u Zagrebu i Zavičajnog muzeja Kaštela (danas Muzeja grada Kaštela), a trajala su do 2003. godine. Istraživanja su započeta geodetskim snimanjem pećine, postavljanjem mrežišta i određivanjem repernih točaka (Karavanić, Bilich 1997: 196). Zatim je provedeno sondiranje na kvadrantima E9 i F9 kako bi se ustanovila osnovna stratigrafija nalazišta i pokušala odrediti dubina sedimentnog kompleksa. Namjera je, također, bila prikupiti uzorke za kronometrijsko datiranje, odrediti učestalost nalaza i ustanoviti

Sl. 1 Fotografija pećine s ceste (snimio: I. Karavanić)
Fig. 1 Photo of the cave - view from the road (photo: I. Karavanić)

und on the site could suggest various micro-habitats existing in the surroundings of the cave, including a permanent water source (Karavanić et al. 2008a: 270).

Sl. 2 Fotografija pećine (unutrašnjost) (snimio: I. Karavanić)
Fig. 2 Photo of the cave - interior (photo: I. Karavanić)

Mujina pećina had already been mentioned several times in the scientific literature before the systematic excavations began. Mirko Malez (1979: 248) stated that many stone artifacts with Middle Paleolithic features were collected during an examination of the site in 1977, while a brief report on the first test excavation in 1978 was written by Nikša Petrić (1979). A sufficient amount of material, like cores, flakes, chunks and tools, was gathered, which defined Mujina pećina as a Middle Paleolithic site and classified its material culture as a Mousterian one. Further research was continued in 1995 as a joint project of the Department of Archeology at the University of Zagreb and the Regional Museum of Kaštela (today the Museum of the Town of Kaštela), which lasted until 2003. The excavation began with a geodetic mapping of the site and setting up of a metric grid (Karavanić, Bilich-Kamenjarin 1997: 196). Then 2 sq meters (E9 and F9) were excavated in order to establish the depth of the deposit and the basic stratigraphic sequence of the site. The intention was also to collect samples for radiocarbon dating, to determine the frequency of archeological finds and to ascertain whether there is any other archeological culture, except Mousterian, present at the site. Already in the following year the excavation area was widened 1 m toward the north, west and south and 3 m toward the east. The research of this area continued during the next following seasons and in 2000 also included the right niche, as well as several sq meters in the area in front of the cave in 2001. The niche was completely excavated in 2002.

Over these nine years, the research was conducted by precise excavation and data-obtaining methods which meet the criteria of contemporary archeological science. Samples for many analyses were also collected. The preliminary sediment analysis, microfaunal and avifaunal analyses, as well as the spatial analysis of the upper levels were conducted in Zagreb, while the lithic and petrographic analyses were carried out in both Zagreb and Split. The radiocarbon dating was performed in the Netherlands (Gröningen), Great Britain (Oxford) and Canada (Hamilton), charcoal and pollen analyses in Ljubljana, detailed sediment and preliminary micromorphological analyses in Italy (the University of Pisa), and faunal analysis in Great Britain (Cambridge) and Zagreb (Rink et al. 2002; Miracle 2005; Karavanić et al.

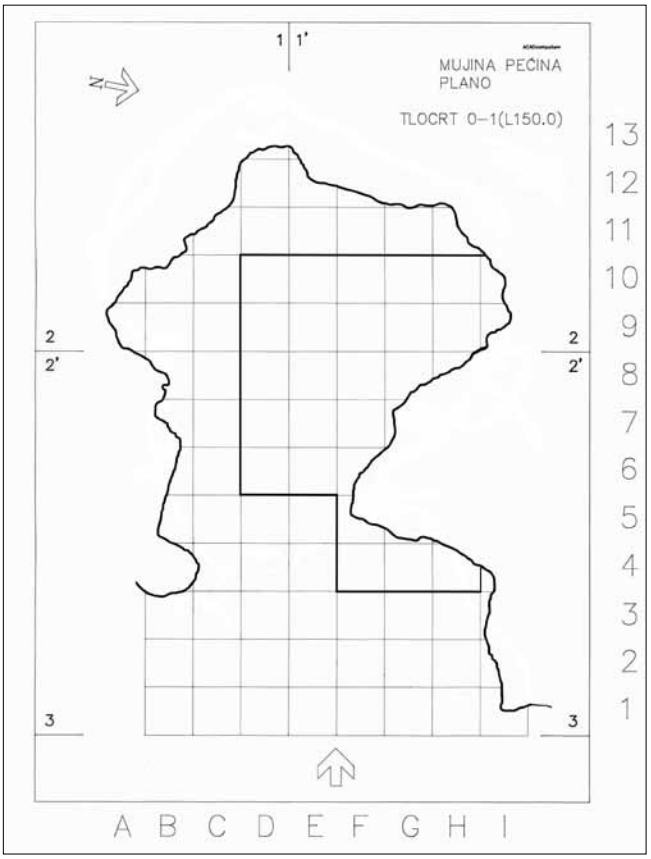
eventualno postojanje još neke kulture osim musterijenske. Već je iduće godine sonda znatno proširena po metar na sjever, zapad i jug te tri metra na istok, a istraživanja su se na ovoj iskopnoj površini nastavila sljedećih nekoliko godina. Godine 2000. započeto je iskopavanje desne niše, koja je u potpunosti istražena 2002. godine, a 2001. godine počelo se s iskopavanjem dijela predšpiljskog prostora uz stijenu pećine.

Tijekom devetogodišnjih terenskih istraživanja koristila se precizna metoda iskopavanja i bilježenja nalaza koja zadovoljava standarde suvremene arheološke znanosti. Također su uzeti uzorci za brojne analize, poput sedimentoloških, palinoloških (fosilni pelud), antrakotomskih (ugljen), kronometrijskog datiranja itd. Dio analiza, poput preliminarne sedimentološke analize, analize mikrofaune i avifaune te spacijalne analize gornjih slojeva, načinjen je u Zagrebu, dok su litička i petrografska analiza provedene u Zagrebu i Splitu. Kronometrijsko datiranje izvršeno je dvjema metodama u Nizozemskoj (Gröningen), Velikoj Britaniji (Oxford) i Kanadi (Hamilton), palinološke i antrakotomske analize načinjene su u Ljubljani, preliminarna sedimentološka analiza u Zagrebu, detaljna sedimentološka i preliminarna mikromorfološka analiza u Italiji (Sveučilište u Pisi), a faunistička analiza u Velikoj Britaniji (Cambridge) i Zagrebu (Rink et al. 2002; Miracle 2005; Karavanić et al. 2008a ; Karavanić et al. 2008b; Gerometta 2011; Mihelić, Karavanić, u tisku).

2.2. STRATIGRAFIJA I KRONOLOGIJA

Tijekom istraživanja Mujine pećine provedena je preliminarna sedimentološka analiza na uzorcima sedimenta slojeva B, C, D1 i granice slojeva E1 i E2 iz kvadranta F9. Milka Sarkotić (Rink et al. 2002: 944) definirala je sediment kao rastresit, a činili su ga uglasti i poluuglasti fragmenti kršja, zaobljene i poluzaobljene čestice pijeska, rijetko silt i nešto gline, dok su Rink i suradnici (2002: 944) ustanovili da svi stratigrafski profili upućuju na kratko razdoblje sedimentacije bez značajnijih prekida ili hijatusa u procesu taloženja. Preliminarna mikromorfološka analiza pokazala je da je sediment Mujine pećine većim dijelom nastao prirodnim putem, odnosno cikličkim smrzavanjem i odleđivanjem svoda (fragmenti vapnenca otpadali su sa svoda zbog njegova hlađenja i zagrijavanja), dok je ostatak bio prethodno nataložen izvan pećine, a zatim je putem koluvija (akumulacijama materijala koji je transportiran gravitacijom) dospio u njenu unutrašnjost (Gerometta 2011: 19). Prilikom analiziranja sedimenta Mujine pećine Katarina Gerometta (2011: 18, 19; usmeno priopćenje) uočila je prisutnost sekundarnih karbonata, osobito u sloju E, koji su nastali tijekom vlažnog razdoblja i sugeriraju prisustvo vode te se vezuju uz postdepozicijske procese.

Opis slojeva načinjen je prema sjevernom profilu A, gotovo u cijelosti otvorenim još tijekom prve sezone istraživanja 1995. godine, jer on sadrži sloj C, koji nije prisutan na kasnijem proširenom i u potpunosti otkopanom sjevernom profilu (Rink et al. 2002: 944) (sl. 4). Obilježja ostalih slojeva uglavnom su ista na cijelom prostoru obuhvaćenom iskopavanjima, osim varijacija u debljini slojeva. Jedina iznimka je sloj E3 koji se uglavnom javlja iznad poda pećine pri ulazu



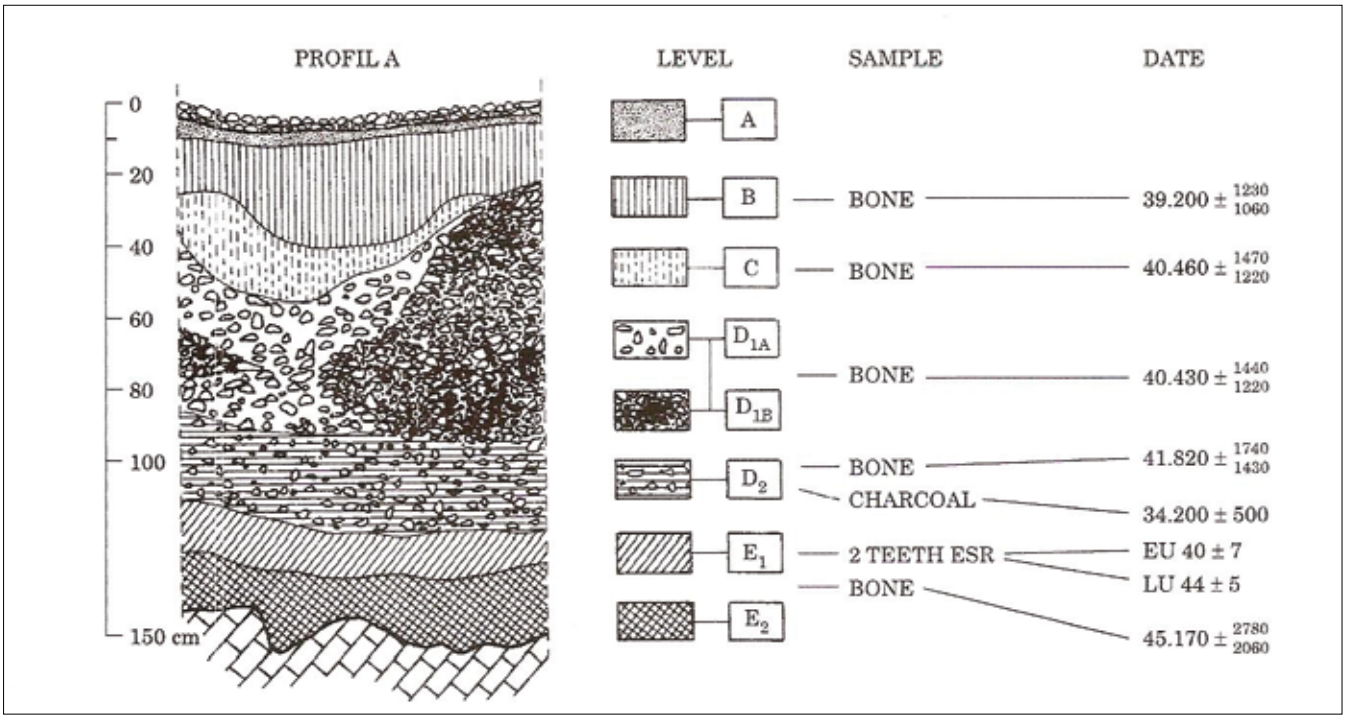
Sl. 3 Tlocrt Mujine pećine s ucrtanom iskopnom površinom (modificirano prema Karavanić, Bilich-Kamenjarin 1997)

Fig. 3 Plan of Mujina pećina indicating the excavation area (modified according to Karavanić, Bilich-Kamenjarin 1997)

2.2. STRATIGRAPHY AND CHRONOLOGY

Sediment samples from levels B, C, D1 and the E1/E2 interface were preliminarily analyzed during the excavation of Mujina pećina. Milka Sarkotić (Rink et al. 2002: 944) has defined the sediment as poorly sorted and composed of angular and subangular fragments of carbonate rock, rounded and subrounded sand grains, rarely silt, and some clay, while Rink et al. (2002: 944) have ascertained that the entire stratigraphic sequence suggests a short period of deposition with no significant hiatus attributable to erosion or nondeposition. The preliminary micromorphological analysis has shown that the sediment from Mujina pećina was formed mainly by cyclic frosting and defrosting of the cave ceiling (which made the fragments of carbonate rock fall off the ceiling due to its repetitive cooling and heating), whereas the rest of the sediment was first deposited outside the cave, and then transported to its interior by colluvium (accumulations of material transported by gravity) (Gerometta 2011: 19). While studying the sediment from Mujina pećina, Katarina Gerometta (2011: 18, 19; pers. comm.) noticed the presence of secondary carbonates, which especially occurred in E levels. They were formed during a wet period and suggest the presence of water on the site, but are also connected to postdepositional processes.

The description of the entire stratigraphic sequence is based on the northern profile A, which was almost entirely



Sl. 4 Sjeverni profil s pripadajućom datacijom nalaza iz pojednih slojeva (prema Rink et al. 2002, crtež: M. Perkić)
Fig. 4 Northern profile with the corresponding datation of finds from individual layers (according to Rink et al. 2002, drawing: M. Perkić)

i nije vidljiv u sjevernom profilu.

Slijedi pregled slojeva Mujine pećine (prema Karavanić, Bilich-Kamenjarin 1997: 196, 197; Rink et al. 2002: 944–946), uz detaljniji opis slojeva razine E3 (sl. 5).

Sloj E3 čini vrlo tamnosmeđi pjeskovito-glinovit sediment s povremenim kamenim kršjem koji ispunjava i brojne udubine u podu pećine. Međutim, na ulaznom dijelu pećine riječ je o kompleksu koji se sastoji od tri stratigrafske jedinice (E3C, E3B i E3A). Najveća debljina kompleksa E3 približno iznosi 50 cm, a ona se smanjuje podizanjem matične stijene prema unutrašnjosti pećine gdje potpuno nestaje.

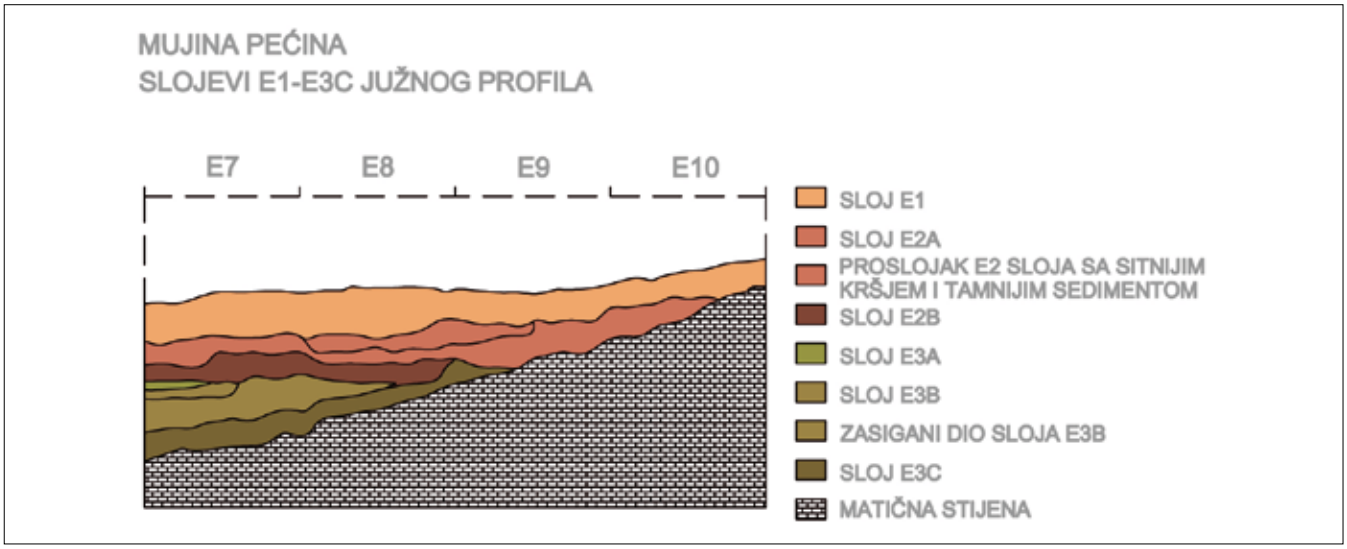
Također upućuje na veliku prisutnost organske materije.

Sloj E2 odnosi se na tamnocrvenkastosmeđi pjeskovito-glinovit sediment, debljine 12 do 18 centimetara, s kame-

exposed during the first season of systematic excavations in 1995. It was used because it contained level C, which is lacking in the latter fully excavated northern profile (Rink et al. 2002: 944) (Fig. 4). The features of other levels are mostly the same throughout the entire excavation area, except for the varying layer thicknesses. The only exception is level E3, which mostly appears above the cave floor at the entrance and cannot be seen in the northern profile.

Here is an overview of the stratigraphic sequence from Mujina pećina (according to Karavanić, Bilich-Kamenjarin 1997: 196, 197; Rink et al. 2002: 944–946), with a more detailed description of level E3 (Fig. 5):

Level E3 consists of a very dark brown sandy clay sediment with some stone debris, which fills a number of cracks in the floor of the cave. However, at the entrance of the ca-



Sl. 5 Južni profil na kojemu su prikazani slojevi E1, E2 i E3 (crtež: R. Nizek 2012 prema terenskom crtežu N. Vukosavljevića i I. Karavanića)
Fig. 5 Southern profile showing layers E1, E2 and E3 (drawing: R. Nizek 2012 according to the field drawing made by N. Vukosavljević and I. Karavanić)

nim kršjem. Upućuje na relativno toplo razdoblje i veliku prisutnost organske materije.

Sloj E1 karakterizira crvenkastosmeđi pjeskovito-glinovit sediment, debljine 8 do 12 centimetara, s puno kamenog kršja. Upućuje na relativno toplo razdoblje i prisutnost organske materije.

Sloj D2 sastoji se od krioklastičnog kamenog kršja sa žućkastocrvenim sedimentom debljine 25 do 28 centimetara. Kamenog kršja je više nego u E slojevima te upućuje na hladnu klimu.

Navedene se razine spacijalno obrađuju u članku (za opis ostalih razina vidi Karavanić, Bilich-Kamenjarin 1997; Rink et al. 2002).

Prilikom istraživanja Mujine pećine uzeti su uzorci za kronometrijsko datiranje. Ono je provedeno dvjema različitim metodama na materijalu organskog podrijetla kako bi se postigla što veća preciznost u određivanju starosti nalazišta. Korištene su radiokarbonska AMS (Accelerator Mass Spectrometry) i ESR (Electron Spin Resonance) metode, koje se, uz termolumuniscenciju i uran/torij metodu, najčešće i primjenjuju za uzorke srednjopaleolitičke starosti (Karavanić 2006a: 41).

Metodom ESR datirana su dva životinjska zuba iz sloja E1, a datiranje metodom AMS provedeno je na 5 uzoraka kolagena dobivenog iz pet uzoraka kostiju prikupljenih u slojevima B, C, D1, D2 i granici između slojeva E1 i E2 te na uzorku ugljena iz sloja D2 (Rink et al. 2002: 948). Za sloj E1 procijenjena je srednja vrijednost ESR starosti na 40±7000 godina prije sadašnjosti (EU) i 44±5000 prije sadašnjosti (LU), dok je radiokarbonsko (AMS) datiranje pokazalo da se ona može smjestiti na približno 45000 godina prije sadašnjosti za uzorak s granice slojeva E1 i E2 te na 39000 godina prije sadašnjosti za pet dobivenih rezultata iz mlađih slojeva (Rink et al. 2002: 949). Ovi rezultati jasno upućuju na činjenicu da je punjenje špilje sedimentom trajalo svega nekoliko tisuća godina i da se odvijalo upravo u vremenu od okvirno 45000 do 39000 tisuća godina prije sadašnjosti. Određivanjem starosti uzoraka iz Mujine pećine na ovaj način dobiveni su prvi rezultati kronometrijskoga datiranja za musterijensku kulturu na cijeloj istočnoj jadranskoj obali (Karavanić 2006a: 43). Na ulomku kosti iz Velike pećine u Kličevici dobivena je starost od 39240±740 prije sadašnjosti, što je jasno ukazalo na preklapanje s rezultatima dobivenim za gornje slojeve Mujine pećine (Karavanić et al. 2006b: 347).

