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CRVENA STIJENA EXCAVATIONS 2004–2006, PRELIMINARY REPORT

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Abstract

The excavations and geological studies made in 2004–2006 at the Paleolithic site of Crvena Stijena in Montenegro are described in preliminary form. Earlier excavations had removed virtually all of the layers later than the Middle Paleolithic, as well as a large part of the Middle Paleolithic, leaving a 9 m tall profile through these deposits. A small deposit of intact Mesolithic layers remained, however, and the Mesolithic materials recovered in 2004–2006 are presented in some detail, along with accompanying ^{14}C dates. Geological investigations were made of the entire remaining section of Middle Paleolithic deposits. These studies demonstrated that the numerous charcoal- and ash-rich layers visible in section are in situ hearths. Lying directly on top of the Middle Paleolithic layers is a layer of volcanic ash, which was identified as the Y5 tephra, or Campanian Ignimbrite, dated to 39,000–41,000 BP. The 2004–2006 excavations did not reach the Middle Paleolithic layers, but access has been prepared for future excavations in these layers. So far, only a few Middle Paleolithic tools and a single Neanderthal tooth have been recovered from the cleaning of the profile of these layers.

INTRODUCTION

In 2004, after several preliminary visits to the site and discussions of goals and possibilities, new excavations were begun at the site of Crvena Stijena in Montenegro. These excavations are a joint project of the Centar za arheološka istraživanja Crne Gore, the Zavičajni muzej, Nikšić, and the University of Michigan Museum of Anthropology. This project is ongoing, and we present here only preliminary results from the first three years of the project.

Crvena Stijena is a rock shelter located on the western border of Montenegro (ca. 42.779°N, 18.481°E, Fig. 1), in the small village of Petrovići, administratively within the municipality of Nikšić. The site is situated high above the river Trebišnjica, at an elevation of about 700 m a.s.l., looking south and slightly west down into the valley and across to neighboring Bosnia–Herzegovina.

The rock shelter of Crvena Stijena is large, ca. 26 m wide at the mouth, extending inward ca. 15 m at the surface, and some 20–25 m in the lower depths, with known archaeological levels down to a depth of at least 20 m.

Previous excavations carried out some 40+ years ago at Crvena Stijena removed an enormous volume of deposits from this site. The results of these excavations were reported in numerous arti-

Fig. 1. Location of Crvena Stijena on the border of Montenegro with Bosnia-Herzegovina

cles and a monograph (Basler (ed.), 1975). However, a new project at this site was considered warranted because deep, massive Middle Paleolithic deposits remained to be excavated. In the assessment of the original excavator (Basler, 1975), these deposits cover virtually the full span of the Middle Paleolithic, and we therefore felt that data from this sequence would allow detailed study of the evolution of human adaptive behavior in the context of a single, long-term record of Middle Paleolithic occupation.

The 2004–2006 excavations accomplished the following, which are reported on in this article:

– excavation of the majority of the remaining uppermost archaeological layers, dating to the Eneolithic,

– achieving complete and detailed geological sampling of the entire span of Middle Paleolithic occupation deposits,

– discovery, detailed excavation and dating of remaining intact Mesolithic deposits with rich lithic, bone tool, shell and bone ornament, and faunal assemblages,

– exposure and cleaning of the lowermost layers in the deep, Middle Paleolithic deposits, with screening and recovery of lithics and fauna from this section of the profile,

– removal of an enormous mass of sterile overburden above the major, Middle Paleolithic occupations here, preparatory to excavating them in detail.

HISTORY OF DISCOVERY AND PREVIOUS EXCAVATIONS

Crvena Stijena first appears in the archaeological literature in the 1957 *Glasnik Zemaljskog Muzeja* in Sarajevo, in which Alojz Benac writes, "In August 1954 I visited some archaeological localities in the vicinity of Nikšić with Prof. Jovan Ivović and Prof. D. Sergejev. On this occasion we went to the village of Petrovići, which lies right on the border of Montenegro and Herzegovina. Here, the villager Dušan Vasiljević led us to Crvena Stijena and showed us several surface finds which he had found there. In this manner, an extraordinarily important prehistoric site was discovered, for which I am most highly indebted to Dušan Vasiljević, a very cultured amateur from Petrovići."

The first archaeological work at this site began in August 1954, when the Zemaljski Muzej in Sarajevo began excavations under the direction of Alojz Benac with a sondage of 3 × 2 m (Sonda A). As these first, limited excavations immediately produced important results and demonstrated that this was a site with multiple cultural layers, it was decided to continue investigations.

Systematic excavations at Crvena Stijena began in May 1955, under the direction of Alojz Benac and Borivoje Čović from Sarajevo and Mitja Brodar from Ljubljana. In the course of these campaigns, five cultural strata were identified in two sondages (B and C). It was confirmed that the first four strata belonged to Holocene archaeological cultures. Material from Stratum I was identified as Bronze Age, finds from Strata II and III as Neolithic, and Strata IV was identified as Mesolithic. Numerous hearths were found in the first three strata, and large numbers of ceramics, bone tools, and flaked lithic tools, as well as a great deal of fauna, were recovered. Stratum IV differed from the other strata in its assemblage of material, specifically in the complete absence of ceramics, the quantity of bone finds, the amount and nature of the flaked lithic finds, as well as the

Table 1

Major strata, archaeological periods and cultures at Crvena Stijena (modified from Basler 1975)

Stratum	Depth (m)	Archaeological period[1]	Geological context[2]
I	0–0.40	Bronze Age	Postglacial
II–III	0.40–1.80	Neolithic	
IV	1.80–2.90	Mesolithic	
V–VII	2.90–3.50	Late Upper Paleolithic (Epipaleolithic)	Würm
VIII–IX	3.50–4.90	Local UP based on Aurignacian	
X	4.90–7.60	Aurignacian	
XI–XII	7.60–8.30	Late Mousterian	
XIII	8.30–9.10	Denticulate Mousterian	
XIV–XVII	9.10–10.40	Mousterian	
XVIII	10.40–10.70	Pontinian	
XIX–XX	10.70–11.40	Mousterian with triangular points	
XXI–XXII	11.40–12.10	Pontinian	
XXIII–XXIV	12.10–15.40	Mousterian	R/W
XXV–XXVIII	15.40–17.80	Protomousterian	Riss
XXIX–XXXI	17.80–20.30	Premousterian	

[1] Basler's (1975) determinations
[2] From Brunnacker 1975

great amount of snail shells. This stratum was divided into several horizons on the basis of the character of the sediments and the occurrence of hearths and snail shells. Horizon IVa was a loose, gray, dusty layer without hearths or significant numbers of snail shells. Horizon IVb_1 contained great quantities of snail shells and numerous hearths, while horizon IVb_2 contained few hearths and only rare snail shells. Excavations ended at a depth of 3.5 m with the appearance of Stratum V, which was later determined to be of Pleistocene age.

In the course of the 1956, 1957, and 1958 excavations, sondages D, E, F, and G were opened in the eastern part of the shelter, and excavations reached a depth of 11.7 m. Đuro Basler of the Zemaljski Muzej in Sarajevo directed excavations at Crvena Stijena from 1960 to 1964, opening a large sondage in the far interior portion of the shelter and excavating down to Stratum XXXI and a depth of 20.3 m. At this level the excavations were terminated, although the bottom of the shelter had not been reached. The results of all these excavations have been published in some detail (Basler (ed.), 1975). At the end of excavations, the site was protected with an iron fence and gate. The Zavičajni Muzej in Nikšić now houses some 15,000 lithic, bone, ceramic, and metal objects from these excavations.

The archaeological sequence revealed by these earlier excavations at Crvena Stijena is extremely long, one of the longest from any rock shelter site in Europe. Beneath the Mesolithic horizons of Stratum IV, this sequence covers late Upper Paleolithic (Epipaleolithic) Strata V–VII, local Upper Paleolithic industries derived from an Aurignacian base in Strata VIII–IX, Aurignacian Stratum X, a number of varieties of Mousterian in Strata XI–XXIV, a "Protomousterian" in Strata XXV–XXVIII, and "Premousterian" Strata XXIX–XXXI (Table 1). Stratum XII, containing a Late Mousterian assemblage, was radiocarbon dated to 40,770 ± 900 BP (GrN-6083; Basler, 1975: 90, Vogel and Waterbolk, 1972: 61).

In spite of many years of interest in continuing archaeological work at this site, it was only in 2004 that conditions came together for the Centar za arheološka istraživanja Crne Gore, the Zavičajni muzej, Nikšić, and the University of Michigan Museum of Anthropology to collaborate in the international research project whose first, preliminary results are reported here.

CONDITION OF SITE PRIOR TO 2004–2006 EXCAVATIONS

In 2004, Crvena Stijena appeared to have altered little since the end of previous excavations in 1964. The deep sondage in the rear of the site was fully open, with very little slumping of sediments from the sides or the exposed profiles. In the upper part of the site – above Basler's (1975) Stratum XI, the volcanic tephra – the sondage made by the previous excavators was terraced in steps that were protected and held in place by carefully made stone walls (Fig. 2). In the lower part of the site – below Stratum XI – the previous excavations had left a single, very deep pit, with vertical profiles on its eastern and southern faces, and the bedrock of the shelter wall on the western and northern sides. The profile on the eastern face of this great pit had been drawn and published by Basler (1975), and a comparison of this published profile with the profile still standing in 2004 revealed relatively little erosion or destruction, with details down to individual rocks still visible and identifiable. The southern face of this pit, however, had eroded noticeably, leaving an accumulation of sediments fallen or washed down from the profile face, largely from some of the thick, Middle Paleolithic layers of Strata XXII–XXVII.