3. Metodologija i faktori narušavanja izvorne rasprostranjenosti nalaza

3.1. METODOLOGIJA OBRADE PODATAKA

Prilikom istraživanja Mujine pećine iskopna površina je, kao što je već prije bilo spomenuto, bila podijeljenja mrežom na četvorne metre, od kojih je svaki bio označen slovom i brojkom (vidi sl. 3). Svaki četvorni metar zasebno je istraživan i dokumentiran. Svi nalazi veličine najmanje 2 centimetra ucrtavali su se na milimetarski papir te su se uzimale tri dimenzije njihova položaja (x, y, z), a ujedno su se svi podaci ručno upisivali u bilježnice jer se u to vrijeme totalna stanica još nije koristila za rad na arheološkim nalazištima. Nalazi su u terenskom laboratoriju prani, signirani i prikladve it forms a layer complex consisting of three stratigraphic units (E3C, E3B and E3A). Maximum layer thickness is approximately 50 centimeters, which decreases due to the bedrock uplift toward the cave interior, where it completely disappears. It also indicates the presence of a considerable amount of organic material.

Level E2 is composed of a dark reddish brown sandy clay sediment, 12–18 centimeters thick, with stone debris. It suggests relatively warm climate and exhibits a considerable amount of organic material.

Level E1 is characterized by a reddish brown thick sandy sediment, 8–12 centimeters thick, with a large amount of rock debris. This sediment suggests relatively warm climate and the presence of a considerable amount of organic material.

Level D2 is made up of cryoclastic stone debris with yellowish red sandy sediment, 25 to 28 centimeters thick. It contains more stone debris than level E1 and suggests cold climate.

All levels mentioned above are included in the spatial analysis in this paper (for the description of other levels see Karavanić, Bilich-Kamenjarin 1997; Rink et al. 2002).

Samples for chronometric dating were collected in the course of the excavations at Mujina pećina. The dating was conducted by two separate methods on the material of organic origin in order to achieve as high precision in determining absolute dates for the site as possible. The methods used were Accelerator Mass Spectrometry – based ^{14}C (AMS) and Electron Spin Resonance (ESR), which are, along with the termoluminiscence and the uranium/thorium method, the most common dating methods used for Middle Paleolithic samples (Karavanić 2006a: 41).

Two teeth from level E1 were dated by the ESR method, while AMS dates were obtained for the bone collagen taken from 5 samples from levels B, C, D1, D2 and the E1/E2 interface and one charcoal sample from level D2 (Rink et al. 2002: 948). The mean value of ESR age has been estimated for level E1 at 40±7000 ka (EU) and 44±5000 ka (LU) (Rink et al. 2002), while the radiocarbon (AMS) dating places the interface of levels E1 and E2 at approximately 45000 BP and the five samples from more recent levels at 39000 BP (Rink et al. 2002: 949). These results clearly indicate that the filling-up of the cave with the sediment lasted only several thousand years within the time frame from roughly 45000 BP to 39000 BP. These dates also represent the first results obtained by the chronometric dating for the Mousterian culture on the entire eastern Adriatic coast (Karavanić 2006a: 43). In addition, a fragment from an animal bone found in Velika pećina in Kličevica was dated at 39240±740 BP, which clearly overlaps with the dates obtained for the upper levels of Mujina pećina (Karavanić et al. 2006b: 347).

3. Methodology and disturbance factors of the original deposit of finds

3.1. DATA PROCESSING METHODOLOGY

As was mentioned before, the excavation area in Mujina pećina was divided by a metric grid into square meters, all of which were designated by a number and a letter (see Fig. 3). Every square meter was excavated and documented separately. All artifacts with dimensions of 2 centimeters or more in size were entered in three dimensions (x, y, z) on grid-paper site plans, while all data were also written down in notebooks since the total station was not in use

no pakirani. Nakon završetka terenskog rada pristupilo se unošenju podataka u računalo kako bi se mogla provesti litička i prostorna analiza nalaza svih slojeva pećine. U Microsoft Excelu izrađena je baza podataka u koju je uneseno sve zapisano u bilježnicama, a to su sljedeći elementi: x i y koordinate pozicije nalaza, dubine (z) na kojoj su iskopani, njihov opis (pr. sileks, kost, rog itd.) i pripadajući brojčani simbol, stratigrafska jedinica i četvorni metar kojima nalazi pripadaju, položaj u kojem su nađeni (vertikalni ili horizontalni) te redni broj nalaza. Uz to su dodana i imena arheologa koji su sudjelovali u istraživanjima, datum iskopavanja, broj lista na kojem je nalaz ucrtan i posebne napomene o pojedinim nalazima i slojevima. Nakon unosa i višestruke provjere uslijedio je sljedeći korak: korištenje baze u Excelu za izradu planova spacijalne distribucije nalaza u Surferu. Surfer je računalni program koji se koristi za izradu dvodimenzionalnih i trodimenzionalnih karata i planova prostora, a temelji se na unosu x, y, z koordinata u prostornu mrežu. Unosom podataka iz Mujine pećine u Surfer omogućeno je dobivanje cjelovitije slike rasprostranjenosti nalaza, što ranije nije bilo moguće. Dobiveni su horizontalni planovi distribucije nalaza svakog sloja zasebno, kao i prikazi vertikalnog presjeka uzdužnih kvadranata označenih slovima i poprečnih kvadranata označenih brojkama (vidi sl. 3). U horizontalne i vertikalne prikaze uključeni su svi slojevi osim sloja A, koji, kako je već napomenuto, nije arheološki zanimljiv zbog miješanja arheoloških i recentnih nalaza te sloja C, u kojemu je pronađeno iznimno malo nalaza pa taj sloj nije relevantan za spacijalnu analizu. Također su izrađeni odvojeni prikazi za litičke artefakte i faunističke ostatke svih slojeva, što je na većini planova bilo nužno, jer je nalaza uistinu mnogo pa slika distribucije postaje nejasna za tumačenje kada su nalazi iz obje skupine prikazani zajedno. Na planovima slojeva B, D1 i D2, koji su siromašniji arheološkim materijalom, kosti i sileksi su ipak prikazani zajedno kako bi se dobio uvid u njihov međusobni odnos.

Posljednji korak u izradi prikaza horizontalnog i vertikalnog rasporeda nalaza bilo je njihovo dopunjavanje relevantnim podacima, poput legende te ucrtavanja stijena i devastacija. Ovaj postupak je važan jer je time definiran odnos nalaza i bočne/matične stijene te je, također, jasno označena devastacija i veći komadi kamenja, što objašnjava "rupe" u nalazima na pojedinim mjestima. U ovoj fazi korišten je AutoCad pomoću kojeg je ucrtana mreža s pripadajućim slovima i brojkama na već postojeći raspored nalaza u sondi. Devastacija i bočna/matična stijena ucrtavane su prema njihovim crtežima na milimetarskom papiru kako bi prikaz same pećine bio što vjerodostojniji, a označen je i još neiskopani dio. Time su dobiveni potpuni prikazi horizontalne i vertikalne distribucije nalaza na temelju kojih je moguće provesti prostornu analizu Mujine pećine.

3.2. MOGUĆI FAKTORI NARUŠAVANJA IZVORNE RASPROSTRANJENOSTI NALAZA

Kao jedan od problema prilikom analize paleolitičkog nalazišta nameće se činjenica da je poprilično teško točno odrediti kada je neki nalaz deponiran u određeni sloj i koliko je vremena prošlo do polaganja artefakta u sloj ispod

on archeological sites at the time. The artifacts were washed, labeled and packed appropriately. When the field work ended, the data obtained during the excavation were entered into a computer, so that all finds from every level at the site could be included in both lithic and spatial analysis. Microsoft Excel was used here to make a database consisting of the following elements: x and y coordinates of the artifact location, depth (z) at which they were discovered, their description/class (silex, bone, antler etc.) and corresponding numerical symbol, stratigraphic unit and square meter where they were found, their position (vertical or horizontal) and artifact number. The names of archeologists who participated in the excavations, dates when the excavation took place, site plan numbers and special comments about particular finds and levels were also added. When the database was created and reviewed several times, the next step followed. It consisted of using the database to make projections of spatial distribution of finds in Surfer. Surfer is a computer program which is used to make two-dimensional and three-dimensional surface and landscape maps and plans, and is based on placing x, y, z coordinates into a space grid. Horizontal projections of artifact distribution were made separately for every stratigraphic unit, including projections of vertical cross sections for both longitudinal (designated by letters) and lateral (designated by numbers) sq meter segments (see Fig. 3). In this way the projections of spatial distribution of finds from Mujina pećina may provide a better understanding of the site and the processes that occurred here. Both horizontal and vertical projections include all levels. The exceptions are level A, which is not archeologically relevant due to the mixing of archeological and recent material, and level C, where only a small amount of artifacts was found. Also, it was necessary to create separate projections for lithic artifacts and faunal remains from every stratum because the great abundance of finds makes it difficult to interpret their distribution where the material is clustered together. Still, in projections for levels B, D1 and D2, which are not as prolific with archeological material as the lower levels, bones and silexes are shown together to get a better understanding of their interrelation. The final step in creating projections of horizontal and vertical distribution of finds was adding relevant data such as legends and plotting the cave wall/bedrock and the devastation. This procedure is important because it defines the effect the bedrock had on the final deposition of artifacts. The devastation and bigger rocks were also plotted to explain "gaps" in the material distribution occurring in some areas of the cave. AutoCAD was used here to plot the metric grid with concomitant letters and numbers on the already existing projections of artifact arrangement in Surfer. The wall/bedrock and the devastation were plotted according to the site plans on grid paper, so that the cave features can be as realistically presented as possible. The unexcavated area of the cave was also designated. A complete representation of both horizontal and vertical distribution of finds was obtained in this way, which makes a good basis for the conduct of the spatial analysis of Mujina pećina.

3.2. POTENTIAL DISTURBANCE FACTORS OF THE ORIGINAL DEPOSIT OF FINDS

One of the issues that occur when a Paleolithic site is analyzed is that it is very difficult to determine when a particular artifact is deposited in a particular stratum and how

ili iznad. Ta razlika se često iskazuje u tisućama godina, što u okviru jednog ljudskog života i nije odviše precizna datacija. Nadalje, sami slojevi često nisu zatvorene cjeline, nego propuštaju arheološke ostatke u niže slojeve, što je zabilježeno na nizu nalazišta diljem Europe (Villa, Courtin 1983: 270). Prilikom iskopavanja pećine Fontbregoua u južnoj Francuskoj, gdje su ustanovljeni kulturni slojevi s materijalom iz gornjeg paleolitika, mezolitika, neolitika, bakrenog i brončanog doba te kasnijih razdoblja, Paola Villa i Jean Courtin (1983: 271, 272) naveli su nekoliko faktora koji bi mogli utjecati na vertikalna i horizontalna pomicanja nalaza, a to su:

Aktivnosti životinja na nalazištu. U pećini Fontbregoua uočeno je više rupa koje su iskopale životinje u različitim slojevima. Takve promjene jasno se razlikuju od okolnih neporemećenih slojeva pa se jednostavno može utvrditi njihova prisutnost na lokalitetu. U Mujinoj pećini uočene su na nekoliko mjesta plitke jame na površini i jedna u sloju B za koje se ne može pouzdano reći jesu li nastale ljudskim ili životinjskim djelovanjem.

Korijenje drveća. S obzirom da je u Fontbregoui svod pećine bio urušen, u njoj je raslo nekoliko hrastova i trešnja, čije korijenje je pronađeno čak 4 metra ispod površine. Početkom sustavnih istraživanja Mujine pećine s ulaznog prostora odstranjeno je manje grmoliko stablo, manje korijenje rijetko se pojavljivalo tijekom iskopavanja, a većeg raslinja u samoj špilji, osim navedenog, nije bilo.

Izmjenično vlaženje i sušenje zemlje. Ako je nalazište bilo direktnije otvoreno suncu i kiši, kao što je slučaj s Fontbregouom, moglo je doći do vertikalnog pomicanja artefakata, osobito ako su sedimenti rastresiti zbog biogenih procesa. Mujina pećina propusna je samo na nekim mjestima, a sam predšpiljski prostor i ulaz izloženi su atmosferilijama. Međutim, sedimenti su uglavnom kompaktni ili obiluju kamenim kršjem, što nije pogodovalo vertikalnom pomicanju nalaza. Ovdje valja napomenuti da procesi poput soliflukcije i krioturbacija nisu ustanovljeni.

Aktivnosti prapovijesnih populacija na nalazištu. Različite strukture, poput jama ili ognjišta, koje su nastale kao rezultat ljudske djelatnosti na nalazištu, dokazano mogu narušiti stratigrafiju i uzrokovati pomicanje nalaza. Ognjišta i, osobito, jame najčešće prelaze u starije slojeve i uzrokuju redistribuciju arheološkog materijala u gornjim stratigrafskim jedinicama. Uobičajene aktivnosti i boravak ljudi i životinja u pećini također su mogli uzrokovati promjene u distribuciji artefakata na nalazištu. Velika je vjerojatnost da je uzrok vertikalne raspršenosti artefakata u Fontbregoui upravo *trampling*, kako uobičajene aktivnosti prapovijesnih zajednica na lokalitetu nazivaju Villa i Courtin (1983: 267). Postojanje jama koje su, nedvojbeno, iskopali paleolitički lovci u Mujinoj pećini nije utvrđeno. Ipak, ustanovljena je prisutnost, vjerojatno, recentnije rupe u sloju B (kvadrant G10) te devastacije nepoznatog počinitelja, koja je obuhvatila slojeve B i D1 u kvadrantima H9 i H10, do kojih je došlo između dvije sezone sustavnih iskopavanja. Treba spomenuti i probnu sondu iz sedamdesetih godina 20. stoljeća koja uključuje slojeve B i D1, a nalazi se na području kvadranata C9, C10, D8, D9, D10, E8 i E9 te još nekoliko manjih rupa

much time has passed since the material from the lower or upper levels were deposited too. This time difference is often expressed in thousands of years, which is not a very precise dating when compared to one human lifetime. In addition, layers are often not closed containers, but they permeate archeological material into lower levels, which has been reported for a series of sites throughout Europe (Villa, Courtin 1983: 270). While excavating the Fontbregoua Cave in southern France, which has yielded a cultural sequence with the material from the Upper Paleolithic, Mesolithic, Neolithic, Chalcolithic, Bronze Age and historic periods, Paola Villa and Jean Courtin (1983: 271, 272) mentioned several factors that could explain the horizontal and vertical displacement of finds at an archeological site, and these are:

Animal activity. Multiple animal burrows in different stratigraphic units were observed in the Fontbregoua Cave. Such disturbed areas are easily distinguished from the surrounding intact layers, which makes them easily noticeable at a site. Shallow burrows were present at the surface of Mujina pećina, as well as one hole in level B, but it cannot be determined with certainty whether animals or humans are responsible for their existence.

Tree roots. Since the cave ceiling had collapsed at Fontbregoua, several oaks and a cherry tree were growing in the cave. Their roots were found 4 meters below site's surface. When the systematic excavation at Mujina pećina began, a small shrubby tree was removed from the cave entrance. Also, small roots were rarely found during the excavation, and no other vegetation was present in cave's interior.

Alternate wetting and drying of the soil. If a site is directly exposed to sun and rain, as is the case with Fontbregoua, the vertical movement of artifacts could occur if sediments are unconsolidated due to biogenic activities. Mujina pećina is permeable only in some places, while the entrance and the area in front of the cave are exposed to all weather conditions. However, sediments are mostly compact or filled with stone debris, which does not go in favor of the vertical displacement of finds. It is also important to mention that processes like solifluction and cryoturbation were not observed at the site.

Activities of Paleolithic and modern populations. Different structures, like pits or hearths, which are the result of various human activities, may disturb the stratigraphic sequence of a site and cause rearrangement of archeological material. Hearths and especially pits often disturb lower levels and cause a redistribution of archeological material in the upper units. Daily life activities and hominin or animal occupation of a site may also cause disturbances in the artifact distribution at a site. Trampling, defined by Villa and Courtin (1983: 267) as a normal activity of prehistoric inhabitants at a site, is the most probable cause of the vertical dispersal of artifacts in Fontbregoua. However, no pits dug out by Paleolithic hunters were observed in Mujina pećina. Still, a probably more recent hole was discovered in level B (square G10), as well as the devastation of levels B and D1 in squares H9 and H10, which occurred between two seasons of the systematic excavation of the site and was caused by an unknown perpetrator. Several smaller holes that were discovered when the systematic excavation began and the test excavation area from the seventies, which included levels B and D1 in squares C9, C10, D8, D9, D10, E8 and E9, should also be mentioned here. In the course of the excavations

na koje se naišlo početkom sustavnih istraživanja. Tijekom iskopavanja definirana su dva vatrišta u sloju D2, koja, međutim, ne prelaze u sljedeći sloj, o čemu će više riječi biti kasnije. Villa i Courtin (1983: 275) također ističu da na horizontalni i vertikalni pomak nalaza mogu utjecati intenzitet *tramplinga*, vrsta i debljina podloge te težina i veličina samog arheološkog materijala. Recentni ostaci potvrđuju da je Mujina pećina posjećivana u suvremeno doba i, uzme li se gore navedena pretpostavka u obzir, može se reći da je boravak ljudi u pećini, donekle, mogao utjecati na vertikalnu rasprostanjenost arheološkog materijala u sloju B (u njegovom najvišem dijelu), a do hodanja po nekadašnjim stanišnim razinama dolazilo je pri svakom zaposijedanju lokaliteta, bez obzira je li se radilo o ljudima ili životinjama.

Navedeni faktori ne smiju se zanemariti pri interpretaciji rezultata prostorne analize koja može pokazati jačinu njihova udjela u procesima formiranja nalazišta te utjecaja na položaj i stanje samih nalaza. Analizirajući različite razine istoga nalazišta, moguće je prepoznati eventualnu horizontalnu i vertikalnu poremećenost, razlikovati poremećenu situaciju od izvornog stanja i odrediti uzrok poremećenosti.

4. Rezultati prostorne analize

4.1. HORIZONTALNA DISTRIBUCIJA NALAZA

Horizontalna rasprostranjenost nalaza za sloj D2 prikazana je na slici 6. Najveća koncentracija faunističkog materijala ustanovljena je na području niše. Podjednaka učestalost kostiju prisutna je u kvadrantima G8, G9, G10, H8, H9, H10, nešto veća u I9, a smanjuje se prema južnom kraju pećine. Poprilična količina koštanog materijala nalazi se u predšpiljskom prostoru (osobito kvadrantima G4, G5 i H4). Kameni nalazi nisu tako brojni i ravnomjernije su raspoređeni. Nešto veća koncentracija uočena je na prostoru niše (kvadrant H9) te na južnom kraju iskopne površine (kvadrant D9). U ovom sloju dokumentirana su i dva vatrišta (kvadranti E9, E10, G9 i G10). Zanimljivo je da je prostor između vatrišta gotovo prazan, kao i područje istočno od desnog vatrišta (rubni dijelovi kvadranata G8, G9, H8 i H9). Tako je uočljivo da se najveća koncentracija arheoloških ostataka nalazi na području niše nedaleko od desnog vatrišta, a manja koncentracija kostiju i litike smještena je nedaleko od lijevog vatrišta (vidljivo u rubnim kvadrantima južnog kraja sonde). Prema Mellarsovoj (1996) podjeli ognjišta iz srednjeg paleolitika, vatrišta iz Mujine pećine pripadaju u skupinu otvorenih vatrišta bez ikakve otprije smišljene konstrukcije. Iskopavanjima nije utvrđeno da ona prelaze u sljedeći sloj, što i ne čudi jer su ona vjerojatno korištena kraći vremenski period, o čemu svjedoči i slabija prisutnost arheološkog materijala u sloju D2.

Obilniji arheološki materijal u odnosu na prethodne slojeve karakterističan je za sloj E1. Kao što je prikazano na slikama 7 i 8, kamene rukotvorine i faunistički ostaci najobilnije su zastupljeni u onim dijelovima pećine u kojima je dosad njihova prisutnost bila najmanja. Najveća koncentracija kostiju, koje su brojnije od sileksa, je u južnom dijelu pećine, točnije, prostoru nasuprot niše. Iznimna koncentracija ove vrste nalaza vidljiva je u kvadrantima E odsječka (E6, E7, E8, E9 i E10), osobito kvadrantu E9. Brojnost nalaza smanjuje

two hearths, which will be discussed later in the paper, were discovered in level D2, but their traces were not found in the next stratigraphic unit. Villa and Courtin (1983: 275) also point out that the degree of horizontal and vertical displacement may depend on the intensity of trampling, the degree of compaction and thickness of the deposits, as well as the weight and size of artifacts. Contemporary finds discovered at the site confirm that Mujina pećina had visitors in modern times, and if the afore mentioned assumption about trampling is taken into consideration, it may be concluded that hominin occupation of the cave could have an influence on the vertical distribution of archeological material in level B (in its highest part) to some degree, while walking in all stratigraphic units occurred every time the site was occupied, no matter if the occupants were hominins or animals.

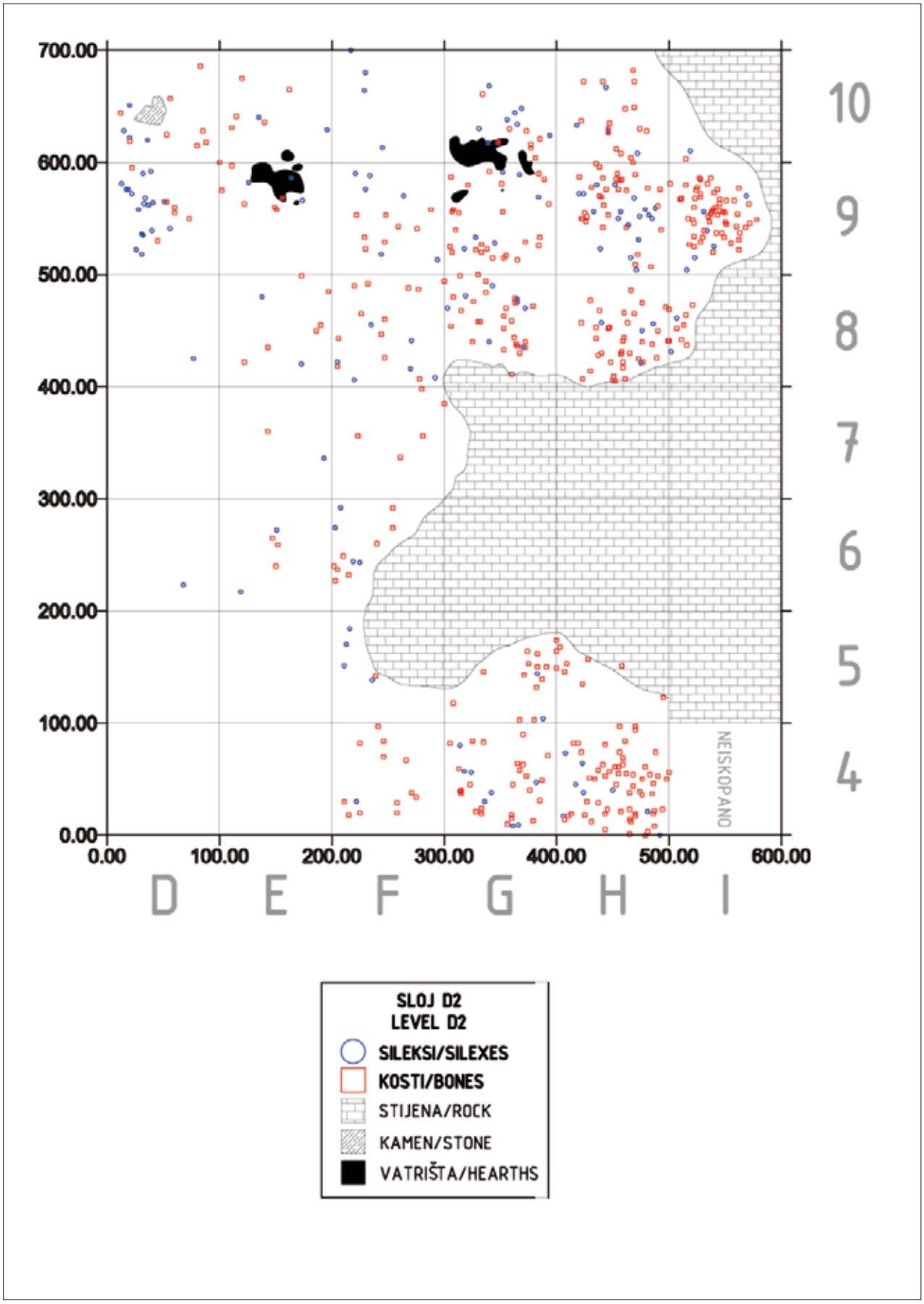
The above mentioned factors should not be ignored when interpreting spatial analysis results because they are significant in determining site formation processes and estimating their influence on both the position and condition of artifacts. A comparision of different levels from the same site may lead to recognizing a possible horizontal and vertical artifact rearrangement, defining a disturbed situation from the intact areas and determining the cause of disturbances.

4. Spatial analysis results

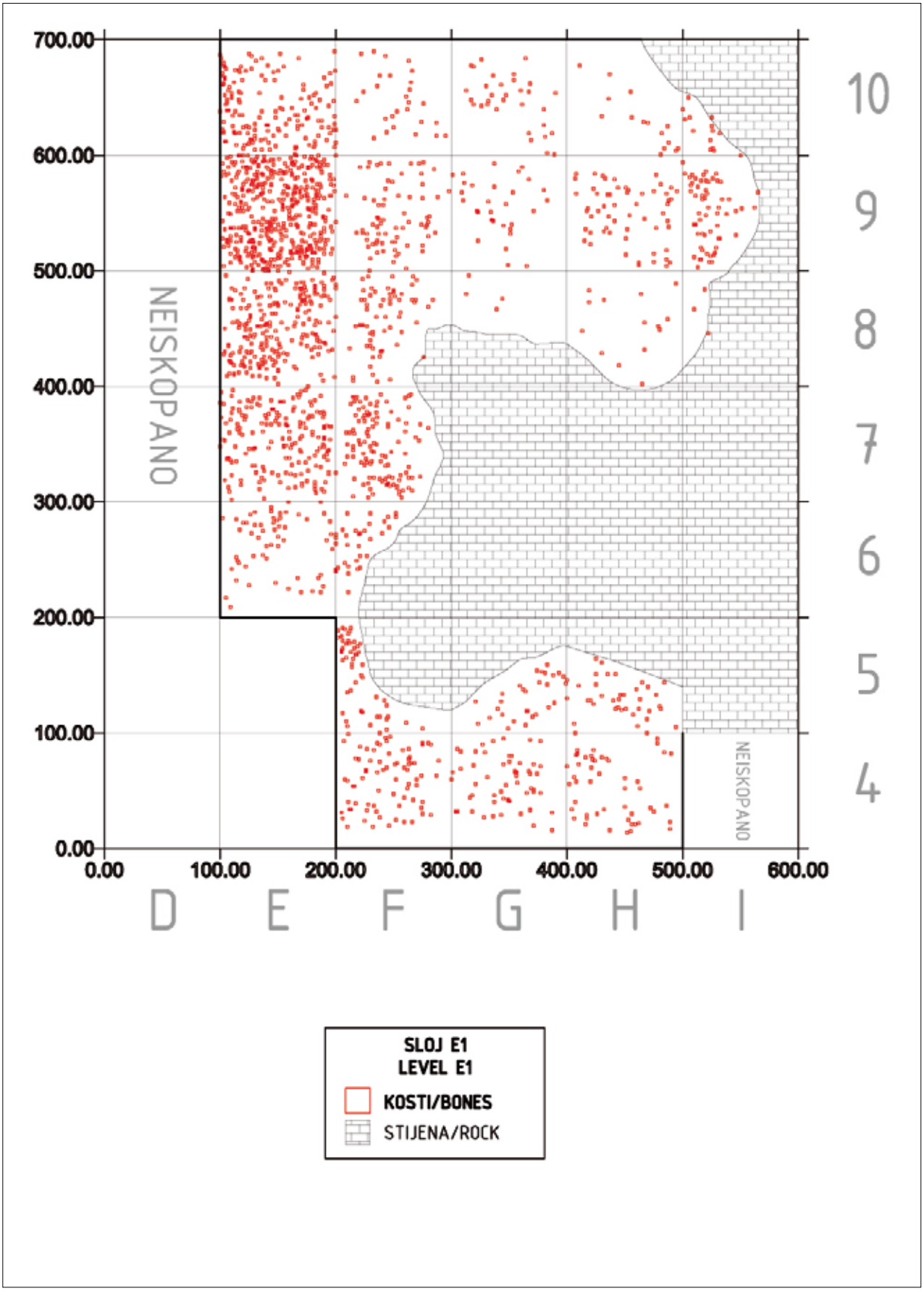
4.1. HORIZONTAL DISTRIBUTION OF FINDS

Horizontal distribution of finds in level D2 is shown on Figure 6. The highest concentration of faunal remains is observed in the niche. An even bone frequency is noticed in squares G8, G9, G10, H8, H9 and H10, while it increases in I9 and decreases toward the southern end of the cave. A substantial amount of bone material is located in the area in front of the cave (especially in squares G4, G5 and H4). Stone artifacts are not as numerous as faunal remains and are more evenly distributed. A somewhat larger concentration of these finds was discovered in the niche (square H9) and at the south end of the excavation area (square D9). Two hearths were also documented in this level (squares E9, E10, G9 and G10). It is interesting that the space between the hearths, as well as the area east of the right hearth (marginal areas in squares G8, G9, H8 and H9), are almost entirely devoid of archeological finds. The biggest concentration of archeological material is located close to the right hearth in the niche, whereas a smaller amount of bones and lithics is positioned closer to the left hearth (noticeable in marginal squares at the southern end of the excavation area). According to the classification of Middle Paleolithic hearths made by Mellars (1996), the hearths from Mujina pećina represent open, unconstructed and unpaved areas of burning. The research has shown that the hearths did not permeate into the next stratigraphic unit, which is not surprising since they were probably short-lived. This is also confirmed by a lower frequency of archeological material in level D2.

A greater abundance of archeological material is a distinctive feature of level E1 when compared to the upper layers. As Figures 7 and 8 show, stone handicrafts and faunal remains are mostly situated in those areas of the cave where the artifact frequency was the lowest in the upper levels. Bones, which are more numerous than silexes, are mostly concentrated in the southern area of the cave, or to be more exact, in the area opposite the niche. The largest concentration of these finds is located in the square me-



Sl. 6 Prikaz horizontalne distribucije nalaza u sloju D2 (crtež: R. Nizek, 2011.)
Fig. 6 Horizontal distribution of finds in layer D2 (drawing: R. Nizek, 2011)



Sl. 7 Prikaz horizontalne distribucije kostiju u sloju E1 (crtež: R. Nizek, 2011.)
Fig. 7 Horizontal distribution of bones in layer E1 (drawing: R. Nizek, 2011)

se i najrjeđa je prema i na prostoru niše, a manja koncentracija kostiju uočena je u njenom najsjevernijem dijelu blizu bočne stijene (kvadrant I9). Predšpiljski prostor obiluje ostacima koji su podjednako raspoređeni na čitavom istraženom području. Manja koncentracija faune vidljiva je u kvadrantu F5 uz stijenu na samom ulazu u pećinu, a s njom se podudara i jednako velika koncentracija kamenih nalaza. Litički artefakti pokazuju istu rasprostranjenost kao i koštani ostaci. Litika je na prostoru niše rijetka i ravnomjerno zastupljena, a njena učestalost povećava se prema jugu. Najviše kamenih rukotvorina ima u odsječku E i F (kvadranti E7, E8, E9, E10, F7, F8, F9), osobito u njihovom središnjem dijelu. Slabija učestalost vidljiva je i u predšpiljskom prostoru, osim kvadranta F4 u kojemu se može prepoznati manja skupina litičkih artefakata.

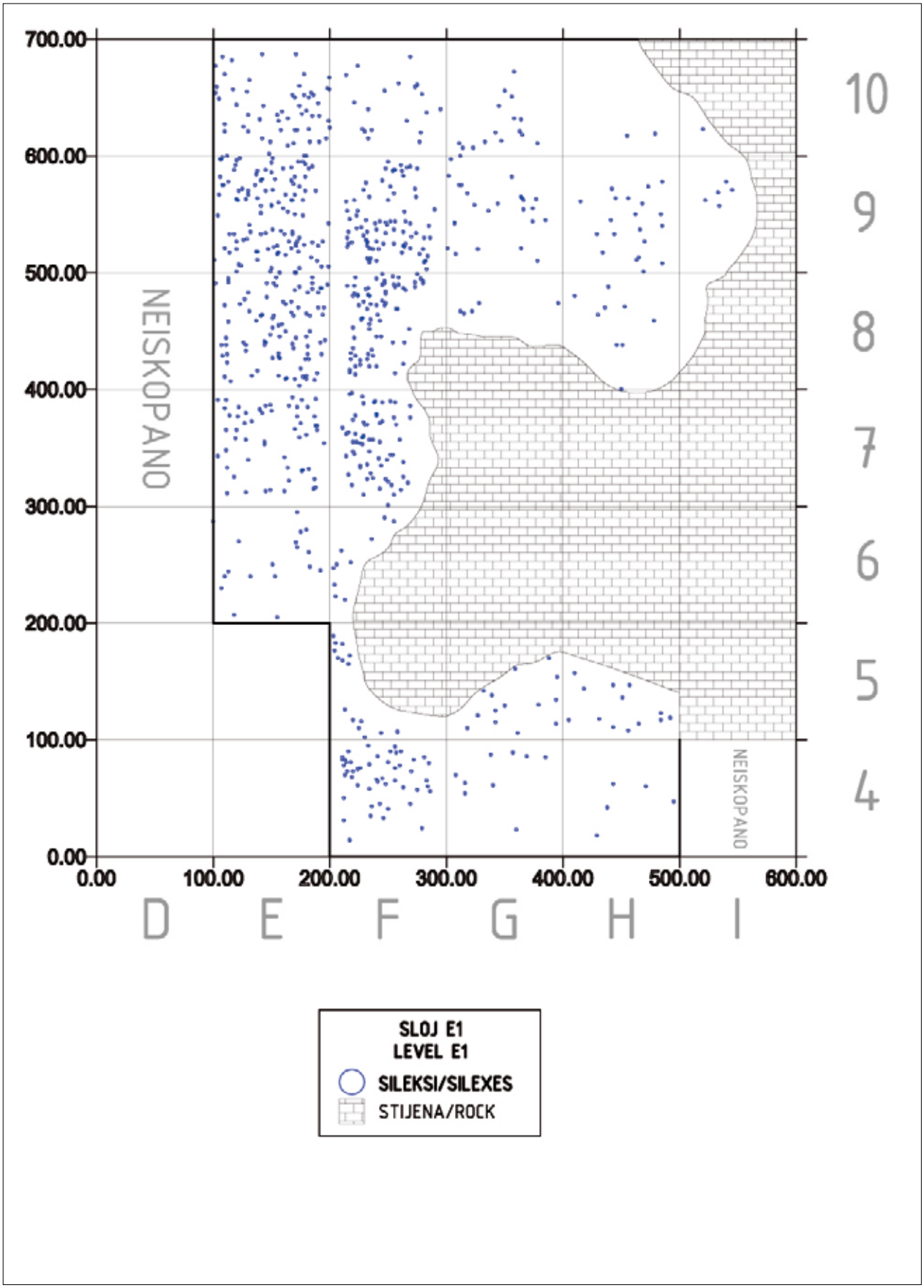
Iako sloj E2 pokazuje sličnost sa slojem E1 u količini arheološkog materijala, njegova distribucija više nalikuje onoj iz gornjih slojeva (Mihelić, Karavanić, u tisku). Slike 9 i 10 pokazuju iznimno veliku učestalost nalaza na području niše, ali novost su grupacije kostiju i sileksa na ulazu u samu pećinu i u predšpiljskom prostoru. Koštani nalazi su i ovaj put brojniji od kamenih. Cijelo područje niše obiluje kostima (kvadranti G8, G9, G10, H8, H9, H10, I9 i I10), osobito u H odsječku. Gustoća faunističkih ostataka se smanjuje prema južnom dijelu pećine, ali treba napomenuti da to nipošto ne znači da je ova vrsta nalaza ovdje rijetka. Kosti su na tome prostoru i dalje poprilično brojne, a jedino je u kvadrantu F9 vidljiva njihova veća odsutnost. Razlog tomu nisu aktivnosti neandertalskih populacija, nego izdignut teren koji je onemogućio taloženje nalaza na tome mjestu. Gustoća nalaza se opet povećava prema istočnom dijelu pećine, dakle, prema njenom ulazu, gdje je najveća koncentracija jasno vidljiva uz samu stijenu (kvadranti E6, E7, F6 i F7). Velika brojnost i podjednaka zastupljenost koštanih nalaza može se uočiti i na cijelom predšpiljskom prostoru. Isti uzorak rasprostiranja nalaza može se pripisati kamenim artefaktima. Na području cijele niše oni su ravnomjerno raspoređeni, uz nešto gušće koncentracije u kvadrantima G9 i H8. Najveća brojnost sileksa vidljiva je na ulazu u pećinu (kvadranti E6 i F6), a njihov ravnomjerni raspored karakterističan je za predšpiljski prostor.

Sloj E3, najniži i najstariji sloj u Mujinoj pećini, prisutan je samo na ulazu pećine i u pojedinim kvadrantima bio je podijeljen u tri zasebna sloja: E3A, E3B i E3C. Ipak, svaki od ovih slojeva nije mogao biti ustanovljen u svim kvadrantima u kojima je E3 prisutan pa su njihovi podaci korišteni zajedno za izradu prikaza horizontalne distribucije nalaza. Kao što je prikazano na slikama 11 i 12, arheološki materijal prisutan je u kvadrantima E6, E7, E8, F4, F5, F6, F9, G4 i H4. Najveća koncentracija koštanih nalaza prisutna je na samom ulazu u pećinu (kvadrant E6), osobito uz bočnu stijenu (kvadrant F5), te na rubovima predšpiljskoga prostora (kvadranti F4 i H4), a smanjuje se prema unutrašnjosti pećine. Nekoliko nalaza ovoga sloja otkriveno je na njenoj sredini u manjim udubljenima matične stijene. Kamene rukotvorine opet su distribuirane na isti način kao i kosti. Najučestalije su na ulazu u pećinu (kvadranti E6, E7, F5 i F6), uz pojačano grupiranje uz sam rub stijene (kvadranti F5 i F6). Velika količina

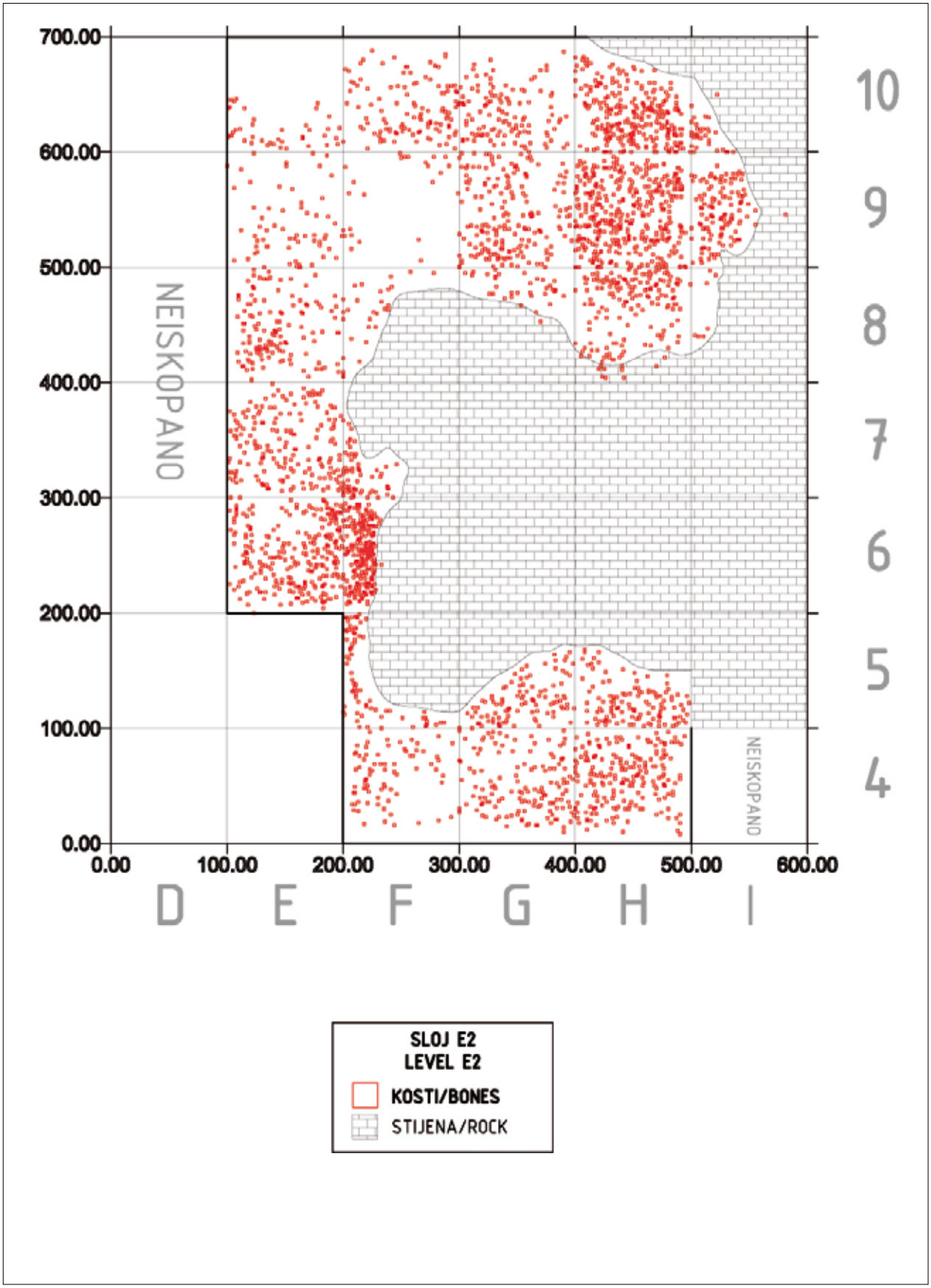
ter segment E (E6, E7, E8, E9 and E10), especially in square E9. Their frequency decreases toward the niche and is the smallest in that particular area, while a smaller concentration of bones is observed in its northernmost part close to the wall (square I9). The area in front of the cave abounds with faunal remains, which are evenly distributed throughout the excavated area. A smaller faunal concentration is also noticeable close to the wall in square F5 at the mouth of the cave, with an equally large concentration of stone artifacts in the same place. Lithic material follows the distribution of faunal remains. The lowest frequency of stone finds is present in the niche, where they are evenly distributed, while their number increases toward the south. The largest amount of stone handicrafts is located in square meter segments E and F (squares E7, E8, E9, E10, F7, F8, F9), especially in their central area. A lower frequency of these finds is also observed in the area in front of the cave, with the exception of square F4, where a smaller group of lithic artifacts is noticed.