Toward the front of the shelter, beginning at the southern edge of the 1954–1964 excavations, there remained a broad plateau (Fig. 3), over which ran a straight, concrete wall, which served as the base for a metal fence intended by the previous excavators to protect the site. This plateau was around 23–25 m in width and varied in its interior-exterior dimensions from a broad, 14 m on the east side through 8 m in the middle, narrowing to a small, 4 m on the far western edge of the shelter. The front of this plateau was marked by a relatively clear break in slope at the beginning of a steeply descending talus dropping off in front of the site.

Fig. 2. The interior east side of Crvena Stijena at the beginning of the 2004 excavations, showing the upper terraced steps from the 1954–1964 excavations, supported by dry-stone walls (photo: Jamie Clark)

EXCAVATION AREAS AND GOALS 2004–2006

It proved impossible to reconstruct the original grid of the 1954–1964 excavations, and a new grid was therefore established over the site, oriented in the same way as the earlier grid, as closely as was possible. The new grid lines were labeled with letters and numbers in 1 m increments. Letters run from west to east and numbers from north to south. Grid squares are designated by the intersection of a lettered line and a numbered line at the southwest corner of the square. Thus, the 1 m square lying to the north and east of the intersection of grid lines P and 100 is designated as square P100.

At the beginning of the 2004 excavations, it was also impossible to re-establish exactly the same base point for taking elevations exactly as was used for the previous excavations. A new base point was therefore established on the side of the shelter, somewhat above all remaining sediments, and as close as we were able to estimate where the earlier base point had been. This base point was set at an arbitrary elevation of 0.0, so that all measurements within the site are, in fact, depths below this datum. Later, when it became possible to tie our new base point to the original one, it was found that our base point was 20 cm

Fig. 3. Overall plan of Crvena Stijena prior to the beginning of excavations in 2004. Elevations are in centimeters below an arbitrary datum of 0, established approximately 1 m above the surface of the plateau of remaining unexcavated sediments over the front of the shelter

above the original one, i.e. the original base point is –0.20 in our new system.

The first goals of the new excavations were to establish if any *in situ* archaeological layers remained in the upper portions of the site, and to excavate any such remaining layers. The initial plan was therefore to excavate along a N–S axis, roughly in the middle of the shelter, from the open,

Fig. 4. Areas excavated in Crvena Stijena 2004–2006

interior area out to and partially down the talus in front of the site. In 2004, a series of trenches with wider excavations in productive areas were opened within the area bounded roughly by grid lines M-Q and 108-94, with a break in continuity where the fence and its supporting concrete wall crossed their path. To this N–S cut through the site was later added an area of excavation in the NE corner of the plateau, within the bounds of grid lines S-AA and 97-91 (Fig. 4).

Based on the findings of these 2004 excavations, two large areas were opened in 2005 (Fig. 4). Area 1 covered the western side of the plateau, roughly within gridlines A-O and 105-96. Area 2 was bounded by grid lines Q-AA and ran from grid line 100 north to the edge of the first terrace of the interior sondage, which varied from half way between grid lines 98 and 99 to grid line 97. Later, this area was extended to the edge of one of the major terraced steps, which ran from half way between grid lines 93 almost to grid line 90.

Having completed the investigation of most of the remaining upper layers within Crvena Stijena in 2004 and 2005, excavations in 2006 were aimed at opening up a wide area over which to remove sterile deposits down to the tephra of Stratum XI and the underlying, still intact Middle Paleolithic layers in the lower portion of the site. These excavations covered the area enlarged from Area 2 in 2005, with some small extension to the west, and continued to expand to the north as the excavations proceeded deeper, removing a wider and wider swath of sterile sediments.

STRATIGRAPHY

Upper Layers, on the Remaining Plateau

The trenches and sondages running N–S between grid lines M-Q revealed that the all the archaeological layers above the Stratum XI tephra had been essentially completely removed by the previous excavations, with the exception of some layers of very limited depth and extent remaining on part of the plateau. Below these surface layers and above the tephra of Stratum XI, all around the face of the large pit remaining from the earlier excavations, only reddish to reddish-yellow, sterile sediments were found. At only one spot on the terraced face of this pit, a small patch of dark gray-black sediment was found at an elevation that suggested that it might be a remnant of Basler's (1975) Stratum VI (Fig. 5, marked 3b on far left end of profile). However, this was only a small patch of sediments, which proved to be devoid of any archaeological materials.

Over most of the plateau area, the remaining archaeological layers were relatively thin and in most cases appeared to contain a mixture of materials from different periods. Typically, over everything, once any grassy, surface growth was removed, was a layer of light gray, very loose and powdery sediment without any apparent bedding or other soil or sedimentary structure. This layer was very thin on the eastern part of the plateau, but thickened abruptly to the west, from about the M grid line (Figs 5, 6, 8), and formed a rather deep, amorphous, and apparently disturbed layer, with archaeological materials from Meso- lithic, Neolithic, Eneolithic, and possibly the Early Bronze Age periods. Below this "gray, dusty, surface layer", in the middle of the shelter, the stratigraphy and nature of the sediments was rather different between those on the interior of the protective wall and fence and those beyond this wall, approaching the talus slope.

On the outside, layers and sediments largely have the appearance of redeposited materials that were dumped down the exterior talus of the shelter in the course of earlier excavations. The layers more or less alternate from dark, gray to black or "greasy" black to light yellow or reddish yellow, with varying amounts of small to larger rock fragments included in the sediment. Approaching the mouth of the shelter, several of these layers are relatively thin and lie at a steep angle over the underlying reddish, sterile deposits. At their furthest extent, just before the present talus slope begins, layers are heaped up in thicker, looser, and more jumbled masses, with few clearly defined, stratigraphic layers (Fig. 5). No clear features were evident over these parts of the site. Archaeological materials consisted of ceramics, lithics, and fragments of animal bone. Subsequent examination of the ceramics failed to reveal any clear chronological identity to these outside layers. The overall impression is that all the sediments and included archaeological materials are in secondary position in this part of the site, and are most likely the remains of dumping of backdirt from the earlier excavations of the upper, Neolithic and later, strata further inside the shelter.

Inside the wall and fence, there was an extent of flat plateau over which stretched a short series of relatively horizontal layers, some of which appeared possibly to be still *in situ*, archaeological strata. However, in the deeper portions of this series, toward the interior of the shelter, there were some thicker layers and pockets that again appeared to be disturbed and in secondary position (e.g., Fig. 5, north of grid line 100). The area of

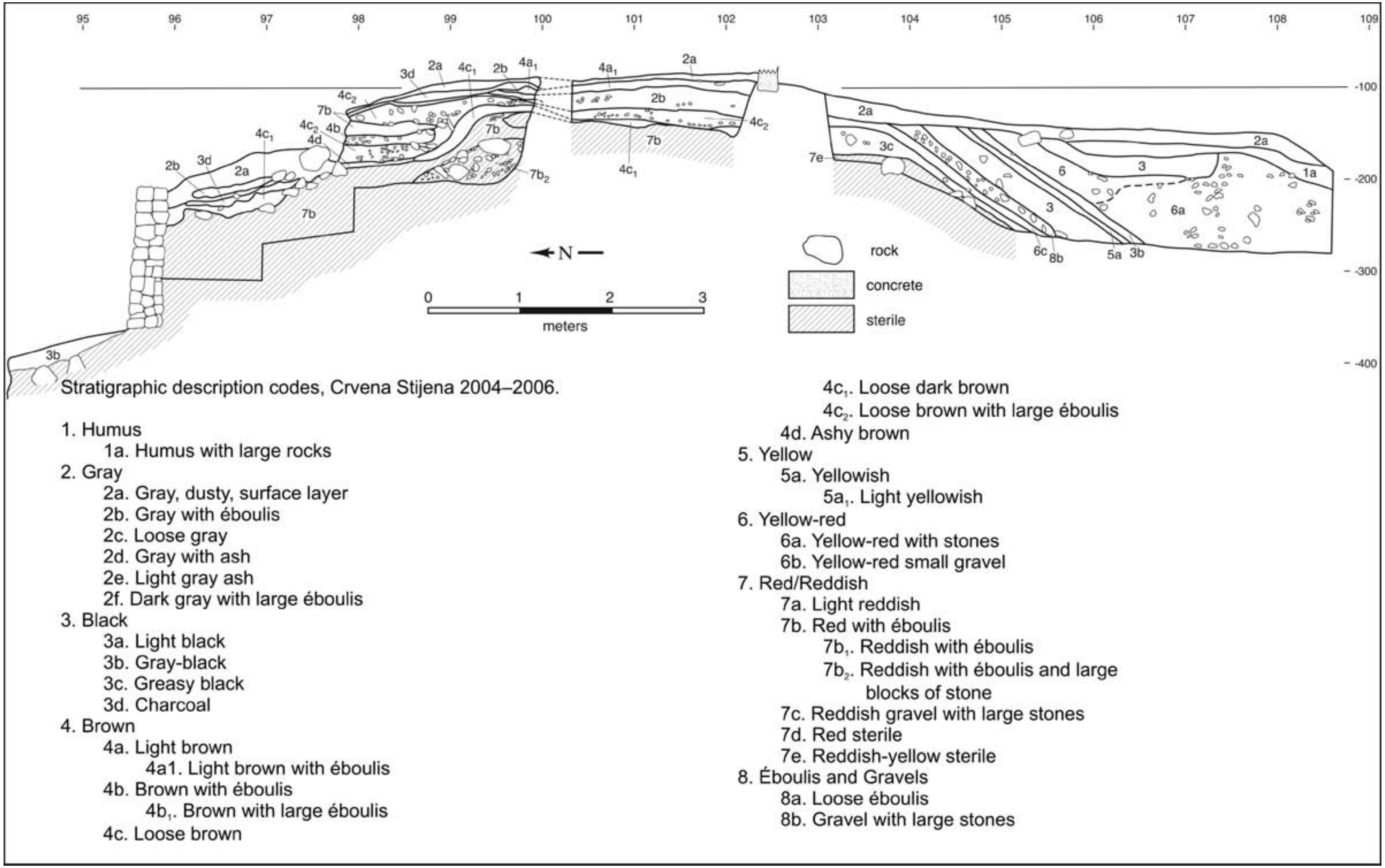

Fig. 5. Stratigraphic cross-section of the remaining surface sediments as seen in the N–S trench. This profile was drawn from the east wall of the trench, in terms of our new grid, along the P line from lines 108/109 to 100, and along the Q line from 100 to 93/94

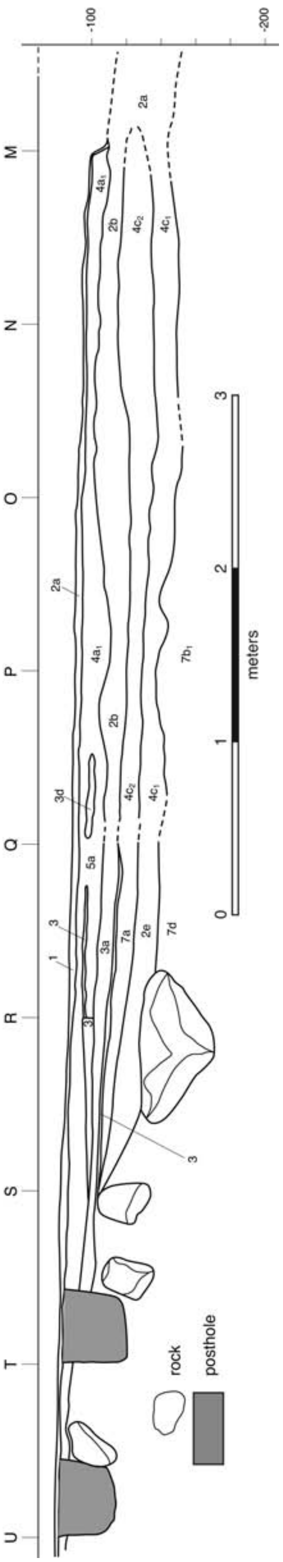

Fig. 6. Stratigraphic cross-section showing horizontal, surface layers along the 100 line, over the eastern portion of the plateau from grid line M to grid line U. Stratigraphic description codes are given in Fig. 5

horizontal layers extended primarily over the eastern portion of the plateau, as can be seen in the profile from grid line M to grid line U, along the 100 line (Fig. 6). Extending downward from various of these uppermost layers were smaller and larger pits (e.g., Fig. 6, near U and near T). Some of these pits may have been small storage pits (Fig. 7), but the majority were clearly identifiable from their size and the frequent stone packing around them as post holes. These postholes do not appear to outline any structure, but they do appear to occur regularly in pairs spaced most commonly about 1.0 m apart, although there are several pairs that are only about 0.5 m apart, and one pair separated by 1.5 m (Fig. 7).

The intact, surface layers found over the eastern portion of the plateau terminated rather abruptly at about the M grid line. From this point on over the western part of the remaining plateau, the site was covered by a more or less thick, loose, powdery, gray layer, full of archaeological materials from a variety of periods, from the Mesolithic on. This appeared clearly to be a highly disturbed layer, perhaps backdirt thrown over this part of the site from the earlier excavations of the later layers in the interior. Absolutely no stratigraphic structure was observed in this layer. Only at the far western end of the remaining plateau, buried rather deeply under the powdery gray surface layer, were several remnants of *in situ*, Mesolithic layers discovered (Fig. 8). Although only remnants, these layers were intact, contained several hearths and ash lenses, provided a small but good sample of Mesolithic archaeological materials, and produced a series of three consistent ^{14}C dates of about 6460 cal BC for one of the upper layers and around 8000 cal BC for one of the lower layers (Fig. 8). These layers and the material from them are described in more detail below.

Below all these uppermost layers lay only sterile, red to reddish-yellow sediments, probably all washed down into the shelter from soils on the surfaces of the hill above the site. In 2006, excavations were focused entirely on removing a large block of these sediments over the eastern portion of the site, inside the 100 grid line. The aim of this large-scale removal of sterile material was to begin to open up an area over which it would be possible to excavate the substantial, underlying, Middle Paleolithic layers. By the end of the 2006

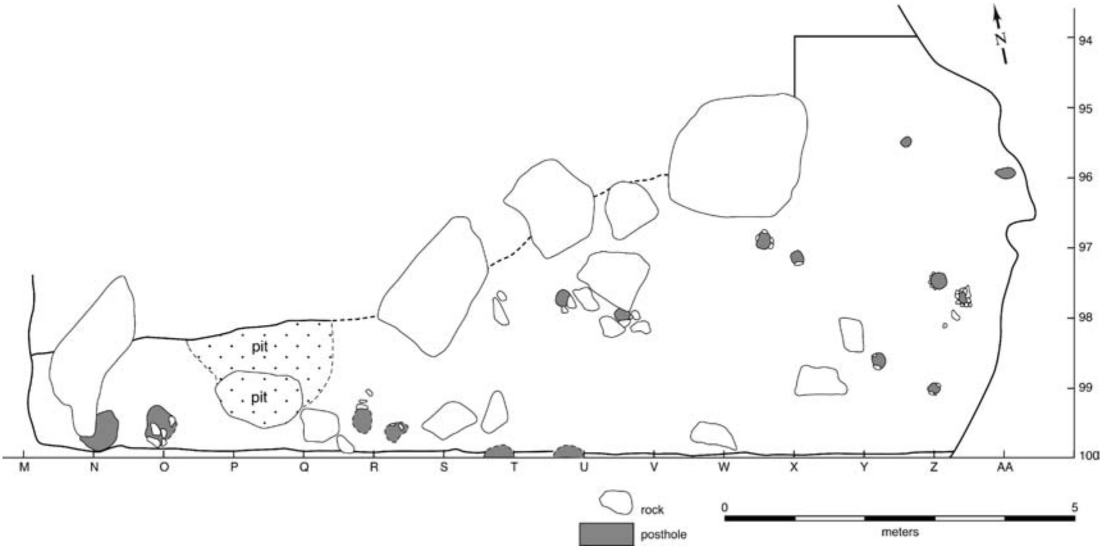

Fig. 7. Probable postholes occurring in pairs, found in the uppermost levels of Crvena Stijena

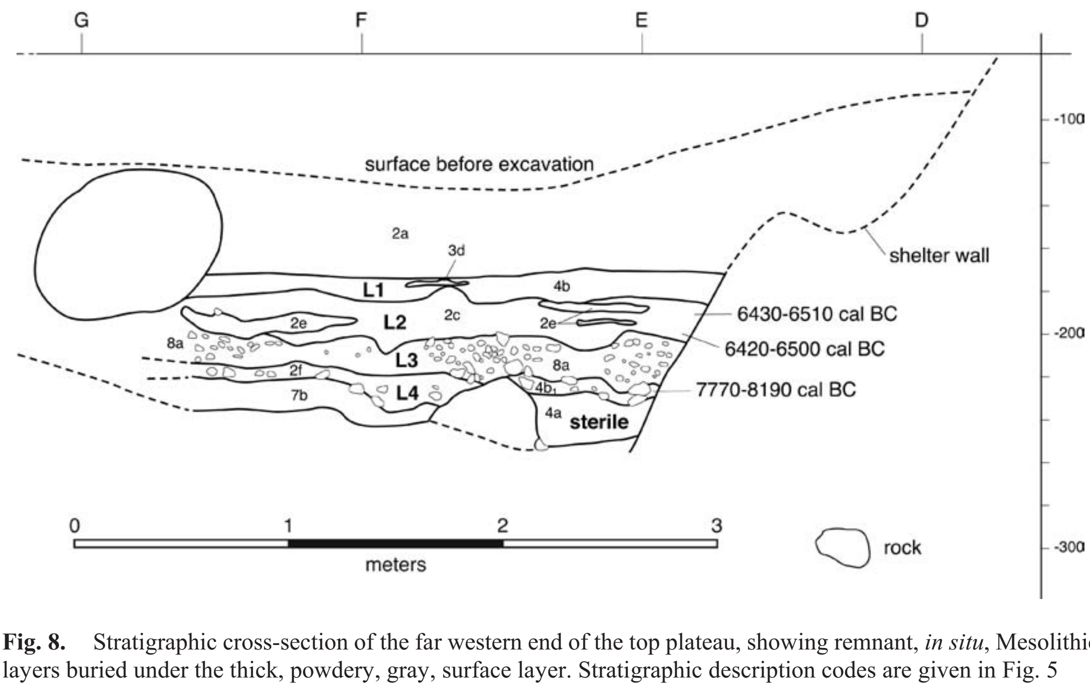

Fig. 8. Stratigraphic cross-section of the far western end of the top plateau, showing remnant, *in situ*, Mesolithic layers buried under the thick, powdery, gray, surface layer. Stratigraphic description codes are given in Fig. 5

season, sterile sediment had been removed over an area roughly from grid line M over to grid line V down to a level at which it appeared that the tephra of Stratum XI was beginning to be uncovered. Judging from the already-exposed profiles from earlier excavations, the lower, Middle Paleolithic layers should lie directly below this tephra layer.

Cleaning of fallen Middle Paleolithic deposits

As noted above, a noticeable amount of sediment had fallen or washed down from the south face of the profile of the deep, Middle Paleolithic layers, coming, as nearly as we could judge, from the level of Basler's (1975) Strata XXII–XXVII. Some of this material was collected, partly to clear it away from the intact profile face to allow geological sampling, and it was carefully screened, even though it was no longer in situ and could not provide a precise stratigraphic context for the materials found in it.