Even though level E2, like level E1, abounds with archeological material, artifacts are following the same dispersal patterns as the material from the upper levels (Mihelić, Karavanić, in press). Figures 9 and 10 show a very high frequency of finds in the niche, but for the first time larger clusters of bone and lithic artifacts are also located at the mouth of the cave and in the area in front of Mujina pećina. Faunal remains are also more numerous than stone artifacts in this stratum. The entire niche is filled with bones (squares G8, G9, G10, H8, H9, H10, I9 and I10), especially the square segment H. The frequency of faunal remains is decreasing toward the south of the cave, but it is important to mention that a considerable amount of bones is still located in this area. Only square F9 shows a significant absence of such finds. Such artifact arrangement was not caused by the activities of Paleolithic populations, but by the uplifted bedrock, which prevented the deposition of finds in this area. The frequency of finds increases toward the entrance of the cave, where the largest concentration is located close to the wall (squares E6, E7, F6 and F7). A great concentration and an even distribution of bone artifacts are also observed in the area in front of the cave. Stone handicrafts are following the dispersal pattern of faunal remains. They are evenly distributed throughout the entire area of the niche, with the smaller clusters of finds in squares G9 and H8. The highest number of silexes is located at the mouth of the cave (squares E6 and F6), while their even dispersal pattern is distinctive in the area in front of the cave.

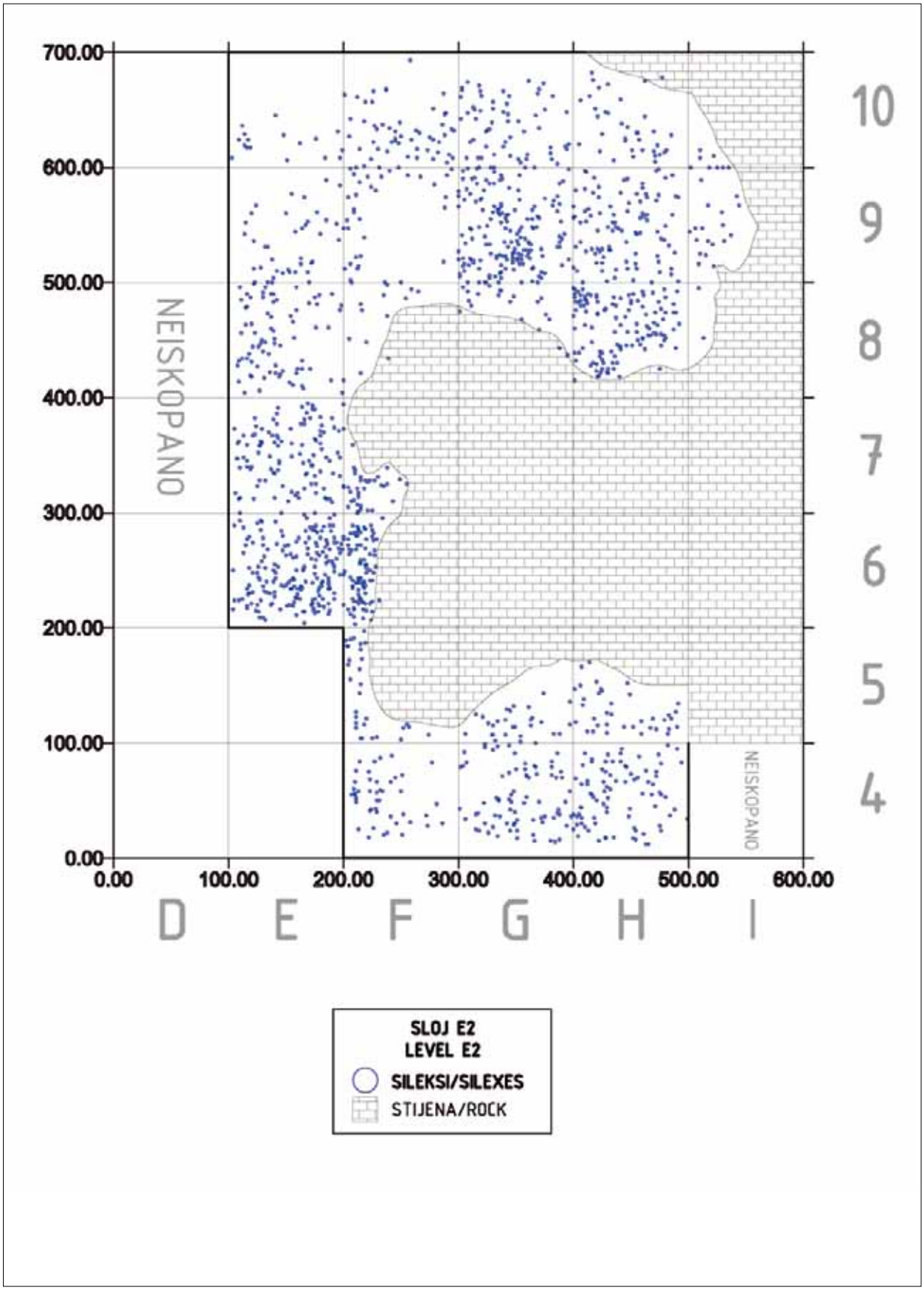
Level E3, the lowest and the oldest stratum in Mujina pećina, appears only above the cave floor at the entrance and forms a layer complex consisting of three separate units: E3A, E3B and E3C. Still, these units were not observed in all square meters where level E3 was discovered, so the data about the artifact positioning within these units were used together to create projections of horizontal distribution of finds. As Figures 11 and 12 show, archeological material is deposited in squares E6, E7, E8, F4, F5, F6, F9, G4 and H4. The largest concentration of faunal remains is located at the mouth of the cave (square E6), especially next to the wall (square F5) and on the very edges of the excavation area in front of the cave. The artifact frequency decreases toward its interior, where only several finds were discovered in bedrock cracks. Stone handicrafts have the same dispersal pattern as bones. They are mostly concentrated at the cave



Sl. 8 Prikaz horizontalne distribucije sileksa u sloju E1 (crtež: R. Nizek, 2011.)
Fig. 8 Horizontal distribution of silexes in layer E1 (drawing: R. Nizek, 2011)



Sl. 9 Prikaz horizontalne distribucije kostiju u sloju E2 (crtež: R. Nizek, 2011.)
Fig. 9 Horizontal distribution of bones in layer E2 (drawing: R. Nizek, 2011)



Sl. 10 Prikaz horizontalne distribucije sileksa u sloju E2 (crtež: R. Nizek, 2011.)
Fig. 10 Horizontal distribution of silexes in layer E2 (drawing: R. Nizek, 2011)

kamenih nalaza otkrivena je i u predšpiljskom prostoru, gdje se ističu koncentracije ovog tipa nalaza uz sam rub tog područja (kvadranti F4 i H4). Prisutnost arheološkog materijala se, očekivano, smanjuje prema unutrašnjosti pećine, ali se na temelju njegove brojnosti uz sam rub E odsječka može očekivati da bi se znatna koncentracija litičkih artefakata i faunističkih ostataka mogla očekivati na neistraženom dijelu Mujine pećine.

4.2. VERTIKALNA DISTRIBUCIJA NALAZA

Horizontalni prikaz rasprostranjenosti nalaza dopunjen je vertikalnim, koji može značajno doprinijeti daljnjem shvaćanju odnosa nalaza i uvjeta koji su mogli utjecati na njihovu distribuciju. Napravljeni su prikazi poprečnih i uzdužnih odsječaka s nalazima svih slojeva iz Mujine pećine. Svaki odsječak označavan je slovom ili brojkom na temelju mreže kvadranata koja je postavljena na samom početku iskopavanja. Svaki uzdužni odsječak uključuje kvadrante koji nose oznaku određenog slova. Primjerice, odsječak D odnosi se na kvadrante D6, D7, D8, D9 i D10, dok odsječak F na kvadrante F4, F5, F6, F7, F8, F9 i F10 itd. Svaki poprečni odsječak sastoji se od kvadranata koji u sebi sadrže određenu brojku. Primjerice, odsječak 4 čine kvadranti F4, G4 i H4, dok odsječak 8 obuhvaća kvadrante D8, E8, F8, G8, H8 i I8 itd. Prvotno je napravljeno ukupno 12 prikaza za 6 uzdužnih te 14 prikaza za 7 poprečnih odsječaka, ali u ovom radu će biti prikazana distribucija nalaza iz odsječaka E, H, 6 i 9 jer obuhvaćaju nalaze iz različitih dijelova pećine te se na njima jasno vidi slijed slojeva i distribucija nalaza.

Ono što se jasno ističe na uzdužnim prikazima očit je nagib slojeva prema ulazu i predšpiljskome prostoru. To je osobito uočljivo za niže slojeve koji prate prirodnu konfiguraciju matične stijene pećine. Prikazi vertikalne distribucije nalaza odsječka E (sl. 13, 14) jasno pokazuju spomenutu situaciju. Nagib nije uočljiv za slojeve B, C, D1 i D2, ali se počinje primjećivati od sloja E1 i blago se pojačava prema nižim slojevima. Koštani nalazi u sloju B koncentrirani su u stražnjem dijelu pećine, u sloju C i D1 su sporadični, dok su u sloju D2 ravnomjerno raspoređeni. Najveća koncentracija ove vrste nalaza za sloj E1 vidljiva je u kvadrantu E9, dok je isto primijećeno na gornjem dijelu sloja E2 u kvadrantu E7. Istraživanja u ovom odsječku omogućila su podjelu sloja E3 na E3A, E3B i E3C, a na prikazima je vidljivo kako se arheološki materijal tih slojeva preklapa s onima iz sloja E2. To ne znači da je došlo do pogreške prilikom istraživanja Mujine pećine, nego je sloj E3 zauzimao samo dio kvadranata E odsječka, dok je ostatak pripadao sloju E2. Može se primijetiti da su koštani ostaci najgušći u sloju E3C, najrjeđi u sloju E3B, a najveća koncentracija u sloju E3A nalazi se u kvadrantu E6. Kamene rukotvorine u gornjim slojevima prate raspored kostiju. U sloju E1 sileksi su zastupljeniji u stražnjem dijelu pećine, dok se njihova brojnost i gustoća povećava prema ulazu u sloju E2. Oni su, ujedno, najgušći u sloju E3C, najrjeđi u sloju E3B, a poveća koncentracija vidljiva je u sloju E3A.

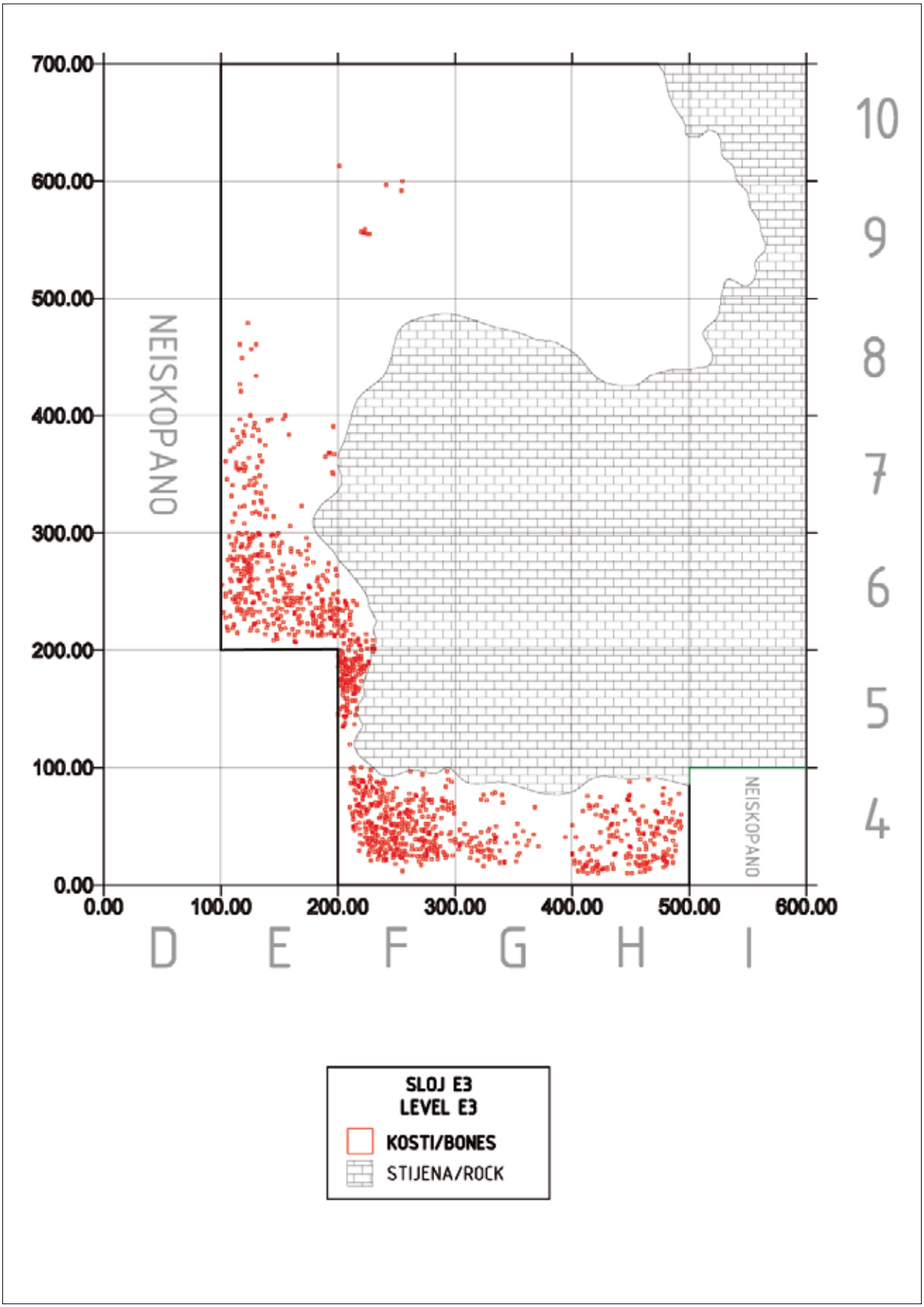
Odsječak H, kako pokazuju slike 15 i 16, nalikuje prethodnom prikazu. Kosti su ovdje brojnije od sileksa i na području niše grupirane su u posljednjem kvadrantu u najvišem sloju, a u nižim stratigrafskim jedinicama, poput slojeva D1 i

entrance (squares E6, E7, F5 and E6), with the largest cluster located next to the wall (squares F5 and F6). A large amount of stone finds was discovered in the excavation area in front of the cave, where a considerable concentration of lithic material can be observed along the edge of this area (squares F4 and H4). Their frequency expectedly decreases toward the cave interior. Based on the high concentration of all finds along the edge of the square meter segment E, a significant amount of lithic artifacts and faunal remains may be expected to be discovered in the unexcavated area of the cave.

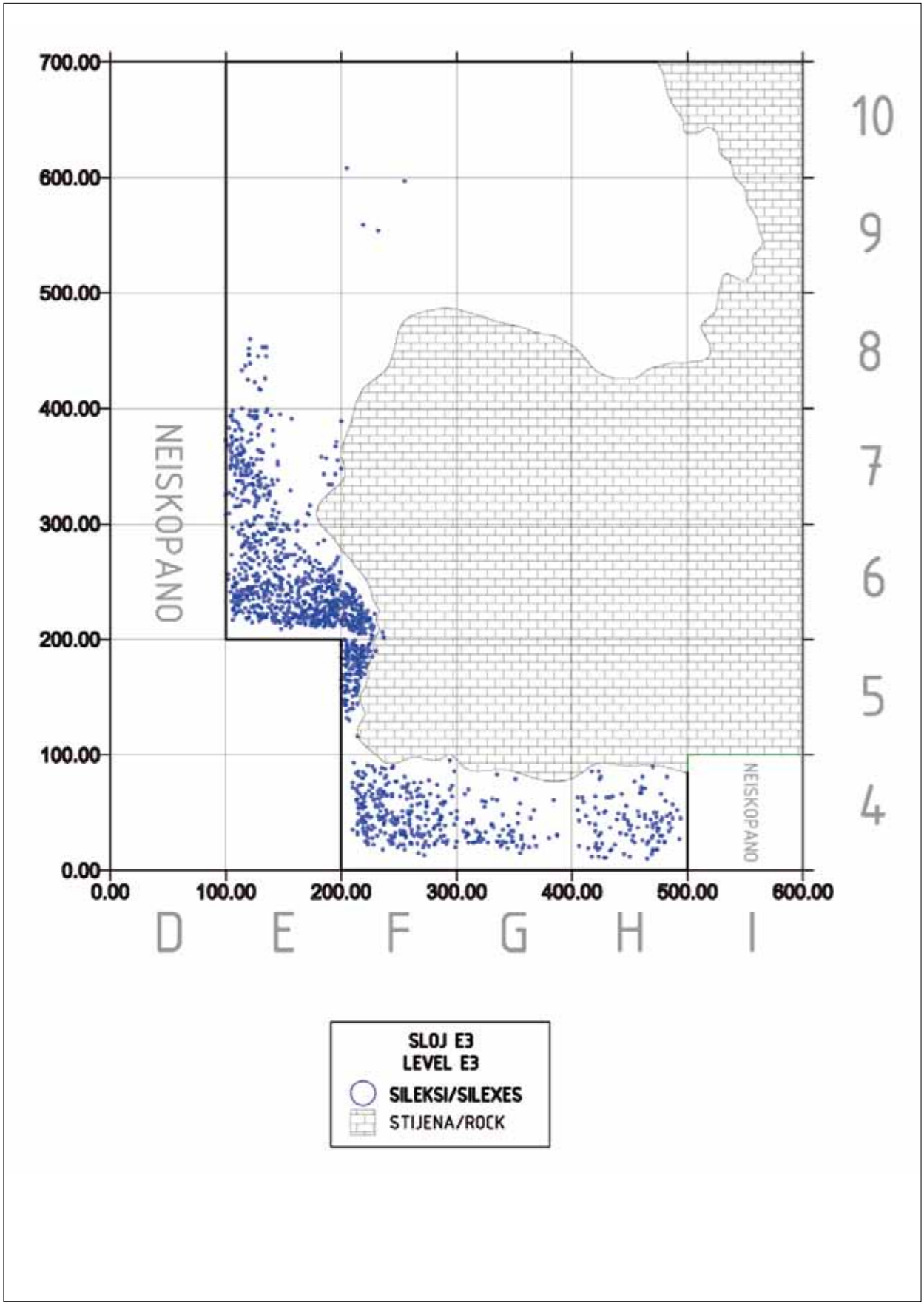
4.2. VERTICAL DISTRIBUTION OF FINDS

Horizontal projections of artifact distribution are supplemented with vertical ones, which may contribute considerably to the further understanding of the interrelation of archeological finds and the conditions which might have affected their dispersal. Projections of vertical cross section for both longitudinal and lateral sq meter segments were created by adding the archeological material from every stratum of Mujina pećina. Every segment was designated by a letter or a number based on the metric grid set up at the beginning of the systematic excavation of the site. Every longitudinal segment includes squares designated with a particular letter. For example, segment D consists of squares D6, D7, D8, D9 and D10, while segment F is made up of squares F4, F5, F6, F7, F8, F9 and F10 etc. Every lateral segment is composed of squares designated by a certain number. For instance, segment 4 comprises squares F4, G4 and H4, while segment 8 includes squares D8, E8, F8, G8, H8 and I8 etc. The total of 12 plans for 6 longitudinal and 14 plans for 7 lateral square meter segments were created, but only vertical distribution of finds from segments E, H, 6 and 9 will be presented in this paper. These segments were chosen because the stratigraphic sequence and artifact distribution are clearly distinguishable on the site projections and because they also include archeological finds from different areas of the cave.

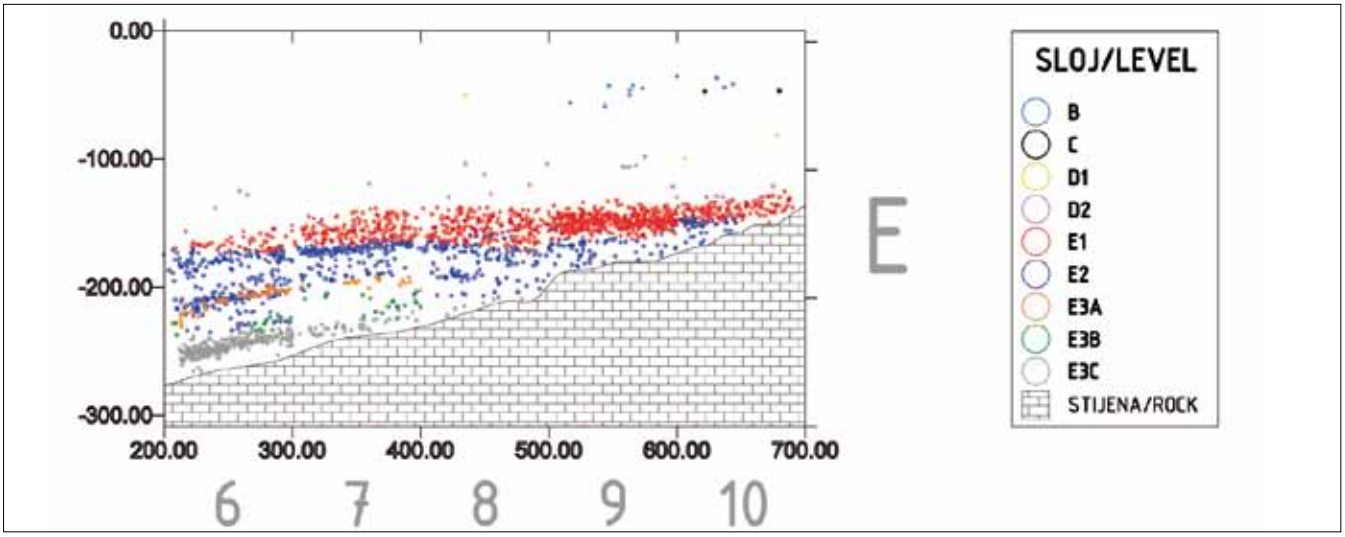
One feature that is clearly discernable on longitudinal site projections is the inclination of stratigraphic layers toward the mouth of the cave and the area in front of it. The sloping sediment is especially visible in the lower layers which follow the natural configuration of the bedrock. Vertical distribution projections of segment E (Fig. 13, 14) are clearly indicating the above mentioned situation. The inclination is not present in levels B, C, D1 and D2, but is starting to appear from level E1 and slightly increases toward the lower levels. Faunal remains in level B are concentrated at the back of the cave, but appear only sporadically in levels C and D1, and are evenly distributed in level D2. The highest concentration of bones in level E1 is located in square E9, while the same situation can be observed in square E7 for the upper section of level E2. The research of this segment resulted in dividing level E3 into units E3A, E3B and E3C. Vertical site projections show that archeological material from these units is overlapping with artifacts from level E2. This, however, does not mean that mistakes were made during the research. The overlap occurred because level E3 only partially fills segment E, while the rest of the sediment in these squares belongs to level E2. The frequency of faunal remains is the highest in level E3C and the lowest in E3B. The largest concentration in level E3A is located in square E6. Stone handicrafts follow the faunal distribution pattern



Sl. 11 Prikaz horizontalne distribucije kostiju u sloju E3 (crtež: R. Nizek, 2011.)
Fig. 11 Horizontal distribution of bones in layer E3 (drawing: R. Nizek, 2011)



Sl. 12 Prikaz horizontalne distribucije sileksa u sloju E3 (crtež: R. Nizek, 2011.)
Fig. 12 Horizontal distribution of silexes in layer E3 (drawing: R. Nizek, 2011)



Sl. 13 Prikaz vertikalne distribucije kostiju u odsječku E (crtež: R. Nizek, 2011.)
Fig. 13 Vertical distribution of bones in section E (drawing: R. Nizek, 2011)

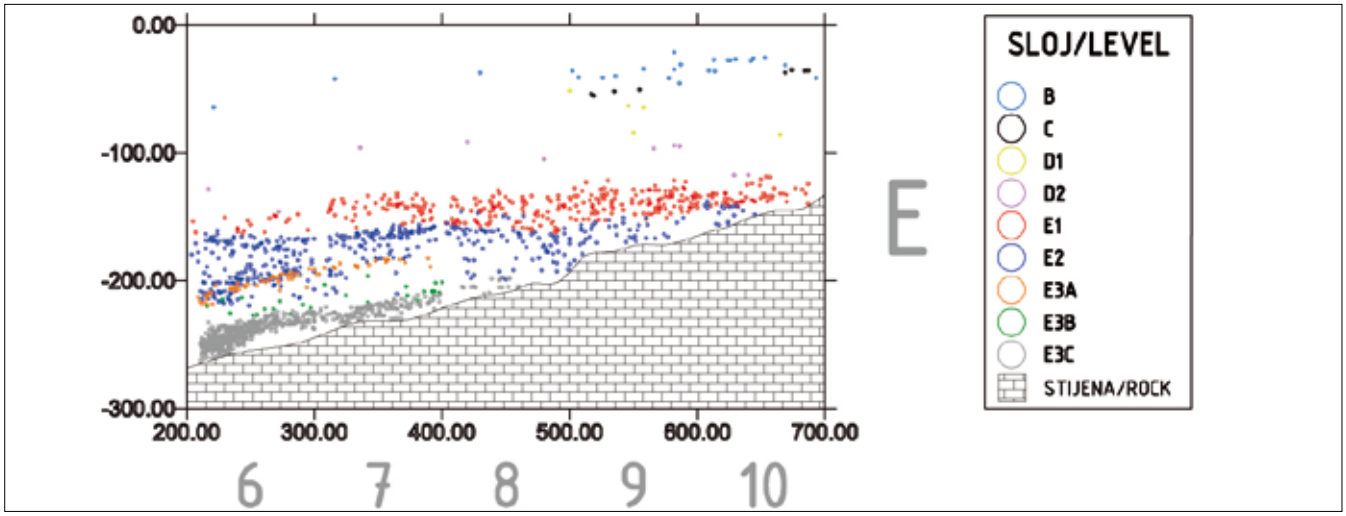
D2, koncentrirane su u najistočnijem kvadrantu. U sloju E1 i E2 one su najgušće u središnjem prostoru niše. U predšpiljskom prostoru fauna je podjednako zastupljena na svim dijelovima, a razlika u odnosu na nišu jest da je ovdje prisutan i sloj E3. Kamene alatke i odbojci prate distribuciju kostiju, a iznimka je sloj D2 gdje su sileksi malobrojniji i centralnije smješteni od faune.

Odsječak 6 obuhvaća svega tri kvadranta (D6, E6 i F6). Kao što slike 17 i 18 prikazuju, nalazi u gornja četiri sloja su iznimno rijetki, dok slojevi E1, E2 i E3 obiluju arheološkim materijalom. Kosti su u sloju E1 ravnomjerno raspoređene, a najviše ih ima u sloju E2 (osobito je vidljiva njihova povećana koncentracija u kvadrantu F6). Ovdje je bilo moguće načiniti prikaz slojeva E3A, E3B i E3C i ono što se jasno može razabrati na prikazima jest zastupljenost materijala po tim stratigrafskim jedinicama. Najviše koštanih ostataka pronađeno je u sloju E3C, gdje su ravnomjerno zastupljeni. Najmanje ih je u sloju E3B, a one iz sloja E3A nalazimo samo u kvadrantu E6. Sileksi i u ovome slučaju prate rasprostiranje kostiju. Najviše nalaza ovoga tipa otkopano je u slojevima

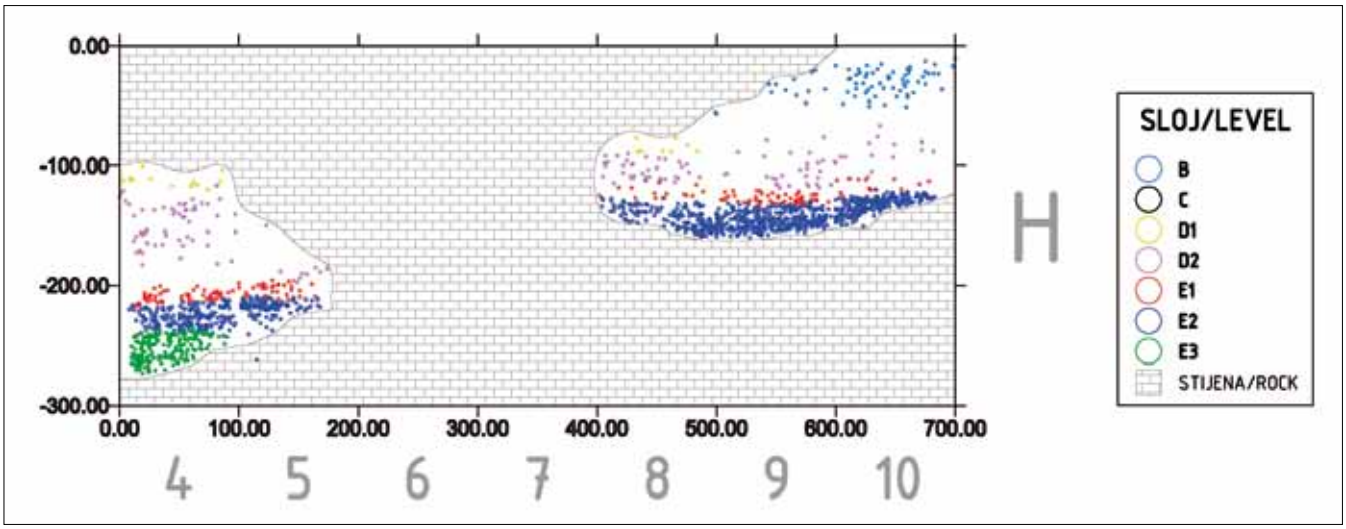
in the upper levels. The highest concentration of lithic artifacts in level E1 is located at the back of the cave, while their frequency and density rises in level E2 toward the cave entrance. The frequency of lithic material is the highest in level E3C and the lowest in E3B, with a considerable amount of stone artifacts dispersed in level E3A.

Figures 15 and 16 represent segment H. Bones, which are more numerous than lithic artifacts, are clustered in the final square in level B, whereas in the lower stratigraphic units like levels D1 and D2, they are mostly concentrated in the easternmost square. The highest frequency of faunal remains in levels E1 and E2 is located in the central area of the niche. Faunal residues are evenly dispersed throughout the excavation area in front of the cave. Stone tools and flakes have the same dispersal pattern as bones do, with the exception of level D2, where silexes are less frequent and positioned closer to the central area of the cave.

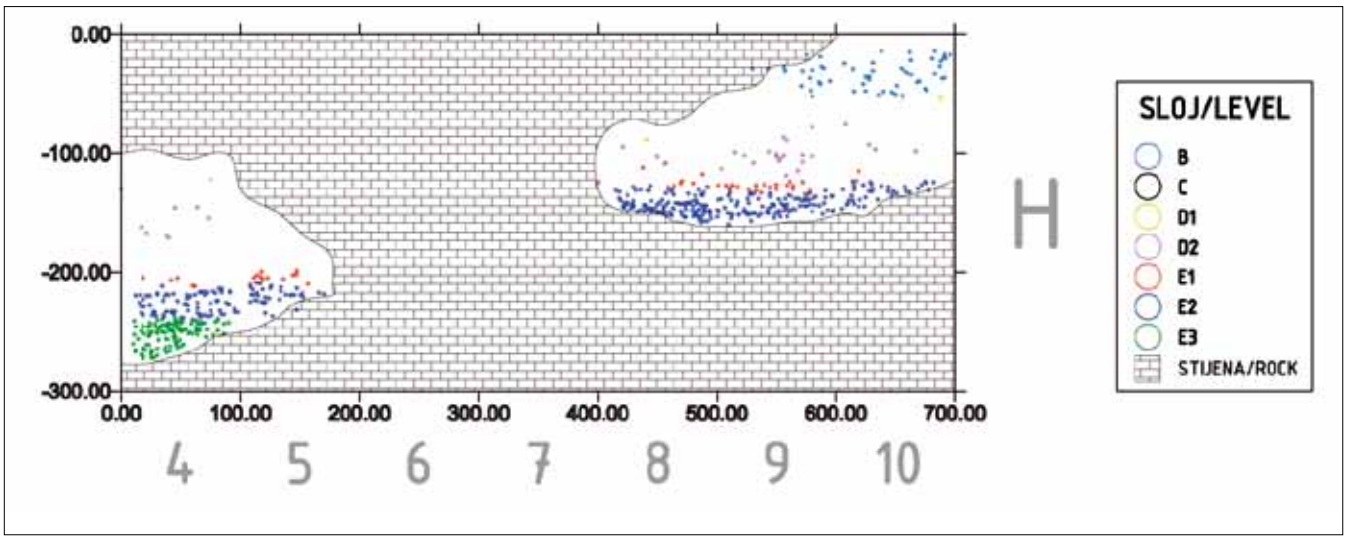
Segment 6 consists of only three square meters (D6, E6 and F6). As Figures 17 and 18 show, artifacts are very scarce in the upper four levels, while levels E1, E2 and E3 abound with archeological material. Faunal remains are evenly distributed throughout level E1, with their highest frequency



Sl. 14 Prikaz vertikalne distribucije sileksa u odsječku E (crtež: R. Nizek, 2011.)
Fig. 14 Vertical distribution of silexes in section E (drawing: R. Nizek, 2011)



Sl. 15 Prikaz vertikalne distribucije kostiju u odsječku H (crtež: R. Nizek, 2011.)
Fig. 15 Vertical distribution of bones in section H (drawing: R. Nizek, 2011)



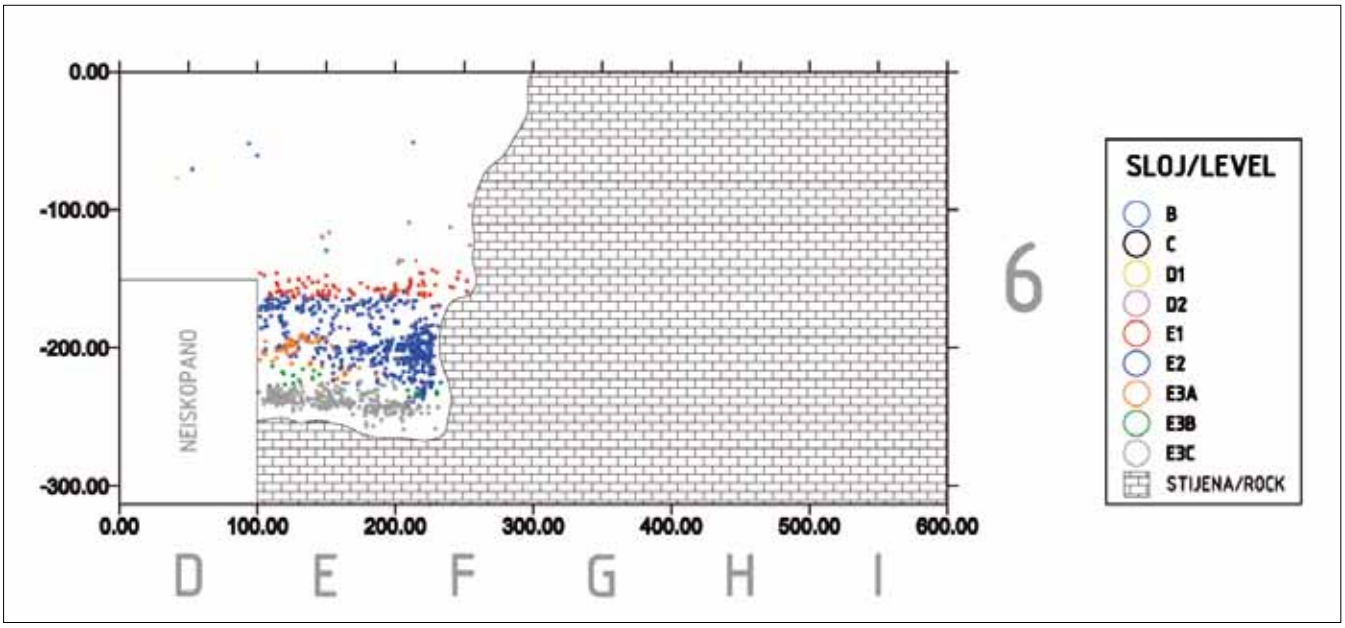
Sl. 16 Prikaz vertikalne distribucije sileksa u odsječku H (crtež: R. Nizek, 2011.)
Fig. 16 Vertical distribution of silexes in section H (drawing: R. Nizek, 2011)

E2 i E3C, dok se njihov manji broj pripisuje slojevima E3A i E3B. Kameni artefakti zastupljeni su samo u kvadrantu E6, a ravnomjerni prostorni razmještaj sileksa pripisuje se sloju E1. U kvadrantu E6 vidljivo je miješanje nalaza iz slojeva E2 i E3, koje se javlja jer se sloj E3 rasprostire samo do polovine toga kvadranta.

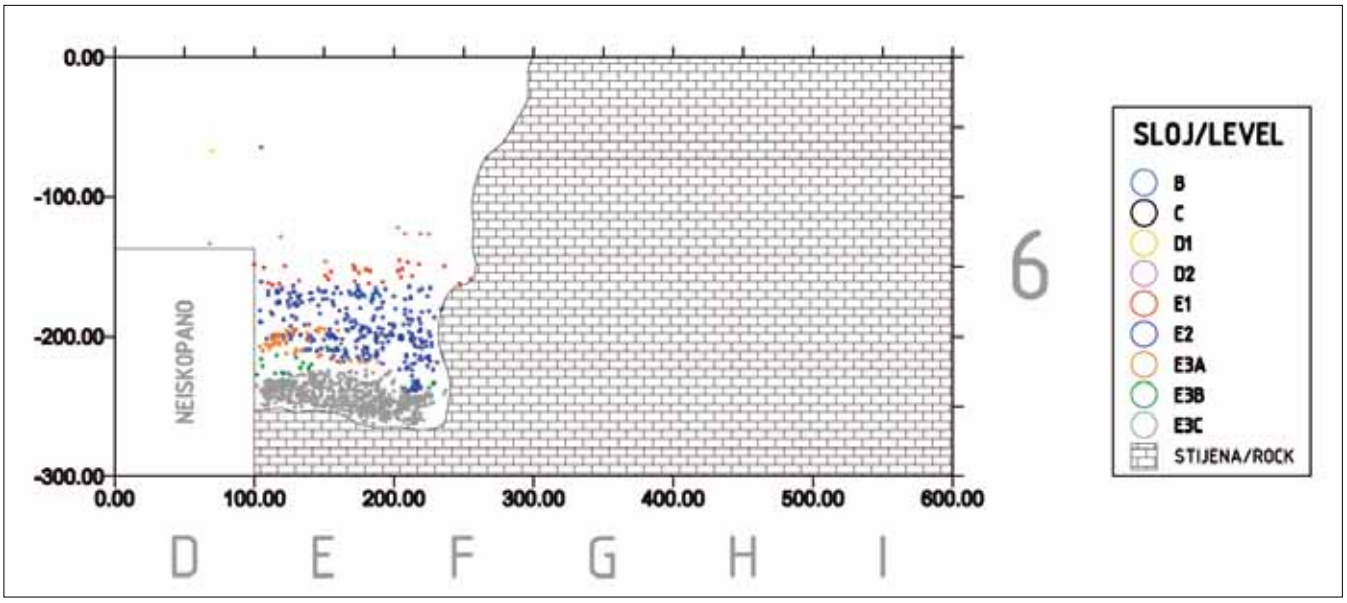
Odsječak 9 sastoji se od 6 kvadranata i odnosi se na unutrašnjost pećine i područje niše, a slike 19 i 20 prikazuju vertikalni raspored nalaza u tome segmentu. U sloju B vidljiva je značajno veća brojnost nalaza nego na području ulaza u pećinu i predšpiljskoga prostora. Kod koštanog materijala ističe se njegova gušća koncentracija u kvadrantu I9, dok je isto ustanovljeno za kamene rukotvorine u kvadrantu G9. Prazan prostor između ovih skupina nalaza nastao je već otprije spomentom devastacijom, koja je onemogućila dobivanje vrijednih podataka za ovaj dio kvadranta H9. Manja skupina nalaza iz sloja C smještena je u kvadrantima E9 i F9,

in level E2 (a considerable amount of bones can be observed in square E6). Here it was possible to include units E3A, E3B and E3C in the vertical projections. What can be clearly discerned from them is the high frequency of archeological material in these three stratigraphic units. The largest amount of faunal residues was discovered in level E3C, where they were evenly distributed. The lowest number of bones was recovered from level E3B, whereas those from level E3A were found only in square E6. Silexes are as equally dispersed throughout segment 6 as are bones. The majority of these finds was discovered in levels E2 and E3C, whereas a smaller number of lithic artifacts is attributed to levels E3A and E3B. An even distribution of stone artifacts is visible in level E1. A mixing of finds from levels E2 and E3, which occurred because level E3 partially filled square E6, is also noticeable in here.