As luck would have it, a complete Neanderthal tooth was recovered from the screening of these fallen deposits (Fig. 9). Anthropological investigation of this tooth remains to be done, but it is an encouraging sign that other human remains from the Middle Paleolithic may possible be found in further excavations of these lower strata.

Fig. 9. Neanderthal tooth found while screening debris fallen from lower strata in Crvena Stijena (photo: Jamie Clark)

POTTERY FROM THE REMAINING UPPER LAYERS

A small amount of ceramic material was found during the 2004–2006 excavations at Crvena Stijena. This material was found mostly in the upper layer of gray, dusty sediments with éboulis that was concentrated toward the western wall of the shelter. This layer was removed over the relatively small area covered by grid squares A96-103 to O100-105. This layer has an average depth of around 60 cm in the western part of this area, and it diminishes in thickness to a little less than 30 cm until it finally disappears at about grid line M. It was quickly noted that the major part of this layer was made up of sediment redeposited from the earlier excavations of Holocene layers in this site. On the eastern side of the top plateau, only an insignificant number of ceramic fragments was found, mostly in shallow postholes.

By carefully screening the sediment from the upper layer on the western side of the site, we were able to recover 256, small, or, better, tiny potsherds (1–2 cm^2). The majority of these sherds came from the western side of the site, on which the deposits of excavated sediments were largest. A serious analysis of this material is made difficult by their unclear stratigraphic context, their low number, and their small dimensions. Nevertheless, it is possible to chronologically place a limited number of these sherds, mostly rim fragments, handles, or bases, on the basis of their ornamentation or form.

The ceramics illustrated in Figure 10 represent several fragments of vessels which, from their character, may be placed in specific periods of occupation at Crvena Stijena. Examples 1–8 are from vessels belonging to the early phases of the Neolithic. Their decoration was made with stamping or by impression with a specific instrument (fingernail, shell edge, or some other instrument). The decoration on examples 1 and 2 were made by impression, creating horizontal lines of short, vertical cuts on the burnished surface of a reduction-fired vessel. The decoration was made with a specific instrument, and presents a certain character of the ceramic material at Crvena Stijena, chronologically linked to Stratum III of the previous excavations (Benac, 1975: 129, T. III; Marković, 1985: 14).

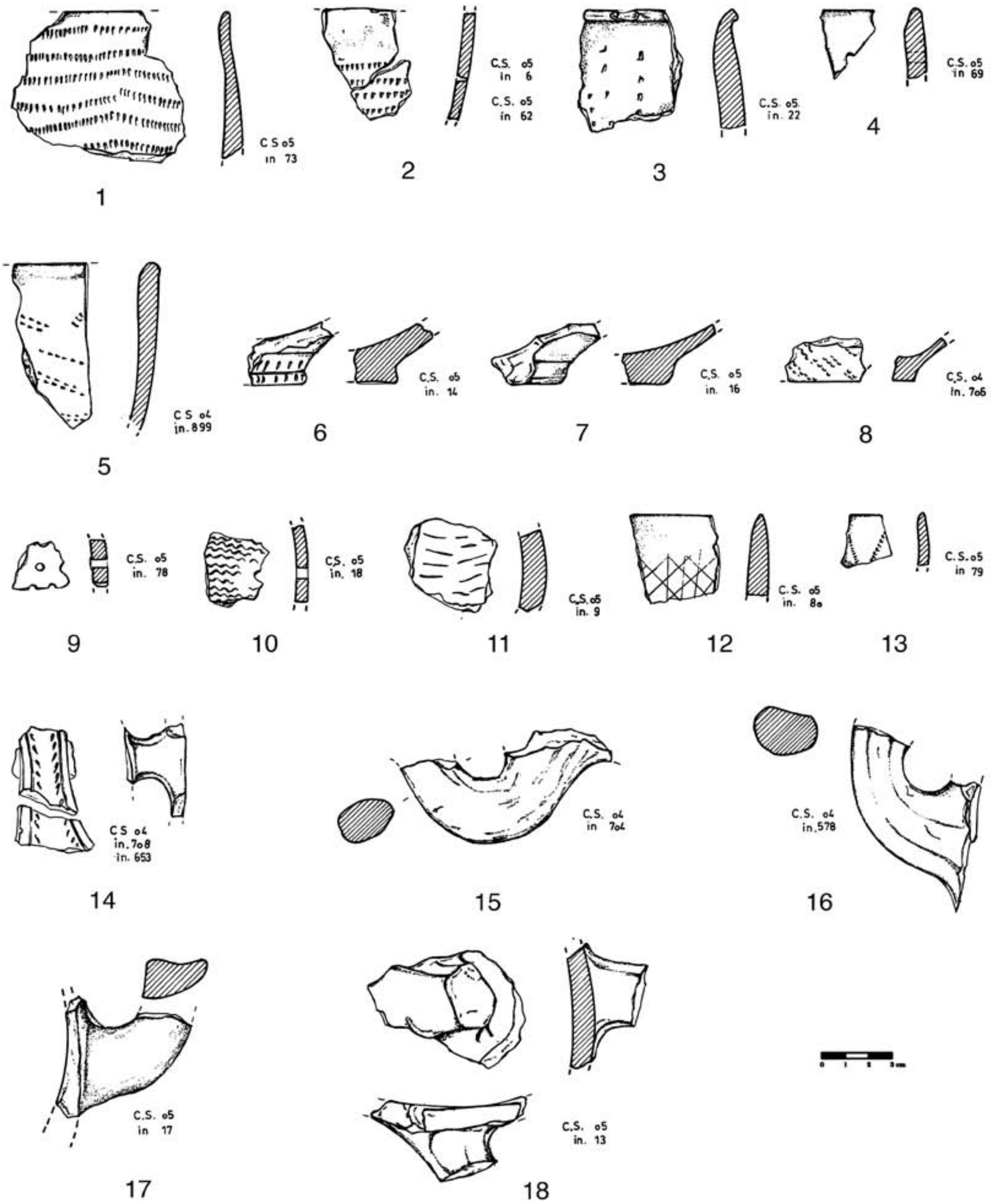

Fig. 10. Ceramics from the uppermost layers excavated at Crvena Stijena in 2004–2005

Several fragments of ceramics have Middle Neolithic characteristics, that is, of Crvena Stijena Stratum II (Fig. 10: 9–13). One rim sherd with thin walls and burnished surface is decorated with incised crossed lines (Fig. 10: 12), which is “the basic way of decorating ceramics of this stratum” (Benac 1975: 141, T. VI 3–4).

Decorated handles, as illustrated in Fig. 10: 14, are from vessels used in the Early Bronze Age. Such handles were found in Strata I and II of the earlier excavations (Benac, 1975: 142, T VIII 2). More widely, this kind of handle can be compared with finds from several tumuli in Montenegro, such as Mala Gruda and Velika Gruda near Tivat (Primas, 1996: 58), Gruda Boljevića in Podgorica, and a stray find from Rubeža Nikšić.

In Figure 10: 15–18, horizontal, banded handles with with triangular cross-sections are presented that belong to a kind of pot which was frequently found in Stratum I at Crvena Stijena, and which belongs chronologically to the developed Bronze Age or the Early Iron Age (Benac 1975: 144).

PRELIMINARY RESULTS OF GEOARCHAEOLOGICAL RESEARCH AT CRVENA STIJENA

The Crvena Stijena sediments

The Pleistocene deposits at Crvena Stijena are more than 20 m in thickness and constitute one of the deepest rockshelter sediment records in Europe. In very general terms the rockshelter sediments comprise poorly sorted angular and sub-angular limestone clasts with a fine-grained matrix of variable composition but dominated by silt and clay (Fig. 11). Large limestone boulders are present throughout the sequence (Fig. 12a) and both matrix-supported and clast-supported fabrics are present. The geoarchaeological research at Crvena Stijena forms part of a PhD program undertaken by Morley and is based on geo- archaeological fieldwork carried out at the site in 2004 and 2005 following a reconnaissance study by Woodward and Whallon in 1998.This research has three principal aims:

1) To document the sedimentary record in the rockshelter and to assess its value as an archive of Pleistocene environmental change.

2) To conduct a range of analyses on the fine sediment fraction throughout the sequence to determine how natural geomorphological processes and human activity have shaped the evolution of the sedimentary record.

3) To carry out detailed microstratigraphic analysis of key sedimentary features to investigate the human use of the site and the role of anthropogenic activity in site formation.

The geoarchaeological investigations have combined a range of approaches including detailed field-based logging and sampling of the sedimentary record and laboratory-based analysis of the fine sediment fraction. The latter includes sedimentological, geochemical, mineral magnetic and microscopic techniques, including microstratigraphic analyses using thin sections derived from impregnated blocks of sediment (Courty *et al.*, 1989). These approaches will allow us to explore the relationship between the cultural record and the local and regional record of environmental change that emerges from the study of the rockshelter deposits.

Field and laboratory methods

Geoarchaeological fieldwork in 2004 and 2005 was carried out in unison with the archaeological field seasons. Detailed section logs were drafted in the field and located on a site plan. Bulk sampling of over 9 m of sediment at 50 mm resolution was combined with the collection of intact blocks of sediment using Kubiena tins for the preparation of thin sections. Samples of local bedrock and Quaternary sediments were also collected from the immediate environs of the rockshelter to allow the source of the sediments found within the rockshelter to be established.

A range of laboratory analyses have been conducted on the fine sediment fraction from the bulk samples (Woodward and Bailey, 2000; Woodward *et al.*, 2001). Particle size, grain morphology, organic matter content, calcium carbonate content and charcoal abundance analyses have been carried out on almost 200 samples. In addition, XRF and mineral magnetic analyses of rockshelter sediment samples and potential off-site source materials have been carried out. The distinctive tephra layer that lies at the boundary between the Upper and Middle Paleolithic assemblages was also sampled in 1998 and 2004. This material was identified as volcanic in origin during the original excavations at the site and was labeled “Layer XI” by Brunnacker (1975) (Fig. 11) – although the provenance and age of the tephra was not established. The detailed results of these analyses will be presented in Morley’s PhD thesis. This preliminary report will focus on the outcomes from the micromorphological investigation of Middle Paleolithic hearth features and the analysis of the volcanic ash.