Segment 9 consists of 6 square meters and includes the material from the interior of the cave and the niche. Figures 19 and 20 show the vertical distribution pattern of finds in this segment. In level B a more significant number of arti-



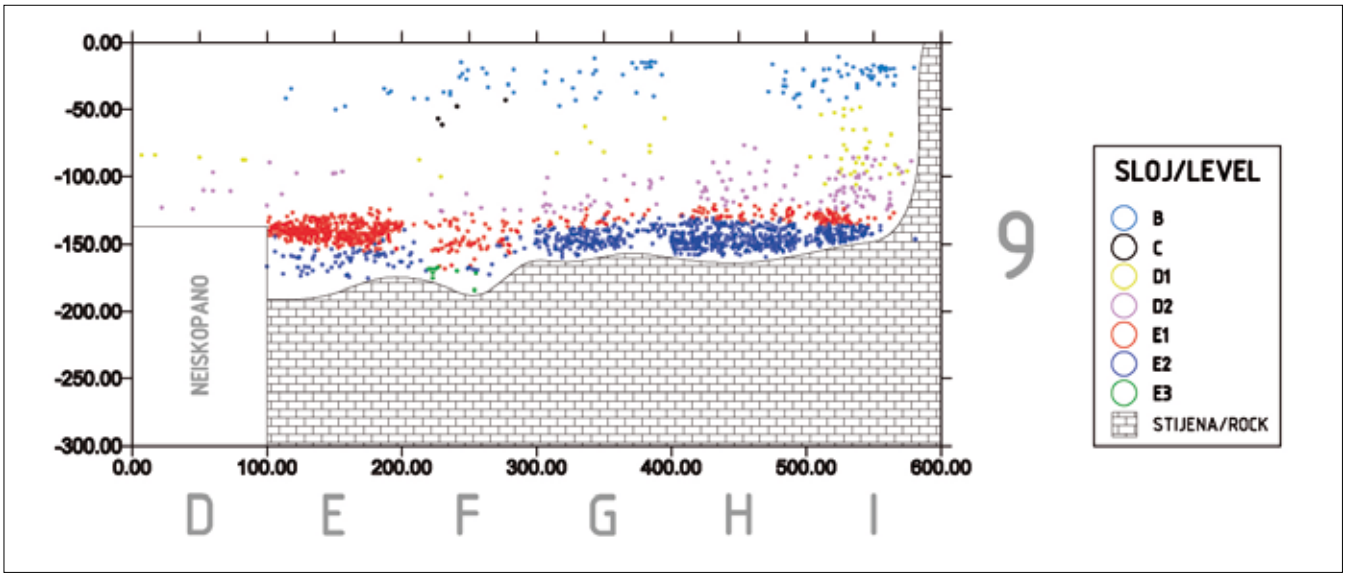
Sl. 17 Prikaz vertikalne distribucije kostiju u odsječku 6 (crtež: R. Nizek, 2011.)
Fig. 17 Vertical distribution of bones in section 6 (drawing: R. Nizek, 2011)



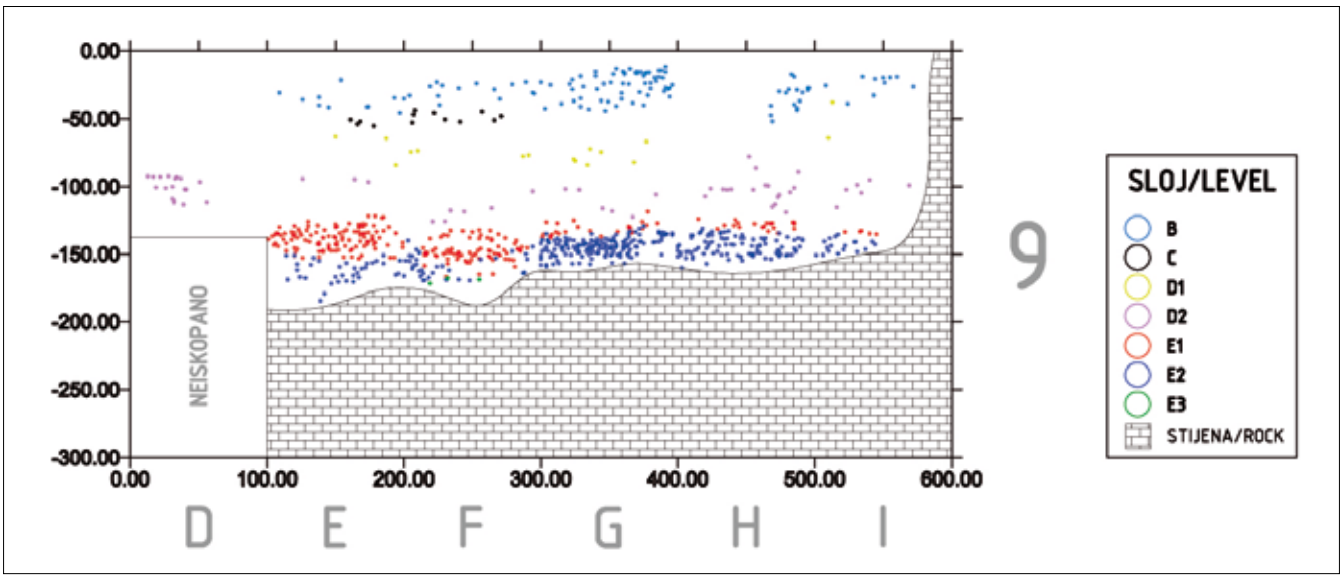
Sl. 18 Prikaz vertikalne distribucije sileksa u odsječku 6 (crtež: R. Nizek, 2011.)
Fig. 18 Vertical distribution of silexes in section 6 (drawing: R. Nizek, 2011)

a raspršeni uzorak rasprostiranja arheološkog materijala glavna je značajka sloja D1. U ovome sloju jedino su kosti jače koncentrirane na prostoru kvadranta I9. Distribucija nalaza u sloju D2 pokazuje veću učestalost kostiju u odnosu na silekse. One su najgušće grupirane na prostoru niše (kvadranti G9, H9 i I9), dok kameni artefakti čine dvije manje skupine na prostoru niše (kvadrant H9) i kvadranta D9. Iznimno velika koncentracija obje vrste nalaza u sloju E1 smještena je unutar kvadranta E9 i susjednog F9, a nešto manja grupacija kostiju u ovoj stratigrafskoj jedinici pripisuje se kvadrantima H9 i I9. Sloj E2 pokazuje drugačiji trend rasprostiranja materijala. Svi nalazi izrazito su koncentrirani na prostoru

facts was discovered in the interior of the cave than at the entrance and in the area in front of the cave. The highest concentration of faunal remains is located in square I9, while the same is observed for stone handicrafts positioned in square G9. The empty space between these two artifact clusters represents the already mentioned devastation, which prevented collecting valuable data for this section of square H9. A smaller cluster of finds in level C is located in squares E9 and F9, while a dispersed artifact distribution pattern is the main feature of level D1. A somewhat denser concentration of bones in this level can be observed in square I9. The distribution of finds in level D2 indicates that bones are more frequent finds than silexes in this level. The largest concentration of faunal remains is placed in



Sl. 19 Prikaz vertikalne distribucije kostiju u odsječku 9 (crtež: R. Nizek, 2011.)
Fig. 19 Vertical distribution of bones in section 9 (drawing: R. Nizek, 2011)



Sl. 20 Prikaz vertikalne distribucije sileksa u odsječku 9 (crtež: R. Nizek, 2011.)
Fig. 20 Vertical distribution of silexes in section 9 (drawing: R. Nizek, 2011)

niše (kvadranti G9, H9 i I9), s time da je gustoća kostiju znato veća od one sileksa. Sloj E3 zastupljen je sa svega nekoliko kostiju i sileksa pronađenih u udubini matične stijene unutar kvadranta F9.

5. Rasprava

U razmatranje su uzeti rezultati prostorne analize nalaza iz svih slojeva Mujine pećine iako oni za slojeve B, C i D1 (horizontalna distribucija) nisu prikazani u ovome radu. Rezultati pokazuju značajne razlike u učestalosti i distribuciji arheološkog materijala, što može upućivati na različite načine na koje su neandertalske populacije koristile nalazište u vremenskome razdoblju od nekoliko tisuća godina. Na razlike u učestalosti nalaza mogu utjecati različit intenzitet ljudske

the niche (squares G9, H9 and I9), while lithic artifacts form two smaller clusters in squares H9 (the area of the niche) and D9. An exceptionally high concentration of both faunal and lithic artifacts was discovered within squares E9 and F9 in level E1, whereas a somewhat smaller cluster of bones within this stratigraphic unit was found in squares H9 and I9. Level E2 shows a different distribution pattern. All finds are densely concentrated in the niche (squares G9, H9 and I9), with a significantly higher faunal density in comparison to stone artifacts. Level E3 contains only several faunal and lithic artifacts discovered within the bedrock crack placed in square F9.

5. Discussion

The results of spatial analysis of the entire stratigraphic sequence from Mujina pećina are included in the discussi-

djelatnosti i različita brojnost neandertalskih skupina koje su tijekom musterijena nastanjivale pećinu. Zasad nije moguće ustanoviti točan broj osoba koje su koristile ovo nalazište zbog nedostatka preciznijih podataka o proizvodnji alatki na nalazištu i detaljnijih znanja o paleoekološkoj slici Dalmacije u vrijeme musterijena. Ipak, Karavanić i Bilich-Kamenjarin (1997: 199) primijenili su princip određivanja broja individua s obzirom na kvadraturu stanišnog prostora koji se temelji na proučavanju kalifornijskih Indijanaca (Cook, Heizer 1968). Time su ustanovili da je Mujina pećina, bez predšpiljskog prostora, bila pogodna za život devet osoba. Naravno, treba uzeti u obzir da razlike u učestalosti i distribuciji nalaza vjerojatno ukazuju na različite veličine neandertalskih skupina koje su dolazile na nalazište i drugačiju namjenu staništa tijekom musterijena te zbog toga gore ustanovljeni broj može poslužiti tek kao okvirni podatak o broju neandertalaca koji su koristili Mujinu pećinu.

Gledajući prikaze horizontalne distribucije nalaza svakog sloja zasebno, moguće je donekle rekonstruirati aktivnosti ljudi i/ili životinja koji su koristili pećinu. Prostorna analiza sloja B pokazala je da je najkorišteniji dio Mujine pećine bio prostor niše unutar kojeg su utvrđene najveće koncentracije litičkih i faunističkih nalaza. Iako je arheološkog materijala u ovome sloju razmjerno malo, nalaz male levaloaške jezgre i nešto levaloaških odbojaka upućuje na proizvodni posupak koji se odvijao *in situ*. Kako pokazuje izrazita grupiranost kamenih artefakata u kvadrantima G9, G10, H9 i H10, moguće je žarište proizvodnih aktivnosti bilo upravo u zaštićenoj ni-ši koja je bila najpogodnije mjesto za boravak unutar pećine. Miracle (2005: 97) je ustanovio tragove ljudske aktivnosti na kostima kozoroga i divokoze iz sloja B, što jasno pokazuje da je na nalazišu provođeno komadanje plijena i lomljenje kostiju kako bi se došlo do hranjive koštane srži. Prema količini koštanih ostataka koji su pronađeni u kvadrantima G8, H9, H10, I9 i I10 u istome sloju, čini se da je proces komadanja plijena također obavljan na području niše. Ostaje otvoreno pitanje za što se koristio ostatak pećine s obzirom da su u ostalim dijelovima iskopne površine nalazi puno rjeđi ili ih uopće nema. Kao mogući odgovori nameću se dva rješenja. Prvi bi bio da taj prostor nije niti bio korišten, dok bi drugi pretpostavljao mogućnost da je taj dio služio kao boravišni prostor u kojem su neandertalci objedovali i/ili noćili. Naime, Binford (1983: 163, 164) je dokazao da se u suvremenim zajednicama lovaca i sakupljača prostor namijenjen spavanju često koristio za obavljanje drugih aktivnosti, poput jedenja ili izrađivanja alatki, što nužno stvara manje skupine otpadaka nastalih provođenjem tih aktivnosti oko ležajeva. Kada bi se isti princip primijenio na neandertalce iz Mujine pećine, onda bi sporadični nalazi u prednjem dijelu pećine možda mogli potvrditi pretpostavku o korištenju toga prostora za spavanje, a tome u prilog, svakako, idu i praznine između nalaza dovoljne za polaganje nekoliko ležajeva. Miracle (2005: 94) je također ustanovio da su se zvijeri gostile ostacima neandertalskoga plijena, a neki uzorci, poput kostiju zeca i ekvida iz gornjih slojeva, upućuju da su ih na lokalitet donijeli isključivo mesojedi. Osim toga, koštani ostaci *Ursus spelaeusa* iz sloja B potvrdili su da je pećina služila i kao medvjeđi brlog. Očito je da su zvijeri imale udjeon, even though projections of horizontal distribution of finds from levels B, C and D1 are not presented in this paper. The results suggest significant differences in frequency and distribution of archeological material, which may refer to different ways in which Neanderthal populations used the site during the period of several thousand years. The differences in artifact frequency may be influenced by various intensities of human activities and different sizes of Neanderthal groups who visited the site during the Mousterian. So far it was not possible to determine the exact number of individuals visiting the site due to the lack of any precise information about tool making processes that were conducted at the site and with no detailed knowledge about the paleoecological situation in Dalmatia during the Mousterian. Still, Karavanić and Bilich-Kamenjarin (1997: 199) applied the principle of determining the number of individuals occupying a particular site by taking into account site's surface, which is a concept based on the study of California Native Americans (Cook, Heizer 1968). They have concluded that Mujina pećina, without the area in front of the cave, was suitable for the life of nine individuals. Certainly, it should be taken into consideration that the differences in frequency and distribution of finds probably indicate various sizes of Neanderthal groups visiting the site and a different purpose of the site during the Mousterian. For this reason the above mention number of individuals may only serve as a general datum about the number of Neanderthals using the site.

The projections of horizontal distribution of finds from all levels of Mujina pećina may be used for the reconstruction of hominin/animal activities at the site. The spatial analysis of level B has shown that hominin and animal activities were mostly concentrated in the niche, where the highest frequency of lithic and faunal artifacts was discovered. Even though a small amount of archeological material was found in this level, the discovery of a small Levallois core and several Levallois flakes indicates that the tool making process occurred *in situ*. As is indicated by a large concentration of lithic artifacts in squares G9, G10, H9 and H10, a possible focal point of manufacturing activities was located in the protected niche, which was the most favorable dwelling place in the cave. Miracle (2005: 94) found traces of human activities on ibex and chamois bones from level B, which clearly suggests that the human modification of animal remains, including cracking open of long bones to extract marrow, was present at the site. If the concentration of faunal remains located in squares G8, H9, H10, I9 an I10 of this level is taken into consideration, it appears that processing of animal remains was conducted in the niche. Since archeological material is scarce or non-present in other parts of the excavation area, there still remains an open question about the utilization of other areas of the cave. Two possible solutions may be proposed. The first suggests that those areas were not used at all, while the second puts forward the possibility of utilizing the rest of the cave as a habitat area where Neanderthals were eating and/or sleeping. Namely, Binford (1983: 163, 164) has proved that the space intended for sleeping in contemporary communities of hunters and gatherers is often used for other activities such as eating or tool making, which necessarily results in the deposition of a small amount of refuse around beds. If the same principle is applied to the Neanderthals from Mujina pećina, then sporadic finds in the southern part of the cave might possibly confirm the assumption of using this area for sleeping. Empty spaces between finds, which are big enough for several

la u konačnoj distribuciji koštanih nalaza, a činjenica da su svi koštani nalazi pronađeni na zaklonjenom prostoru niže znači da je to područje bilo podjednako privlačno čovjeku i životinjama (Mihelić, Karavanić, u tisku). Arheološki materijal iz predšpiljskoga prostora također nije obilan, ali jasno ukazuje da je on korišten u vrijeme boravka neandertalaca u sloju B. Također, moglo bi se reći da je sloj B mogao biti izložen *tramplingu* suvremenih ljudi, čiju prisutnost potvrđuju recentni ostaci pronađeni u sloju A.

U sloju D1 nalaza je vidljivo manje nego u prethodnom sloju, ali su oni smješteni na mnogo većoj površini pećine. Litika je ravnomjerno raspoređena po njenoj unutrašnjosti, dok su kosti ipak brojnije na području niže. Na temelju distribucije arheološkog materijala moglo bi se zaključiti da nekog većeg procesa izrade kamenih alatki ovdje nije bilo jer je nalaza vrlo malo te postoji tek jedna manja koncentracija u kvadrantu D7 koja bi upućivala na mjesto proizvodnje alatki. Faunističkom analizom materijala iz pećine ustanovljeno je da su ovome sloju plijen neadertalaca bili jeleni i bovidi, a otkriveni su i tragovi aktivnosti zvjeradi (Miracle 2005). Obrada plijena i ovdje je mogla biti provođena na području niže, a širi areal rasprostiranja kostiju mogao bi se pripisati aktivnostima vuka i hijene. Nalazi u predšpiljskome prostoru su rijetki pa ne mogu dati jasniju sliku njegova korištenja.

Nalazi sloja D2 brojniji su u odnosu na prethodne slojeve i pokazuju zanimljiv raspored rasprostiranja, čemu pridonose dva dokumentirana vatrišta (vidi sl. 6). Ona nisu bila posebno omeđena, a vatra je bila zapaljena na stanišnoj razini. Oko vatrišta u desnoj niši pronađen je veći komad jelenjeg roga i nekoliko komada razbacanih rukotvorina i kosti. Arheološki materijal grupiran je između vatrišta i bočne stijene/kraja sonde, dok je prostor između vatrišta gotovo prazan. Teško je ovakav razmještaj točno interpretirati, a Sanjin Mihelić i Ivor Karavanić (u tisku) smatraju kako nije riječ o pukom slučaju. Poslužili su se modelom koji je Binford (1983) ponudio za pripećak Abri Pataud datiran u rani orinijasijen i kasnije kulture gornjeg paleolitika. Proučavajući spavalačke navike suvremenih skupina lovaca i sakupljača, Binford je zaključio kako ognjišta predstavljaju granicu koja dijeli ležajeve spavača. On je pretpostavio da standardna širina ležaja za jednu osobu iznosi 120 centimetara, a upravo toliko je razmak izmjeren između dvaju vatrišta u Mujinoj pećini. Pitanje je, međutim, može li se taj model, utemeljen na ponašanju suvremenih lovaca i sakupljača, sa sigurnošću primijeniti na neandertalce u slučaju Mujine pećine. Važno je napomenuti da su vatrišta u Mujinoj pećini ustanovljena na samo dvije lokacije, ali s obzirom da je dio sedimenta ostao neotkopan, možda bi se i na neistraženom dijelu pećine mogli očekivati tragovi trećeg vatrišta (Mihelić, Karavanić, u tisku). Neovisno o Binfordovoj teoriji, zanimljiv je odnos smještaja vatrišta i rasprostranjenosti materijala. Koštani ostaci najobilniji su na prostoru niže, osobito oko vatrišta i sjeverno od njega. Njihova učestalost se vidljivo smanjuje prema južnom dijelu sonde, gdje je uz drugo vatrište uočljiva još jedna manja koncentracija kostiju. Miracleova (2005: 97) analiza faune iz sloja D2 pokazala je da su neandertalci ulovljeni plijen (jelene i bovide) donosili u pećinu i tu ga

beds to fit into them, certainly go in favor of that assumption. Miracle (2005: 94) has also determined that carnivores scavenged hominin food waste, while some faunal remains, like hare and equid bones from the upper levels, indicate that they were brought to the site solely by carnivores. Faunal remains of *Ursus spelaeus* from level B have confirmed that the cave was also used as a bear den. It is clear that carnivores took part in the final distribution of faunal material, while the fact that all such finds were discovered in the niche may be interpreted by the proposition that this area was as equally attractive for occupation to hominines as was to animals (Mihelić, Karavanić, in press). The area in front of the cave does not abound with the archeological material from level B, but its presence still suggests that it was used by Neanderthals in this stratum. In addition, it might be concluded that level B was exposed to the trampling of modern hominins, whose presence at the site was confirmed by the discovery of contemporary finds in level A.