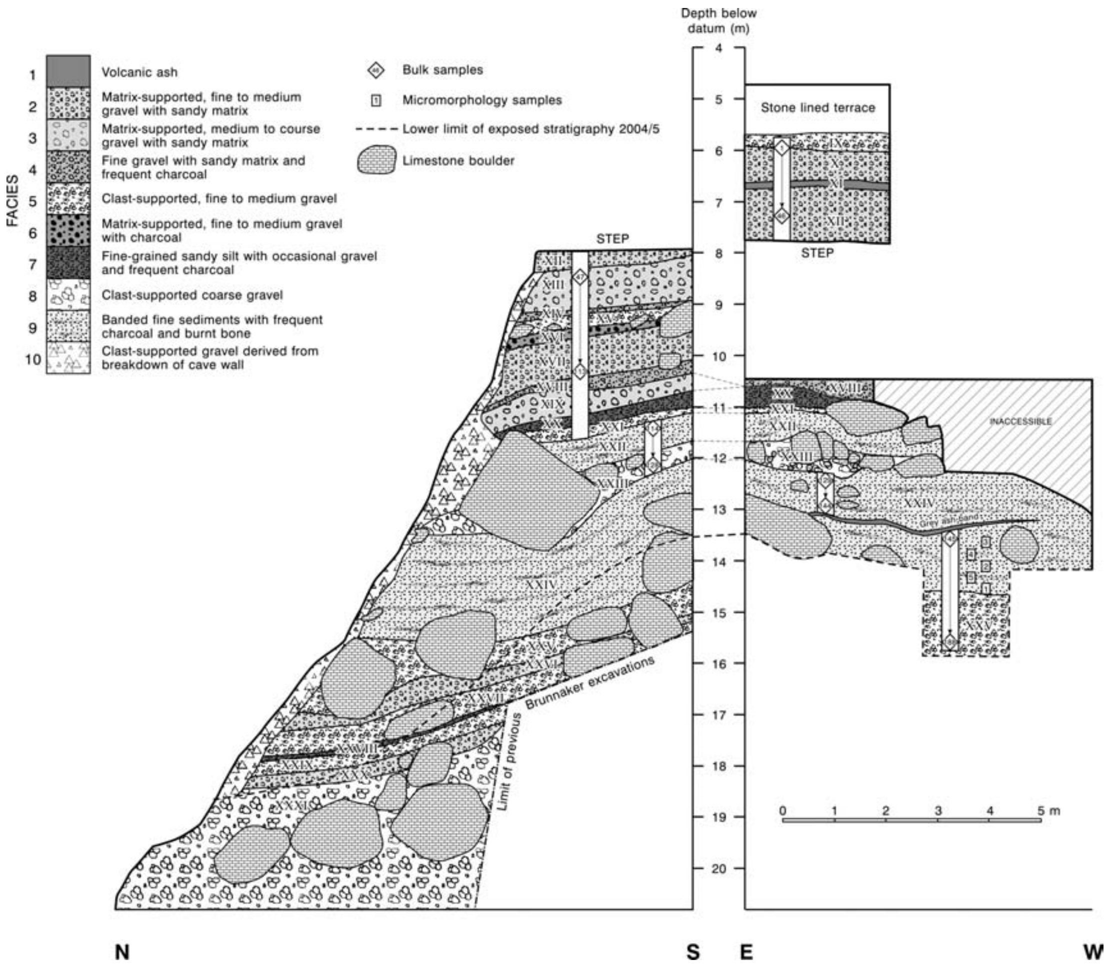

Fig. 11. Composite profile of the section of the Middle Palaeolithic sediment sequence exposed at Crvena Stijena and sampled as part of the geoarchaeological work carried out at the site (adapted from Brunnaker 1975)

In July 2004 a 6 m profile was selected for study (Figs 11, 12a). The sampled column of sediment immediately underlies a distinctive, laterally continuous ash layer. Below this ash layer the entire profile contains abundant Middle Paleolithic lithic material. In places the sediments are matrix supported and intact blocks of sediment (50 × 50 × 200 mm) have been extracted for microstratigraphic analyses (Courty *et al.*, 1989).

In 2005 a further 4 m of the rockshelter sediment record was sampled at 50 mm resolution. This extended down from the base of the 2004 sample column (Figs 11, 12b) and added two meters at the top to incorporate the ash layer and thus creating a continuous column through over 9 m of sediment. Where present, samples of burnt flint and fossil teeth have been collected from the sampled sediments for dating by Thermoluminescence (TL) and Electron Spin Resonance (ESR). The development of a robust geochronology is a key requirement if the aims of the geoarchaeological research are to be fully realized.

Micromorphology

The micromorphological study of intact microstratigraphic features in sedimentary sequences can reveal much about the depositional,

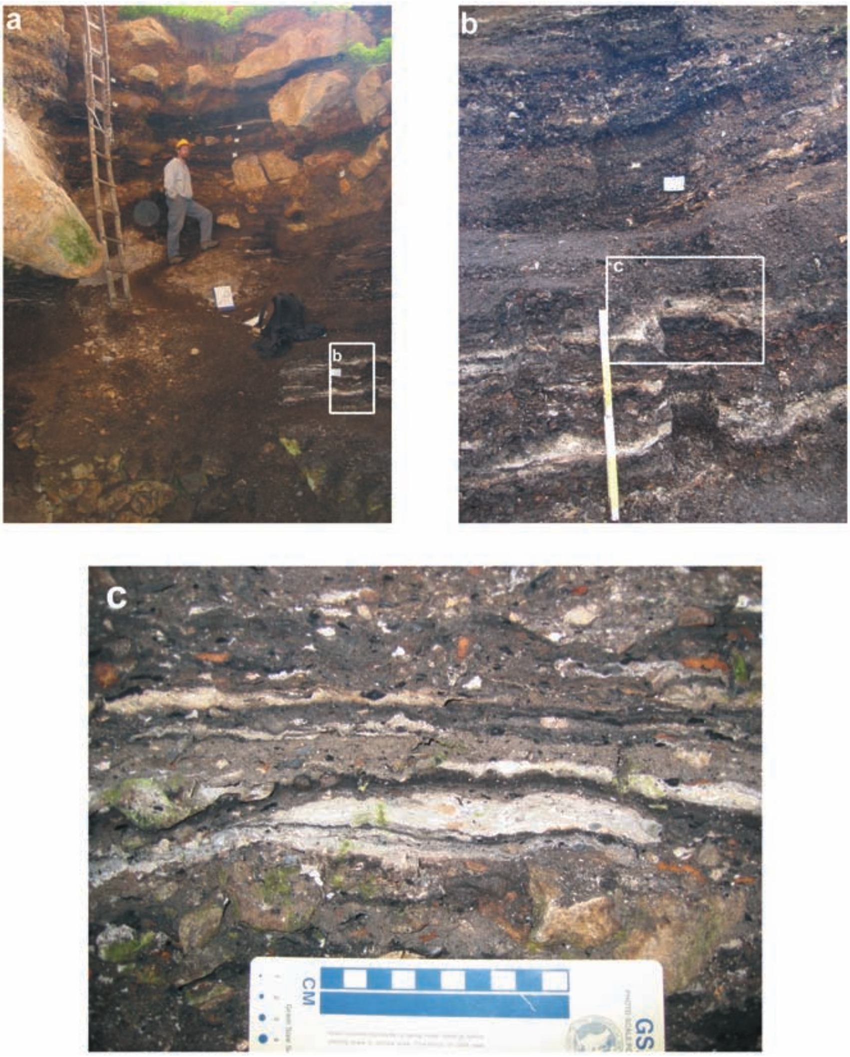

Fig. 12. (**a**) The lowermost 5 m of the Middle Paleolithic record exposed at Crvena Stijena in 2004. Note the large boulders in the upper part of this exposure and the distinctive layering in the lower part of this exposure. (**b**) Details of the sediments shown in the lower part of (a) showing the location of the samples collected for thin section production (scale bar = 20 cm). (**c**) Detail of a well defined lenticular hearth structure exposed in (b)

post-depositional and occupation history of a site. This approach has been successfully applied to examine site formation processes (Goldberg *et al.*, 2001; Vallverdu *et al.*, 2001; Angelucci, 2003; Mallol, 2006; Goldberg and Sherwood, 2006), the nature of Quaternary environmental change in the off-site environment (Courty *et al.*, 1989; Courty and Vallverdu, 2001; Karkanas, 2001), the history and intensity of human occupation of a site (Matthews *et al.*, 1997; Goldberg and Arpin, 1999; Karkanas, 2002), and the depositional and post-depositional history of cave and rockshelter sediments (Goldberg *et al.*, 2001; Karkanas, 2002).

In the lower part of the sedimentary record a thick sequence of distinctive and well stratified ash layers was observed (Fig. 12b). These layers are rich in charcoal and crushed faunal material, and occasionally yield burnt flints. The ash layers are commonly lenticular within dark, charcoal-rich sediments (Fig. 12c). Blocks of undisturbed sediment (50 x 50 x 200 mm) were extracted from this part of the sequence so that the nature and origin of the distinctive white ash layers could be established. Thin sections were made from these sediment blocks after resin-impregnation and curing (Goldberg and Macphail, 2003).The thin sections were examined using a petrological microscope in both plane-polarised light (PPL) and cross-polarised light (XPL) following methods and descriptions outlined in Stoops (2003). Preliminary work on these features have allowed for the recognition of 4 main microfacies.

Microfacies A

Directly overlying the main ash band is a thin layer of densely compacted, homogeneous micritic (<5 µm) calcite in which organic and charcoal inclusions are very infrequent (Fig. 13). This is thought to represent completely combusted organic material covering the upper surface of the hearth. Such upper layers comprising a very pure calcitic groundmass have also been observed at other sites in the Near East and South Africa (Schiegl *et al.*, 1996).

Microfacies B

The white ash band shown in Fig. 13 comprises primarily calcite pseudomorphs of calcium oxalate (CaC_2O_4) crystals (c. 25 µm in diameter), which are common and occur naturally in the wood and leaves of plants and trees (Canti, 2003). Fresh wood-derived ash is composed of calcite which is the product of the reaction between carbon dioxide in the air and calcium oxide (from calcium oxalates in the wood) during exposure to high combustion temperatures (Weiner *et al.*, 2002). Sometimes calcite pseudomorph features of the original plant structure are preserved within an ash layer. Within the hearth features studied at Crvena Stijena, fresh, untransformed calcium oxalate crystals are often found within a fine matrix (groundmass) of micritic (<5 µm) calcite. Intact cellular plant structures have also been observed which indicate that the position of these layers is exceptionally well preserved and have not been reworked. An absence of phytoliths in this microfacies, and in the ash layers in general, confirm that wood is the most likely fuel being used for these fires.

Calcined bone fragments (mm-size) occur within microfacies B (Fig. 13) and indicate burning at temperatures exceeding 650°C resulting in the complete oxidisation of the organic matter (Courty *et al.*, 1989; Schiegl *et al.*, 1996). Other bone fragments observed are dark in colour and have a very dark outer rim which shows that the bone has been burned at lower temperatures than the calcined bone fragments.

Microfacies C

Directly beneath the ash is a dark, reddened layer indicating that the substrate beneath the ash bands has been directly affected by heating from the overlying hearth (Fig. 13). This rubefication, along with the overall structure and composition of these materials, demonstrate that the hearth is still in its primary position and has not been significantly disturbed since deposition.

Microfacies D

The material in which the hearth structures are stratified contains abundant bone fragments, charcoal, limestone fragments, calcium oxalate crystals, and occasional mineral grains in a calcite groundmass (Fig. 13). This material appears to be a generally uniform, unstratified mixture of natural and anthropogenic debris situated within a charcoal-rich, matrix. The high frequency of burned material within this microfacies implies that this microfacies originates partly from the periodic raking out and levelling of the cave floor.

Summary of the micromorphology

Micromorphological investigation has been carried out on samples collected from well defined black and white ashy layers at the base of the sampled sequence in the rear portion of the cave (Figs 11, 12b, 12c). These layers have been interpreted as hearth structures associated with hominid activity in this part of the rockshelter when these sediments formed part of the living floor. These features are in-situ and the hearths represent Middle Palaeolithic activity areas used by the occupants of Crvena Stijena for the cooking of food (Fig. 12c). Such hearth features of Lower and Middle Palaeolithic origin are relatively common at sites in the Near East (Meignen *et al.*, 1989; Mercier *et al.*, 1995; Stiner *et al.*, 1995; Meignen *et al.*, 2001; Albert *et al.*, 2003) containing abundant ash and charcoal and exhibiting a substrate of reddened sediment (Schiegl *et al.*, 1996). Significantly, the relationship between these structures and the underlying layers of mixed material indicate that these hearths are intact, and are not the result of sediment reworking through natural processes. The microstratigraphic work at Crvena Stijena shows much promise and this approach is yielding valuable insights into Middle Palaeolithic cultural activity and the origin of the sedimentary record.

Layer XI at Crvena Stijena

The central and eastern Mediterranean contains one of the best databases of Late Quaternary volcanic activity and airfall tephras form valuable stratigraphic markers in many areas (Vezzoli, 1991; Narcisi and Vezzoli, 1999; Wulf *et al.*, 2004). A layer of ash approximately 100 mm in thickness is present at Crvena Stijena extending laterally across much of the site (Fig. 14). It lies at or close to the boundary between the Middle and Upper Paleolithic industries at the site. Samples of the ash were collected from exposed sections and subjected to a range of analyses to allow comparison with existing tephra data from the Mediterranean region.

Morphology of tephra particles

The morphological characteristics of glass shards and pumice grains have been examined using SEM and are identical to those documented for the Y5 tephra found in many locations around the Mediterranean region (Vezzoli, 1991; Narcisi and Vezzoli, 1999). This tephra is associated with a very large volcanic eruption in the Phlegrean Fields area of southwest Italy – associated with the Campanian Ignimbrite – and is thought to have occurred between 39–41 ka BP (Ton-That *et al.*, 2001). The key morphological characteristics of the Crvena Stijena ash that show close similarities to the Y5 tephra (Vezzoli, 1991) are as follows:

(1) 'Y' shaped, flat or curved shards created by the fragmentation of large vesicle walls (Fig. 15b)

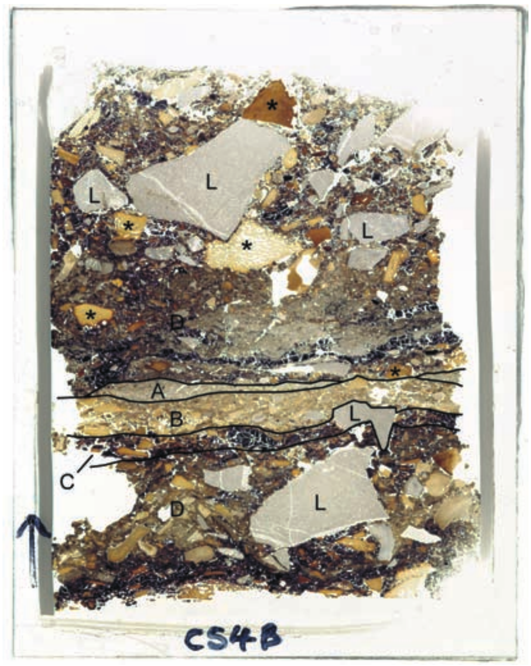

Fig. 13. A thin section produced from a sample collected from the areas shown in 1b. The four microfacies (A to D) described in the text are labelled. L = limestone fragments and * = burnt bone

(2) Intact bubbles sometimes preserved within the glass shards

(3) Pumice grains with intact spherical vesicles as shown in Fig. 15a.

All of these features can be seen in the examples shown in Fig. 15.

Major element geochemistry

To further constrain the origin of the Crvena Stijena ash an electron beam micro-analyser (EPMA) was used in conjunction with the SEM apparatus to generate a geochemical signature for the tephra using major element geochemistry. Data were collected for 60 shards. A comparison with data from tephra samples from other sites in the Mediterranean shows that the Crvena Stijena ash has a geochemical signature indicating a Campanian-Ignimbrite origin (southwest mainland Italy) and we correlate the ash with the Y5 tephra that is widespread in the eastern Mediterranean (Fig. 16).

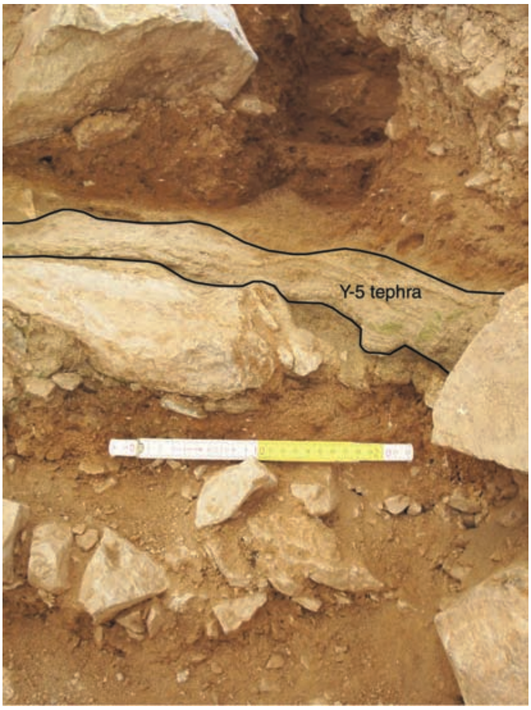

Fig. 14. The tephra layer at Crvena Stijena. Note the coarse matrix-supported clasts above and below this layer. Scale bar = 20 cm

The identification of the Y5 tephra at Crvena Stijena is significant because it is a well documented chronostratigraphic marker across the region. It provides the only firm chronological control in this part of the sequence and it will aid correlation with other archaeological sites and palaeoenvironmental records. The occurrence of this tephra at Crvena Stijena in such a thick, homogeneous and laterally extensive layer is notable as it shows how a south facing cave of this size can act as a trap for far-traveled windblown material. Micromorphological analysis of a thin section through the tephra sediments will help to confirm its depositional context – initial results indicate that the ash layer has not been reworked by running water.