There is less archeological material in level D1 than in the previous stratum, but it is scattered on a larger surface of the cave. Lithic artifacts are evenly distributed throughout its interior, while bones are more concentrated in the niche. Based on the distribution and small amount of archeological material, it may be concluded that there was no large-scale tool production in this level. The only exception that might suggest tool production is a little cluster of lithic handicrafts located in square D7. The faunal analysis of the material from the cave has shown that in level D1 Neanderthals hunted red deer and large bovids, while traces of carnivore activities were also discovered (Miracle 2005). Processing of animal remains might have also been conducted in the niche, whereas the wide area of bone dispersal may be attributed to hyena and wolf activities. Finds in the excavation area in front of the cave are scarce and cannot offer a more detailed account about the activities that took place here.

Finds, which have an interesting distribution pattern, are more abundant in level D2 than in previous layers. Two documented hearths (see Fig. 6) certainly contributed to the spatial arrangement of artifacts. The hearths were not constructed or paved, rather the fires burned at the habitat level. A large deer antler and several scattered bones and handicrafts were found around the hearth in the right niche. Archeological material was clustered between the hearths and the wall/edge of the excavation area, while the space between the hearths was almost entirely devoid of finds. It is difficult to interpret such artifact dispersal correctly, but Sanjin Mihelić and Ivor Karavanić (in press) think that such distribution is not accidental. They used the model that Binford (1983) developed for the rock shelter of Abri Pataud, dated in the early Aurignacian and latter cultures of the Upper Paleolithic. By studying sleeping habits in contemporary hunter-gatherers, Binford came to a conclusion that hearths represent a dividing line between sleepers' beds. He presumed that a standard width of a one-person bed was 120 centimeters, which is the measured distance between two hearths in Mujina pećina. However, the question is whether this model, based on the behavior of contemporary hunter-gatherers, can be applied with certainty to the Neanderthals visiting Mujina pećina. It is important to mention that hearths were found in only two locations at Mujina pećina, but since one third of the sediment has been left undug, maybe traces of the third hearth might be expected in the unexcavated area of the cave (Mihelić, Karavanić, in press). Regardless of Binford's model, the interrelationship

komadali, što se vjerojatno odvijalo u niši, ali da su pećinu povremeno koristile i zvijeri poput vuka i hijene. One su, zasigurno, utjecale na distribuciju koštanih nalaza, ali pitanje je u kojoj mjeri. Iz prikaza horizontalne disperzije materijala jasno se vidi da su grupacije kostiju uglavnom smještene uz vatrišta pa je pitanje koliko je takva distribucija slučajna (vidi sl. 6). Analizom faune također je ustanovljeno da tek 1,3 % kostiju pokazuje znakove gorenja (Miracle 2005: 93), ali je ipak važno istaknuti da izgoreni ostaci pripadaju jelenu, divokozi i kozorogu koji se smatraju isključivo ljudskim plijenom. Litički materijal je u sloju D2 slabije zastupljen, ali pokazuje specifičnu distribuciju. Ističu se dvije koncentracije ove vrste nalaza, od kojih je jedna na prostoru niše, a druga u južnom uglu sonde. Grupiranost litike u niši bilježi se na udaljenosti od gotovo čitavog metra od zida pećine, što dosad nije bio slučaj u prethodnim slojevima. S. Mihelić i I. Karavanić (u tisku) smatraju da analogija s epipaleolitičkim lokalitetom Meer II u Belgiji može razjasniti ovakvo pozicioniranje nalaza. Na području C IV toga nalazišta ustanovljen je zanimljiv prostorni odnos nalaza i vatrišta, na temelju kojeg je utvrđeno da je jedna ili više osoba sjedilo pred vatrom, dok su njihovi proizvodi bili položeni odmah iza njih (Cahen, Keeley 1980: 177). Ognjište, oko kojeg su se prostirala dva polukružna pojasa (prvi pojas širine 60 centimetara s vrlo niskom gustoćom nalaza i drugi širine 70 centimetara s najvećom koncentracijom nalaza), otkriveno u Meeru II, tako može objasniti specifičan odnos nalaza i vatrišta iz Mujine pećine, što je navelo Mihelića i Karavanića (u tisku) da zaključe kako je za svakim vatrištem u pećini mogla sjediti jedna ili dvije individue koje su izrađivale alatke i pozicionirale ih na način kao i osobe iz Meera II. O izradi alatki *in situ* svjedoči i nalaz male levaloaške jezgre i ostalih proizvoda otkrivenih u ovome sloju. Svakako bi bilo važno istaknuti da je ovdje korišten model utvrđen na epipaleolitčkom lokalitetu pa se zato, s pravom, treba zapitati u kojoj mjeri su rezultati dobiveni istraživanjima gornjopaleolitičkih i kasnijih nalazišta primjenjivi na ponašanja neandertalskih populacija. Dok se isti rezultati sa sigurnošću ne potvrde i za razdoblje srednjega paleolitika, upotrebi sličnih modela, svakako, bi trebalo pristupiti s određenom dozom opreza i zadrške. Predšpiljski prostor također je dao poveći broj nalaza u sloju D2, od kojih se najviše ističu kosti grupirane na sjevernom dijelu iskopne površine i uz sam rub stijene (vidi sl. 6). Čini se da su se određene aktivnosti, poput komadanja plijena, mogle održavati i na ovoj poprilično privlačnoj lokaciji, ali bez faunističke analize materijala ovog područja to se ne može sa sigurnošću tvrditi. Litičkih nalaza je malo pa je malo vjerojatno da je proizvodni postupak dobivanja rukotvorina provođen ovdje, ali ipak treba postaviti pitanje kako je određeni postotak odbojaka dospio u predšpiljski prostor. Ako se ispostavi da su uistinu postojala dva područja aktivnosti komadanja plijena, također treba pretpostaviti da je ono provođeno kamenim alatkama izrađenim *in situ* ili donesenim s nekog drugog staništa. Prikazi vertikalne distribucije nalaza pokazali su da je sloj D2 jedna od debljih stratigrafskih jedinica (vidi sl. 13–20), na temelju čega bi se moglo pretpostaviti da je nastajao duže vremena od ostalih slojeva (osim sloja D1). Na temelju toga bi se dalje moglo

of the location of hearths and the artifact distribution seems interesting. Faunal remains are the most frequent in the niche, especially around the hearth and north from it. Their frequency is evidently decreasing toward the south end of the excavation area, where yet another smaller concentration of bones is located next to the second hearth. Miracle's (2005: 97) faunal analysis has shown that in level D2 Neanderthals carried the game (deer and bovids) back to the cave and butchered animal meat at the site, which probably occurred in the niche. The cave was also occasionally used by carnivores like wolf and hyena, which certainly had an influence on the final artifact dispersal, but the question is to what extent. The projection of horizontal distribution of finds clearly shows that bones are mostly concentrated around the hearths, which leads to the question whether such distribution is random (see Fig. 6). The faunal analysis has also indicated that only 1.3 % of bones were burned (Miracle 2005: 93), but it is important to emphasize that the burnt remains are attributed to red deer, ibex and chamois, which were hunted only by hominins. Lithic material is less frequent in level D2, but has a very specific distribution pattern. Two clusters of lithic artifacts may be recognized here, one in the niche, and the other in the south corner of the excavation area, both at the same distance of one meter from the wall of the cave, which was not the case with finds from the previous levels. S. Mihelić and I. Karavanić (in press) believe that the analogy with the Epipaleolithic site of Meer II in Belgium might clarify such arrangement of lithic artifacts in Mujina pećina. In the area of C IV at Meer II an interesting spatial relation between finds and a hearth was established, which was used to determine that one or more individuals were seated next to the fire with their products spread beyond them (Cahen, Keeley 1980: 177). The hearth with two semi-circular bands (the first band 60 centimeters wide, with a lower artifact density, and the second 70 centimeters wide, with the highest concentration of finds) discovered at Meer II might offer an explanation about the specific artifact-hearth relationship from Mujina pećina. This has led Mihelić and Karavanić (in press) to the conclusion that one or two tool-making individuals might have been seated around each hearth in the cave with their products positioned in the same way as in Meer II. An *in situ* tool production at Mujina pećina was confirmed by the discovery of a small Levallois core and other products in this level. It is important to emphasize that the model used here is developed at an Epipaleolithic site, so it is debatable to what extent the results obtained through excavations of the Upper Paleolithic and latter sites may be applied to the behavior of Neanderthal populations. Until the same results are not acquired for the Middle Paleolithic period, similar models should be used with caution. The area in front of the cave has also yielded a considerable number of artifacts in level D2, with a conspicuous concentration of faunal remains located next to the wall and in the northern part of the excavation area (see Fig. 6). It appears that certain activities, such as meat processing, might have also occurred at this location, but this may not be certain since the faunal remains from this part of the excavation area have not been analyzed yet. There are few lithic artifacts in this area, so it is unlikely that the tool making process was conducted here. Still, the question how a certain percentage of flakes got to be deposited in the area in front of the cave should be raised. If there really were two areas where butchering of animal meat was being done, then it should also be assumed that stone handicrafts made *in situ* or brought from another habitat were

zaključiti da su tanji slojevi, poput sloja E1 i E2, nastali u mnogo kraćem vremenu pa iznimna količina nalaza sugerira da su te stratigrafske jedinice bile intenzivnije, češće ili dulje nastanjavane od viših slojeva. Ipak, debljina sloja ne ovisi samo o vremenu nastajanja nego i o drugim procesima, poput promjene klime. Sloj D2 tako je definiran kao sloj hladnije klime i na njegovo nastajanje mogle su utjecati razne (ne)prilike, poput smrzavanja ili jačeg odrona kamenja sa stijenki i stropa pećine, koje su konačno mogle odrediti njegovu debljinu i strukturu. Važno je napomenti da vertikalni raspored nalaza u ovome sloju pokazuje relativno ravnomjernu raspršenost materijala kroz debljinu cijelog sloja i, ako se pretpostavi da geogeni procesi nisu značajnije utjecali na njegovu distribuciju, što se potvrdilo pregledom orijentacije nalaza, može se zaključiti da su neandertalske skupine posjećivale ovo nalazište nekoliko puta tijekom vremena nastajanja ovoga sloja te da se nije radilo o samo jednoj kratkoj lovnoj epizodi.

Prikazi horizontalne distribucije nalaza u sloju E1 pokazali su znatno veću brojnost nalaza i jedinstven raspored njihova rasprostiranja. Arheološki materijal ovdje pokazuje iznimnu grupiranost duž cijelog južnog dijela iskopne površine, što predstavlja novost u prostornoj raspodjeli nalaza. Na slikama 7 i 8 vidljiva je praznina uz lijevi rub F odsječka, što djeluje neobično s obzirom da je arheološki materijal na tome dijelu pećine iznimno obilan i da je područje nedostatka nalaza neobičnog oblika. Praznina poput ove mogla je biti uzrokovana pomakom konopca u mreži koja je dijelila sondu na četvorne metre u vremenu kada se totalna stanica nije upotrebljavala u arheološkim iskopavanjima. S obzirom da analize faune i litičkoga materijala za slojeve E1, E2 i E3 još uvijek nisu provedene, teško je sa sigurnošću odrediti koliko su utjecaja na raspodjelu nalaza imali ljudi, a koliko životinje i prirodni procesi. Ipak, prostorna analiza može ukazati na određene aspekte života dalmatinskoga pračovjeka u sloju E1 Mujine pećine. Faunistički nalazi pokazuju iznimnu koncentraciju u cijelom E odsječku, a njihova učestalost osobito raste prema još neistraženom dijelu pećine pa se može pretpostaviti da bi velike koncentracije nalaza mogle biti smještene i na tom prostoru. Kosti ovoga sloja nisu analizirane pa je teško reći koliko ovoga materijala treba pripisati životinjama koje su ovamo dolazile ili boravile, a koliko praljudima i njihovim lovnim aktivnostima. S obzirom na zaključke analiza gornjih slojeva, slični rezultati mogli bi se očekivati i za starije stratigrafske jedinice, a količina arheološki relevantnog materijala čini tu pretpostavku još vjerojatnijom. Neandertalske populacije, nesumnjivo, su barem jednom intenzivno koristile prostor Mujine pećine u sloju E1 i, s obzirom da su u višim slojevima ustanovljene aktivnosti poput komadanja plijena, moglo bi se zaključiti kako su ovakve djelatnosti obavljane i ovdje. Učestalost koštanih ostataka ukazuje da je obrada plijena mogla biti provođena na prostoru niše (koncentracija uz sjeverni rub bočne stijene), cijelom južnom dijelu sonde te predšpiljskome prostoru (ravnomjerna rasprostranjenost nalaza). Prisutnost karnivora mogla bi biti zabilježena i u ovome sloju i oni su, vrlo vjerojatno, imali udjela u horizontalnoj raspodjeli nalaza. Osim čovjeka i životinja na ovakvu

used in the process. The projections of vertical distribution of finds have shown that level D2 is one of the thickest stratigraphic units (see Fig. 13–20), which might lead to the assumption that its deposition process lasted longer than in other layers (except level D1). One might further conclude that thinner layers like level E1 and E2 were deposited in a shorter period of time and that the great abundance of finds might suggest more intense, more frequent or longer occupation periods than in the upper levels. Nevertheless, layer thickness also depends on other processes, like the climate change. Level D2 has been defined as a cold climate layer and various processes, such as freezing or an intense rock slide from the cave walls and ceiling, might have affected the deposition process and determined the final layer thickness and structure. It is important to mention that the vertical distribution of finds in this stratum demonstrates a relatively even artifact dispersal pattern throughout the entire layer cross section, and, if it is assumed that geogenic processes did not play a significant role in the artifact distribution, which was confirmed by an overview of the orientation of archeological finds, it might be concluded that more than one short hunting episode occurred at the site and that Neanderthal populations visited Mujina pećina several times during the formation of this layer.

The projections of horizontal distribution of finds from level E1 have shown a significantly higher artifact frequency and a unique dispersal pattern. Archeological material is highly concentrated along the entire southern segment of the excavation area, which represents a new dispersal pattern in the spatial analysis of finds from Mujina pećina. Figures 7 and 8 show a hiatus in the artifact distribution along the left edge of the segment F, which seems unusual considering that the archeological material is very abundant in this part of the cave and that the area with no artifacts is oddly shaped. The hiatus like this one might have been caused by the movement of the rope of the metric grid used instead of the total station, which was not in use at archeological sites at the time. Since faunal and lithic analyses still have not been conducted for the material from levels E1, E2 and E3, it is difficult to determine the extent of the influence of hominins, animals and natural processes on the final distribution of finds. Still, the spatial analysis may point to certain life aspects of the Dalmatian early humans who occupied level E1 at Mujina pećina. Faunal remains are highly concentrated in the entire segment E and their frequency increases especially toward the unexcavated area of the cave, so it may be assumed that a considerable concentration of finds might be found here in the future. Bones from this stratum have not been analyzed yet, which makes it difficult to determine how much of the faunal material ought to be attributed to animals which visited or occupied the site and how many bones were modified by Neanderthals and their hunting activities. Based on the results of analyses conducted for the upper layers, similar results may also be expected for the older stratigraphic units, while the high frequency of archeologically relevant material makes this presumption even more plausible. Neanderthal populations undoubtedly used the site intensively at least once during the deposition of level E1, so it may be concluded that activities like meat processing were also carried out here, since similar activities have been ascertained in the upper layers. The frequency of faunal remains indicates that the processing of faunal remains might have been conducted in the niche (faunal concentration along the northern edge of the wall), the entire southern segment of

distribuciju nalaza mogli su ujecati i prirodni procesi. Vertikalna distribucija nalaza u poprečnim odsječcima (vidi sl. 17–20) jasno je pokazala da nema značajnijih nagiba slojeva na osi sjever-jug, na temelju čega bi se moglo ustanoviti da nije bilo pomicanja artefakata s južnog kraja sonde na sjeverni i obrnuto. To znači da nalazi nisu bili značajnije pomicani iz prostora niše na drugi kraj sonde i da je koncentracija kostiju u E odsječku bila ovdje i izvorno deponirana. Vertikalna rasprostranjenost nalaza uzdužnog E odsječka (vidi sl. 13, 14) pokazala je nagib slojeva i matične stijene prema prednjem dijelu pećine pa bi se, prema tome, mogla očekivati veća koncentracija nalaza na samom ulazu u pećinu. Međutim, najgušća grupiranost kostiju može se uočiti upravo u najdubljem dijelu špilje, što odlučno pobija mogućnost da su bilo kakvi geogeni procesi mogli značajnije utjecati na ovakav raspored nalaza. Iako je preliminarna mikromorfološka analiza ukazala na prisustvo vode i djelomično zapunjavanje pećine vanjskim sedimentom (Gerometta 2011, usmeno priopćenje), pregled orijentacije nalaza ovoga sloja također je potvrdio da ovi elementi nisu značajno utjecali na pomicanje nalaza. Sljedeće pitanje koje zahtijeva odgovor jest zašto je taj južni prostor pećine, koji u kasnijim razdobljima ne pokazuje znakove intenzivnijeg korištenja, bio tako izrazito iskorištavan u vrijeme taloženja sloja E1. Moguće je da je razlog bio nedostatak svjetla ili je taj prostor korišten za noćenje. Bez obzira na razloge, ovakva distribucija nalaza mogla bi upućivati na promjenu ponašanja neandertalskih skupina u vremenu taloženja sloja E1 u odnosu na populacije gornjih slojeva. Litički materijal pokazuje isti uzorak rasprostiranja nalaza kao i kosti, uz iznimnu koncentraciju sileksa u E i F odsječku, dok faktori brojnosti i grupiranosti materijala upućuju da je upravo ovaj dio pećine služio kao moguće mjesto izrade i obrade alatki. Količina arheološkog materijala u predšpiljskome prostoru ukazuje na povećano korištenje ove lokacije u sloju E1. Ravnomjerno raspoređen koštani materijal ukazuje na potencijalno obavljanje komadanja plijena na ovome prostoru, dok manja grupiranost kamenih rukotvorina u kvadrantima F4 i F5 može označavati mjesto barem jednog dijela proizvodnog procesa koji se tu mogao provoditi.

Horizontalna distribucija nalaza u sloju E2 prati uzorak rasprostiranja materijala iz gornjih slojeva (vidi sl. 9, 10). Područje niše ponovno pokazuje znakove intenzivnijeg korištenja, a čini se da su izrazito upotrebljavana područja bili ulaz u pećinu te predšpiljski prostor. Prikazi vertikalnog rasporeda nalaza poprečnih odsječaka (vidi sl. 17–20) pokazali su da postoji izričito blagi nagib sloja E2 prema južnom dijelu sonde, ali se čini da pomicanja artefakata u tome smjeru nije bilo. Naime, najveća koncentracija nalaza smještena je na području niše, a ne u otvorenijem dijelu pećine gdje bi ona bila locirana da su prirodni procesi uistinu djelovali na kretanje materijala. Štoviše, učestalost nalaza opada prema južnom dijelu špilje. S druge strane, prikazi vertikalne distribucije u uzdužnim odsječcima (vidi sl. 13–16) jasno pokazuju nagib sloja i matične stijene prema istoku, tj. ulazu i predšpiljskom prostoru. Iako pomicanja nalaza u niši nije bilo, to se ne može jasno potvrditi za materijal u E i F odsječcima. Najgušća grupiranost jasno je defini-

the excavation area and the area in front of the cave (evenly distributed finds). Carnivore presence might also be recorded in this layer and it may be expected that animals had an influence on the horizontal distribution of finds. Along with hominins and animals, natural processes might have also affected the artifact dispersal. The vertical distribution of finds in lateral segments (see Fig. 17–20) clearly indicates that there is no inclination of the sediment on the north-south axis, which leads to the conclusion that there was no artifact movement from the southern end of the excavation area to the northern and vice versa. This means that finds did not travel significantly from the niche to the other end of the excavation area and that bones discovered in the segment E were originally deposited there. The vertical dispersal of artifacts from the longitudinal segment E (see Fig. 13, 14) shows a distinct inclination of the sediment and the bedrock toward the front area of the cave, so a higher concentration of finds should be expected at the mouth of the cave. However, the highest frequency of artifacts is located in the deepest part of the cave, which resolutely refutes the possibility that geogenic processes had an influence on the original arrangement of the archeological material. Even though the preliminary micromorphological analysis has indicated the presence of water on the site and the partial filling-up of the cave with the exterior sediment (Gerometta 2011; pers. comm.), an overview of the artifact orientation in this level has also confirmed that these elements did not cause any significant movement of the material. The next question requiring an answer is why the southern segment of the excavation area, which shows no traces of any intensive use in latter periods, was so extensively utilized during the deposition of level E1. It is possible that the answer lies in the absence of light or the possibility that the area was used for sleeping. Regardless of reasons, such distribution of finds may be an indicator of a behavioral change in the Neanderthal populations who occupied level E1. The lithic material has the same dispersal pattern as faunal remains, with a high silex frequency in segments E and F, which suggests that this area of the cave may have been used for tool production and retouching. The amount of archeological finds in the excavated area in front of the cave shows a more intensive use of this location in level E1. An even dispersal of faunal material indicates that the activity of meat processing may have been conducted in this area, while the smaller concentration of lithic artifacts in squares F4 and F5 may designate the place where at least one phase of the tool making process might have taken place.