Discussion and conclusions

The geoarchaeological work at Crvena Stijena is ongoing but these preliminary results show that there is much promise in the approach outlined here. Micromorphological study of thin sections from sediment containing Middle Paleolithic artifacts has shown that discrete burnt features observed in much of the lower parts of the Crvena Stijena profile are *in situ* hearths. The distinctive stratigraphy in this part of the record represents a series of stacked Middle Paleolithic hearth features. This is a key feature of the Crvena Stijena record and developing an independent geochronology for these sediments is an important priority. The tephra at the site has been shown to correlate with the Y5 tephra of Campanian-Ignimbrite origin. This major volcanic eruption occurred between 41–39 ka BP and its fallout products have been identified throughout the central and eastern Mediterranean region and even as far afield as Russia. As this work progresses, the use of micromorphology alongside mineral mag-

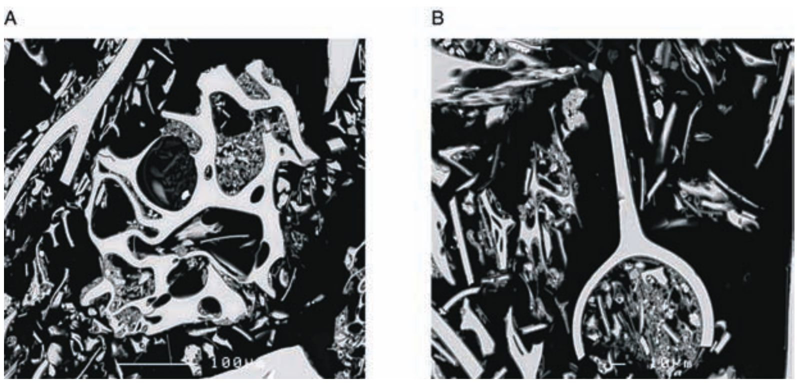

Fig. 15. SEM images of tephra pyroclasts from the layer shown in Fig. 11. (a) Pumice material with intact spherical vesicles and (b) a Y-shaped glass shard. Scale bar is 100 microns for each image

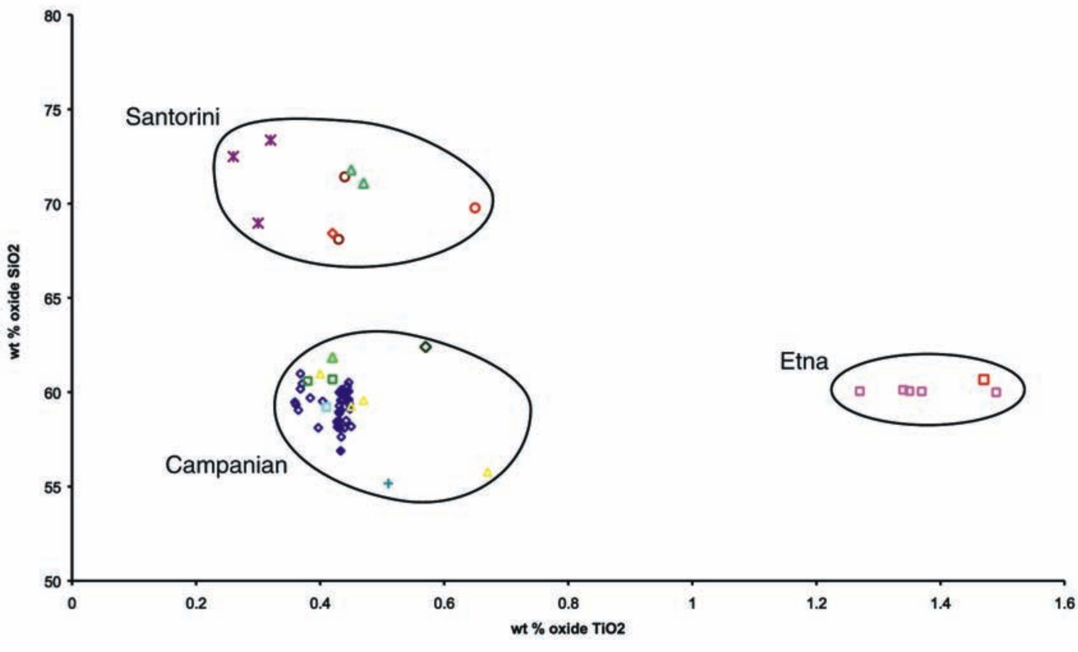

Fig. 16. Selected major elements from the Crvena Stijena tephra samples shown in relation to other tephras in the central and eastern Mediterranean from Narcisi and Vezzoli, 1999). The Crvena Stijena sample closely matches the other samples that have been attributed to the Campanian Y5 eruption

netic analyses and quantitative sediment sourcing will allow deeper insights into the origin of the sediment record by providing local and regional off-site environmental context for the microfacies data.

EXCAVATION OF REMAINING INTACT MESOLITHIC DEPOSITS

As outlined above, one of the main goals of the new excavations was to find and excavate any remaining Upper Paleolithic or Holocene archaeological layers in Crvena Stijena. It was expected, from the results of the earlier excavations, that such layers might be found near and sloping up toward the entrance of the shelter. As described by the earlier excavators, the Mesolithic Stratum IV could be followed on the central and eastern peripheries of the site only between the "large blocks from the collapse of the shelter on level XI," while materials from later periods were mixed together, and on the western side of the shelter, it was not possible to separate horizons within Stratum IV (Basler, 1975: 12–13). Neolithic Stratum III contained only a small amount of archaeological material "characteristic of the periphery of an occupation area" (Benac, 1975: 122).

Results of the 2004 excavations confirmed these expectations. It was found that Holocene materials appeared at the entrance to the shelter only in surface layers in which remains from several prehistoric periods were generally mixed together. However, a small area of intact, *in situ*, Mesolithic deposits was discovered in the 2005 excavations, after cleaning off the backdirt from the earlier excavations and the removal of the retaining wall of the first terrace on the western portion of the top plateau (Area I, Fig. 4). Several layers of gray and brown, loose, dusty sediments were observed along the shelter wall in squares E-G97 and E-G98. The stratigraphy of these layers could be followed clearly in the profile of this western edge of the top plateau (Fig. 8): Layer 1 – brown sediment with éboulis, Layer 2 – gray sediment with éboulis and several levels of ash, Layer

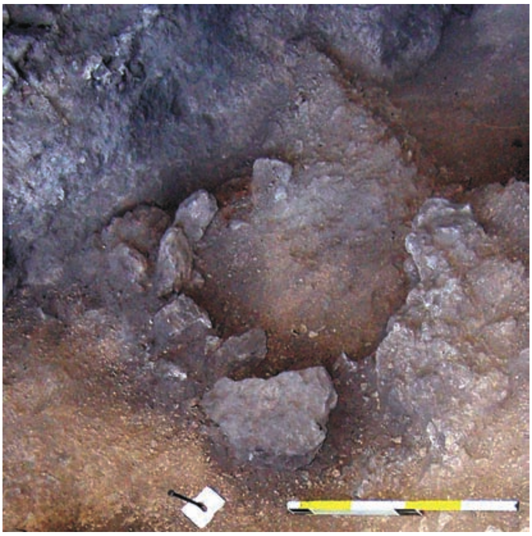

Fig. 17. Circular hearth basin, with charcoal and ash fill removed, near the base of Layer 2, square E97, in the in situ Mesolithic deposits in Area I, 2005 excavations at Crvena Stijena (photo: Dušan Mihailović)

3 – loose éboulis, and Layer 4 – dark gray to brown sediment with large éboulis. The remains of Layer 4, greatly disturbed by occupational activity, were found at the base of the plateau terrace in squares F-G96 and F-G97.

Description of the layers and the context of finds

The lowest horizon in this stratigraphic complex is Layer 4, which lies directly on a level of Pleistocene age on whose surface there are large blocks of rock. This layer exhibits the characteristic slope of later archaeological levels from the shelter entrance down toward its interior and from the central part of the shelter toward its western wall. It appears in squares H98-99 immediately below the surface layer, at a depth below the plateau surface of some 10 cm, and then drops down steeply to a depth of fully 90 cm in the depression seen in profile in squares D-F97-98 (Fig. 8), where the rest of the intact Mesolithic layers are also preserved.

Traces of charcoal and ash, snail shells, animal bones, and a few artifacts were found in Layer 4. The homogeneity of this layer is confirmed by the conjoining of horizontally separated flaked flint artifacts within the layer and by the fact that there are no intrusive finds from higher levels. Layer 4 is ^{14}C dated to 7700–8190 cal BC (Beta-211505).

Layer 3 occurs over a very small surface. Questions about the factors influencing the formation of this layer remain open. It is possible that the accumulation of éboulis might have come from the disintegration of larger blocks of stone on the surface at the entrance to the shelter, but human activities related to leveling and cleaning of the occupation surface might also have been responsible for the formation of Layer 3. In square G98, Layer 3 is only a couple of cm thick, on the border between squares F-E97 around 5 cm (in this area it can be best delimited as a separate layer), while it is thin and difficult to separate from Layer 4 in square E97. No archaeological material was found in this layer.

Layer 2 is relatively thick and contains several levels of charcoal and ash. Near the base of Layer 2, in square E97, an irregular circular hearth around 70 cm in diameter, constructed of rocks of 10–15 cm in size, was found (Fig. 17). Beside this hearth, in square F97, was a zone of burned earth. The hearth was covered by a level of ash, above which lay another charcoal layer. At the same level as the ash in square E97, a second zone of ash was observed in the neighboring square G98, at the very edge of the terrace

A significant amount of bones, snail shells, and flaked lithic artifacts was collected from Layer 2. With the exception of a single fragment, which was found in the zone of mixture with Layer 1, no ceramics were found in this layer. Two ^{14}C dates were obtained from Layer 2: 6510–6430 cal BC (Beta 211504), for a sample taken from squares E-F97 and 6500–6420 cal BC (Beta 211503) for a sample from square E97.

In the greatly disturbed surface layer (Layer 1), only a few artifacts of different periods were found. Near the base of Layer 1, another zone of ash was observed, with two postholes 7–10 cm in diameter.