The horizontal distribution of finds in level E2 follows the dispersal pattern of artifacts from the upper layers (see Fig. 9, 10). Again, the niche shows traces of an intense use, and it seems that the mouth of the cave and the area in front of the cave were also extensively used locations at the site. Projections of vertical distribution of finds from lateral segments (see Fig. 17–20) have shown that there is a very gentle inclination of level E2 toward the southern end of the excavation area, but it appears that there was no artifact movement in that direction. Namely, the highest concentration of finds is located in the niche, and not in the more open area of the cave where it would have been found if natural processes had indeed caused the movement of the material. Furthermore, the artifact frequency decreases toward the southern area of the cave. On the other hand, projections of vertical distribution of finds in longitudinal segments (see Fig. 13–16) clearly show an inclination of the layer and the bedrock toward the east, i.e. the entrance and the area in front of

rana u kvadrantima E6, E7, F6 i F7 i mogla je nastati ljudskim aktivnostima, prirodnim procesima, poput klizanja terena ili curenja vode, te kombinacijom obaju faktora. Orijentacija nalaza u ovom sloju pokazala je da prirodni procesi ipak nisu značajnije utjecali na položaj nalaza. Predšpiljski prostor pokazuje ravnomjernu horizontalnu raspodjelu materijala i upućuje na češće ili intenzivnije korištenje ove lokacije nego u slojevima B, D1 i D2. Iako su koštani ostaci u sloju E2 brojniji, njihov uzorak rasprostiranja podudara se s horizontalnom distribucijom kamenih nalaza. Ako su aktivnosti poput izrađivanja rukotvorina i komadanja plijena bile provođene u ovoj stratigrafskoj jedinici, očito značajnije funkcionalne podjele prostora pećine nije bilo. Nedavno je provedena preliminarna mikromorfološka analiza sedimenata kojom je, između ostaloga, uočeno mnogo malih fragmenata kostiju koje su gorjele ili djelomično gorjele (Gerometta 2011: 19). Ti fragmeti osobito su prisutni u uzorcima sloja E2 i E3C, a mogli bi upućivati na prehrambene navike neandertalaca. Utjecaj zvjeradi na prostornu raspodjelu nalaza trenutno se ne može odrediti, ali, s obzirom na rezultate faunističke analize gornjih slojeva, njihova prisutnost u ovom sloju Mujine pećine sigurno nije bila zanemariva. Štoviše, preliminarnom mikromorfološkom analizom sedimenata sloja B, D1, D2, E2 i E3 Mujine pećine ustanovljena je prisutnost fragmenata koprolita karnivora, vjerojatno hijena (Gerometta 2011: 19).

Kao što je već bilo spomenuto, sloj E3, ukoliko izuzmemo pukotine u matičnoj stijeni, tj. «podu» špilje, ograničen je isključivo na područje ulaza u pećinu te predšpiljski prostor (vidi sl. 11, 12). Na ovoj maloj iskopnoj površini zbila se izrazito jaka koncentracija kamenih i koštanih nalaza, uz očitije grupiranosti u kvadrantima E6, F4, F5, F6 te H4. S obzirom da je nekoliko nalaza ovoga sloja bilo otkriveno u udubinama matične stijene unutar pećine, može se pretpostaviti da je ona i u vremenu taloženja sloja E3 bila korištena u svojoj cijelosti, a da je veći dio materijala, pod utjecajem ljudskih, biogenih ili geogenih aktivnosti te nagiba stijene, otklizao prema ulazu pećine i vjerojatno stvorio izrazitu koncentraciju na tome mjestu. Predšpiljski prostor mogao je biti izvrgnut istim procesima pa je teško ustanoviti koliki je postotak nalaza ovdje izvorno deponiran, a koliki je možda dospio iz drugih područja. Orijentacija nalaza iz sloja E3 uglavnom nije ukazala na značajniji utjecaj prirodnih procesa na razmještaj artefakata, a iznimka su jedino nalazi iz slojeva E3B i E3C u kvadrantu F5 koji su bili istosmjerno orijentirani.

Na temelju prikaza vertikalne rasprostranjenosti nalaza (vidi sl. 13–20) moglo bi se zaključiti da su najstariji slojevi (E1, E2, E3), u kojima je arheološki materijal najbrojniji, bili dugotrajnije nastanjavani, dok bi slojevi B, D1 i D2, zbog manje učestalosti nalaza, mogli upućivati na kraće lovne epizode. S druge strane, velike koncentracije nalaza u pojedinim slojevima mogle bi se objasniti izrazito intenzivnim djelatnostima neandertalaca na nalazištu tijekom kratkog vremenskog perioda (Karavanić et al. 2008a) ili uzastopnim kratkotrajnim boravcima u pećini (Conard 1996). Tragovi ljudske djelatnosti na ostacima faune iz gornjih slojeva upućuju na vjerojatnost da je Mujina pećina, u vrijeme nastajanja mlađih stratigrafskih jedinica, služila kao *kill site*, kako je Binford (1983: 120) definirao epizodni logor na kojemu je obavljana aktivnost komadanja ulovljenog plijena. S obzi-

the cave. Even though there was no artifact movement in the niche, the same cannot be confirmed for the material from segments E and F. The highest concentration of finds is clearly defined in squares E6, E7, F6 and F7 and may be the result of human activities, natural processes such as landslide or solifluction, and the combination of both factors. Still, an overview of artifact orientation in this layer has indicated that natural processes did not cause any significant disturbances in the distribution of finds. The area in front of the cave shows an even horizontal artifact arrangement and suggests more frequent or more intense use of this location than in levels B, D1 and D2. Although faunal remains are greater in number, their dispersal pattern coincides with the horizontal distribution of stone finds. If activities, such as tool production and meat processing, were conducted in this stratigraphic unit, there was obviously no significant functional management of space within the cave. The preliminary micromorphological analysis of the sediment from Mujina pećina was made recently which, among other things, found a great number of small bone fragments which were burnt or partially burnt (Gerometta 2011: 19). These fragments are particularly present in the samples from levels E2 and E3C and they might be an indicator of the eating habits of Neanderthals. The carnivore influence on the spatial arrangement of finds cannot be determined for the time being, but if the results of the faunal analysis of the upper layers are taken into consideration, then their presence in this stratum of Mujina pećina was surely not insignificant. Furthermore, the preliminary micromorphological analysis of the sediment from levels B, D1, D2, E2 and E3 of Mujina pećina has confirmed the existence of carnivore coprolite fragments, probably hyena´s, at the site (Gerometta 2011: 19).

As was mentioned earlier, level E3, if cracks in the bedrock are excluded, appears only above the cave floor at the entrance and the area in front of the cave (see Fig. 11, 12). A high concentration of lithic and faunal artifacts is located in this small excavation area, with larger clusters in squares E6, F4, F5, F6 and H4. Since several finds from this layer were discovered in the cracks of the cave floor in its interior, it may be assumed that the entire cave was used during the deposition of level E3 and that large amount of material slid down the bedrock under the influence of hominin, biogenic or geogenic activities and the bedrock slope toward the mouth of the cave, which probably resulted in the deposition of a high concentration of finds in this location. The area in front of the cave might have been exposed to the same processes, so it is difficult to determine which finds were deposited here originally and which were moved from other areas. An overview of artifact orientation in level E3 has not indicated any significant influence of natural processes on the arrangement of finds, with the exception of the artifacts from square F5 in levels E3B and E3C which were facing the same direction.

If we examine all projections of vertical distribution of finds (see Fig. 13–20) it may be possible to conclude that the oldest levels (E1, E2, E3), in which the archeological material is the most frequent, were occupied for a longer period of time, while lesser number of finds in levels B, D1 and D2 might represent shorter hunting episodes. On the other hand, higher concentrations in certain layers might be explained by especially intensive Neanderthal activities at the site during a short period of time (Karavanić et al. 2008a) or by successive brief occupations in the cave (Conard 1996). Traces of human modification of faunal remains

rom da je ustanovljeno da je broj jedinki životinja u gornjim slojevima uključenima u analizu bio malen (Miracle 2005), može se zaključiti da su ljudi ipak rijetko koristili pećinu u vremenu nastajanja gornjih stratigrafskih jedinica.

Vertikalni prikazi poprečnog presjeka Mujine pećine uglavnom pokazuju jednoliko rasprostiranje nalaza bez većih nagiba, dok uzdužni presjeci ukazuju na pad terena i slojeva prema ulazu pećine (vidi sl. 13–20). Prema ovim podacima može se zaključiti da je nagib matične stijene, a potom i sedimenta, mogao potaknuti potencijalno klizanje i skupljanje jednog dijela nalaza na ulazu i južnome dijelu predšpiljskog prostora (što je već pretpostavljeno za sloj E3).

6. Zaključak

Provođenje prostorne analize nalaza iz Mujine pećine omogućilo je nove spoznaje o načinima korištenja i karakteru boravka neandertalaca na lokalitetu te složenosti ponašanja populacija koje su na njemu obitavale. Faunistička i litička analiza gornjih slojeva te preliminarna mikromorfološka analiza slojeva B, D1, D2, E2 i E3C već su prije dokazale da se prostor Mujine pećine koristio za izradu alatki *in situ* te da su se ulovljene životinje ovdje komadale i, vjerojatno, termički obrađivale, a prikazi horizontalne distribucije arheološkog materijala jasno su pokazali žarišta na kojima su se te aktivnosti odvijale. U gotovo svim stratigrafskim jedinicama (B, D1, D2, E2) najintenzivnije korišten dio špilje bio je prostor niše, što ne čudi s obzirom da je ona osiguravala dobar zaklon od nepovoljnih vremenskih uvjeta te je time činila boravak u pećini ugodnijim i sigurnijim. S druge strane, nalazi iz sloja E1 pokazali su sasvim drugačiju distribuciju jer je najveći dio materijala bio koncentriran uz južni rub sonde, a pomicanje radnih aktivnosti na ovo područje možda se može objasniti većom dostupnošću danjeg svjetla ili polaganjem ležajeva za spavanje u zaklonjeni prostor niše. Novo žarište radnih aktivnosti u sloju E1, svakako, bi moglo upućivati na promjenu ponašanja neandertalaca ovoga sloja u odnosu na ostale stratigrafske jedinice. Još jedno područje aktivnosti bio je ulaz u samu pećinu, što se jasno može iščitati s prikaza 9, 10, 11 i 12 za slojeve E2 i E3, dok je predšpiljski prostor bio iznova upotrebljavan iz sloja u sloj s manjim ili većim intenzitetom. Obilniji nalazi u donjim slojevima, svakako, upućuju na češće ili dugotrajnije posjete neandertalskih skupina ili jači intenzitet provođenja gore navedenih aktivnosti na području Mujine pećine, a slabija učestalost nalaza u gornjim slojevima sugerira da je špilja u vremenu nastajanja tih slojeva služila kao povremeni lovni logor neandertalaca. Također, analiza vertikalne distribucije nalaza sloja D2 pokazala je da je arheološki materijal relativno ravnomjerno raspršen kroz deblijinu cijeloga sloja pa to može značiti da su neandertalci posjećivali Mujinu pećinu nekoliko puta kroz duži vremenski period. Zanimljivo je da se proces izrade kamenih artefakata obavljao na istim mjestima na kojima se obrađivao ulovljeni plijen, što je karakteristika koja se ponavlja kroz sve slojeve ovoga nalazišta, a smještaj većih koncentracija kamenih artefakata se uglavnom podudara s gustim grupacijama koštanih nalaza (iznimka je manja skupina sileksa u kvadrantu D7 sloja D1). Ako je funkcionalne podjele prostora pećine bilo, onda su

from the upper layers suggest the possibility that in times when younger stratigraphic levels were formed, Mujina pećina was used as a *kill site*, which is the term introduced by Binford (1983: 120) for the occasional hunting camp where meat processing was performed. Since it has been determined that only few animal individuals from the upper layers were included in the faunal analysis (Miracle 2005), it can be concluded that hominids rarely used the cave in the period of the formation of the upper stratigraphic units. Vertical projections of lateral cross section of Mujina pećina mainly show an even dispersal of finds without any significant inclination, while longitudinal cross sections indicate the sloping of the bedrock and the sediment toward the mouth of the cave (see Fig. 13–20). According to this data, it may be concluded that the inclination of the bedrock and the sediment might have induced a potential sliding and deposition of some material at the entrance and in the southern segment of the area in front of the cave (which has already been proposed for level E3).

6. Conclusion

The spatial analysis of finds from Mujina pećina has provided new facts about the site use, types of Neanderthal occupations of the cave and complex behavior of populations visiting the site. The faunal and lithic analyses of the upper layers and the preliminary micromorphological analysis of levels B, D1, D2, E2 and E3C have already confirmed that Mujina pećina was used for an *in situ* tool production and butchering of animal meat, which possibly included thermal processing of the meat, while projections of horizontal distribution of archeological material clearly point to focal points where these activities were performed. In almost every stratigraphic unit (B, D1, D2, E2) the niche was the most intensively used area of the cave, which is not surprising considering that it provided a good shelter from bad weather and made the stay in the cave safer and more pleasant. On the other hand, the finds from level E1 have shown an entirely different distribution pattern since most of the material was concentrated along the southern edge of the excavation area. The shift of daily activities to this area might be explained by a greater accessibility of daylight or by setting down the beds in the protected niche. The new focal point of work activities in level E1 may certainly suggest a change in the Neanderthal behavior in this stratum. As observed on Figures 9, 10, 11 and 12 for levels E2 and E3, another extensively used area was the entrance to the cave, while the area in front of the cave was repeatedly utilized in all levels with higher or smaller intensity. The abundance of finds in the lower strata certainly refers to more frequent or long-term Neanderthal visits or a greater intensity of production and processing activities in Mujina pećina. The lower frequency of finds in the upper levels suggests that the site was used as an occasional hunting camp during the accumulation of these layers. Furthermore, the spatial analysis of vertical distribution of artifacts from level D2 has indicated a relatively even dispersal of archeological material throughout the entire cross section of the layer, which might indicate that Neanderthals visited the cave several times during a longer time period. It is interesting that the tool making process was conducted in the same areas where the game was dismembered, a feature present in all layers, and that the positioning of larger concentrations of lithic artifacts mostly coincides with dense clusters of faunal remains (an exception is a small number of silexes from square D7 in level D1). If there was a functional management

se aktivnosti izrade alatki i obrade plijena odvijale na istom, za to određenom, dijelu pećine, a ostali dijelovi špilje su možda korišteni za spavanje i druge dnevne aktivnosti.

Kao što je već bilo spomenuto, na horizontalnu i vertikalnu rasprostranjenost nalaza mogli su utjecati prirodni procesi te životinje i čovjek. Preliminarna mikromorfološka analiza pokazala je da je sediment Mujine pećine većim dijelom nastao cikličkim smrzavanjem i odleđivanjem svoda, dok je ostatak putem koluvija dospio u njenu unutrašnjost (Gerometta 2011, usmeno priopćenje). Budući da je na ovaj način potvrđeno kretanje sedimenta, moglo bi se očekivati da je proces zapunjavanja pećine vanjskim elementima mogao utjecati i na samu distribuciju nalaza, osobito u predšpiljskom prostoru koji je, svakako, najizloženiji vanjskim procesima. Prisutnost sekundarnih karbonata, osobito u sloju E, sugerira prisustvo vode koja je, svakako, mogla pomaknuti i arheološki materijal. Međutim, pregledom orijentacije nalaza ucrtanih na milimetarski papir došlo se do zaključka kako voda nije značajnije utjecala na njihov raspored, osim u kvadrantu F5 za slojeve E3B i E3C, gdje je materijal bio istostrano orijentiran. Analiza vertikalne distribucije nalaza jasno je pokazala da je u svim stratigrafskim jedinicama prisutan nagib slojeva od istoka prema zapadu pećine, dok isti nagib na osi sjever-jug nije uočen. Nagib sedimenta, svakako, je mogao prouzročiti pomicanje materijala, ali razmještaj nalaza jasno opovrgava tu pretpostavku. Od svih prirodnih čimbenika najznačajniji utjecaj na distribuciju kosti i sileksa, svakako, je imao nagib matične stijene na sloj E3. Faunistička i preliminarna mikromorfološka analiza potvrdile su prisutnost životinja na lokalitetu koje su sasvim sigurno utjecale na konačnu distribuciju koštanih nalaza, ali bez dodatnih podataka, poput lokacija kostiju koje su ižvakali i probavili mesojedi u odnosu na smještaj kostiju s tragovima ljudskih aktivnosti, konkretnije zaključke nije moguće donijeti. Također je teško točno ustanoviti koliko su prapovijesni ljudi imali utjecaja na konačnu rasprostranjenost nalaza.

Nalazi iz Mujine pećine jasno pokazuju da su se dalmatinski neandertalci uspješno prilagodili svome okolišu te da su umješno koristili lokalne resurse, poput sirovina za izradu alatki i faune za prehranu. Također se čini da se funkcija Mujine pećine mijenjala kroz razdoblje musterijena, od kratkotrajnog lovnog staništa u gornjim slojevima prema staništu s jačim intenzitetom provođenja raznih aktivnosti ili staništu koje je bilo dugotrajnije ili češće posjećivano, što je rezultiralo obilnijim deponiranjem nalaza u donjim slojevima.

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of space within the cave, then tool production and meat processing activities were performed at the same locations on the site, while other areas might have been used for sleeping and other daily activities.

As was mentioned earlier, natural processes, hominids and animals might have disturbed the original horizontal and vertical arrangement of finds. The preliminary micromorphological analysis has shown that the sediment from Mujina pećina was formed mainly by cyclic frosting and defrosting of the cave ceiling, whereas the rest of the sediment was transported into the cave by gravity (Gerometta 2011; pers.comm.). Since the movement of the sediment has been confirmed, it seems that the process of filing-up of the cave might have caused disturbances in the artifact distribution, especially in the area in front of the cave which was most exposed to external processes. The presence of secondary carbonates, especially in level E, indicates the presence of water on the site, which certainly could have caused the movement of the archeological material. However, a review of the artifact orientation from grid-paper site plans has led to the conclusion that water did not cause any significant movement of artifacts, except in square F5 in levels E3B and E3C, where finds were oriented in the same direction. The analysis of vertical distribution of artifacts clearly indicates the inclination of the sediment in all levels in the east-west direction, while the same situation is not observed on the north-south axis. The sloping sediment could have caused the movement of artifacts, but in this case their distribution refutes such an assumption. The inclination of the bedrock is the natural factor which had the greatest influence on the final dispersal of faunal and lithic material in level E3. Faunal and preliminary micromorphological analyses have confirmed carnivore presence on the site, which certainly contributed to the final distribution of bones, but without further data, such as the exact location of bones gnawed and digested by carnivores in relation to the positioning of faunal remains with traces of human modification, it is not possible to reach further conclusions. It is also difficult to determine the influence of Neanderthals on the final artifact arrangement.

Finds from Mujina pećina clearly indicate that the Neanderthals from Dalmatia successfully adapted to their environment and skillfully exploited natural resources like the lithic raw material for tool making and fauna for food. Also, it appears that Mujina pećina was changing its function during the Mousterian period from an occasional hunting camp in the upper layers towards the habitat with intense tool production and animal processing activities or the habitat with longer or more frequent periods of occupation, which resulted in an abundant deposition of archeological finds in the lower levels.

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Renata Nizek