Flaked lithic artifacts

Only a very few flaked lithic artifacts, a total of 77, were recovered from all *in situ* layers to-

Table 2

Lithic assemblage from Layer 4 in excavations of the first terrace on the western portion of the top plateau

	Chalcedony	Flint	Matt flint	Chert	Other	Indeterminate	Total
Cores	0	0	0	1	0	0	1
Blades/Bladelets	0	1	0	0	0	1	2
Flakes	0	1	0	5	1	0	7
Tools	0	1	1	0	1	0	3
Total	**0**	**3**	**1**	**6**	**2**	**1**	**13**
+ Small Chips	1	0	0	0	0	0	+1

Table 3

Lithic assemblage from Layer 2 in excavations of the first terrace on the western portion of the top plateau

	Chalcedony	Flint	Matt flint	Chert	Other	Indeterminate	Total
Cores		3	1		1	1	6
Blades/Bladelets	3	5	1		1	2	12
Flakes		2		1		2	5
Tools	2	2			1		5
Microburins		1					1
Total	**5**	**13**	**2**	**1**	**3**	**5**	**29**
+ Small Chips		3			1	1	+5

gether in the excavations of the western end of Area 1. Only 14 flaked lithic artifacts were found in Layer 4 (Table 2). The majority of the finds were recovered from the eastern part of the excavated area, where the layer is best preserved. Among the artifacts, flakes are the most numerous. Gray chert is the dominant raw material, although other materials occur. Among the flaking products are: one fragment of an irregular, globular core, seven flakes, and two blade fragments. Tools consist of two lateral burins – one ordinary and one on the break of a retouched flake (Fig. 18: 1, 2), one nosed endscraper (Fig. 18: 3) and a tool with a straight, steeply retouched truncation (Fig. 18: 4). The retouch is on the proximal end of the tool, while the distal end is broken using microburin technique. No finds were made in Layer 3, if we discount artifacts from the contact zone.

The largest number of artifacts from this area of excavations comes from Layer 2 (Table 3). The majority of the artifacts is concentrated above and beside the hearth. Six cores were recovered (of which four are on flakes), and 12 blades were found, while flakes occur in very small number. Very few artifacts are made on chert, while high-quality varieties of gray and beige flint predominate.

Among the cores, four examples are on flakes: three fragmentary flake cores and one blade core discarded in the initial phase of flaking. Also found was one blade core with no traces of preparation, made on high-quality gray flint (Fig. 18: 5). Among the blades are examples with parallel sides, with triangular and trapezoidal cross-section, and with facetted platforms (Fig. 18: 6–8). Most tools are made on blades, including two semi-steep retouched blades (one with alternating retouch – Fig. 18: 9), and one blade with bilateral, retouched notches (Fig. 18: 10). Also found were one endscraper on a flake and one raclette (Fig. 18: 11, 12). In this layer was found one artifact that can be linked to the microburin technique – a proximal fragment of a bladelet made on gray chalcedony, broken exactly at the spot where there was a shallow, retouched notch created with semi-steep retouch (Fig. 18: 13).

Table 4

Lithic assemblage from Layer 1 in excavations of the first terrace on the western portion of the top plateau

	Chalcedony	Flint	Matt flint	Chert	Other	Indeterminate	Total
Cores		4					4
Blades/Bladelets		2		1			3
Flakes		4		1	1	1	7
Tools		1			1	1	3
Total		**11**		**2**	**2**	**2**	**17**
+ Small Chips		1			1		+2

Table 5

Lithic assemblage from the contact zone between Layers 1 and 2 in excavations of the first terrace on the western portion of the top plateau

	Chalcedony	Flint	MattFlint	Chert	Other	Indeterminate	Total
Cores		1		1			2
Blades/Bladelets	1						1
Flakes					1		1
Tools		2					2
Total	**1**	**3**		**1**	1		**6**

Nineteen lithic artifacts were found in Layer 1 (Table 4). Among the cores are two irregular flake cores, one core with narrow flaking surface, and one regular, conical bladelet core (Fig. 18: 14). Bladelets with triangular cross-section, and smooth platforms, removed in the initial phases of core reduction (with cortex on the dorsal side) are found (Fig. 18: 15, 16). The majority of flakes are broken. Tools include a massive flake scraper (Fig. 18: 17), an irregular blade notched with semi-steep retouch, and one bladelet with a straight, semi-steeply retouched truncation (Fig. 18: 18).

In unsure context at the contact between Layers 1 and 2 (Table 5), were found one typical wedge-shaped core with a flat striking surface and facetted platform on which can be seen traces from the removal of bladelets, and one massive flake core of chert. Among the artifacts are one flake endscraper, and one straight bladelet with deep, steeply retouched notches and a facetted platform. One unretouched blade on chalcedony with a facetted platform was found.

Parallels with materials recovered in earlier excavations

Excavations on the western portion of the top plateau (Area I, Fig. 4) at Crvena Stijena have shown that Mesolithic layers were preserved in this area. These layers should thus be related to Stratum IV of the previous excavations, although the finds from Layer 4 in this area are difficult to place because they are few and no characteristic artifact types were recovered from this layer.

In contrast, the material from Layer 2 can be securely related to the earlier Stratum IVb_1, although no typical Castelnovian bladelet tools were found. The range and proportions of the raw materials are typical for the later Mesolithic, the industry has a lamellar character, and straight bladelets with facetted striking platforms as well as the cores from which they were struck appear. It is interesting that hearths constructed from stones were securely documented from this layer because they were previously known only from Neolithic levels (Benac, 1975).

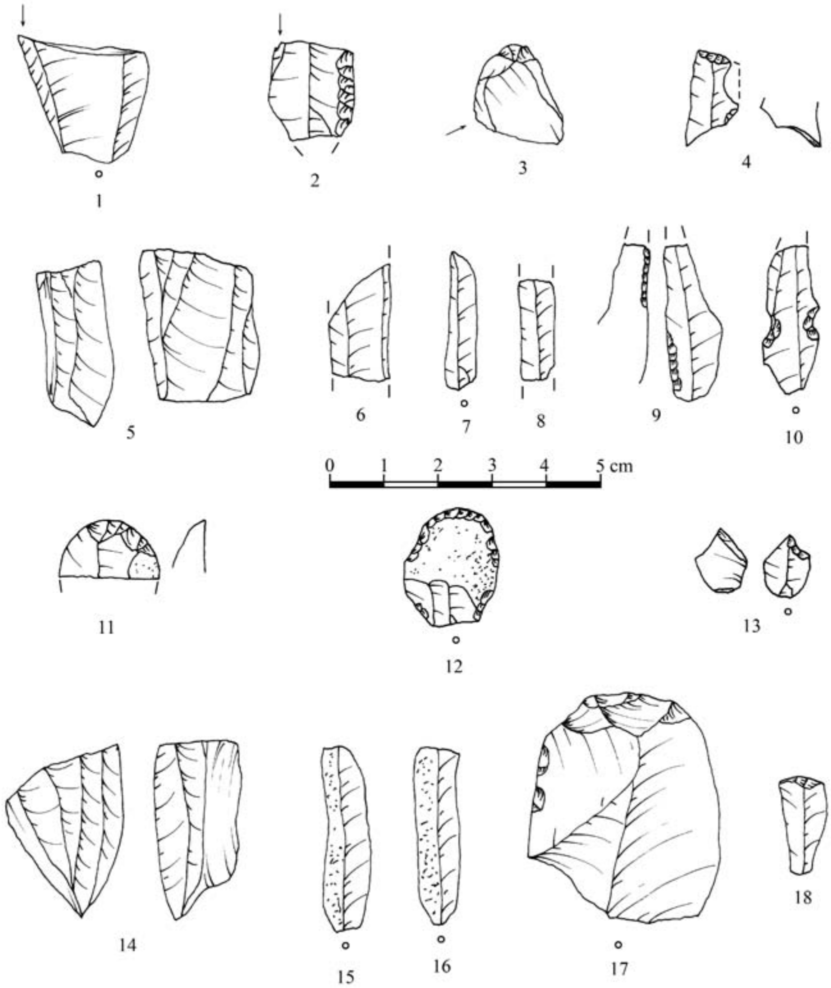

Fig. 18. Selected lithic artifacts from in situ Mesolithic layers, 2005 excavations at Crvena Stijena

The materials from Layer 1 are clearly mixed and can not be confidently assigned to a particular cultural level.

FINDS OUTSIDE OF FIRM STRATIGRAPHIC CONTEXT: FLAKED LITHIC ARTIFACTS AND BONE TOOLS

During the cleaning of the excavation area at the entrance to the shelter in 2005, over 3000 flaked lithic artifacts and several dozen bone and antler artifacts were found, largely through screening. These finds come from the western side of the shelter, where the Holocene layers had been mixed with sediment thrown out from the earlier excavations. Since these materials were not recovered from a closed stratigraphic context, it is clear that they can not be used to draw conclusions about technological characteristics of any specific chronological or cultural phases at Crvena Stijena. However, it can be assumed with some confidence that the great majority of these artifacts come from Mesolithic and Neolithic layers, especially since very few artifacts were recovered from this context that can be assigned either to earlier or to later periods.

Table 6

Flaked lithic artifacts from the cleaning of the excavation area on the western side of the shelter entrance

	Number	Percent
Cores	87	2.8
Blades/Bladelets	234	7.5
Flakes	2240	72.1
Tools	350	11.3
Small Chips	196	6.3
Total	**3107**	**100.0**

Table 7

Lithic tools from the cleaning of the excavation area on the western side of the shelter entrance

Type	Number	Percent
Burins	18	5.1
Endscrapers	74	21.1
Sidescrapers	15	4.3
Retouched blades and bladelets	18	5.1
Pointed blades	2	0.6
Retouched flakes	41	11.7
Denticulated tools	22	6.3
Notched pieces	44	12.6
Raclettes	7	2.0
Splintered pieces	43	12.3
Perforators	12	3.4
Truncated pieces	16	4.6
Backed tools	3	0.8
Backed truncations	3	0.8
Geometrical tools - crescents	7	2.0
Geometrical tools - trapezes	14	4.0
Combination tools	4	1.1
Atypical steeply retouched tools	3	0.8
Tool fragments	4	1.1
Total	**350**	**99.7**

Lithic artifacts

In this assemblage, flakes predominate, while other artifact categories occur in smaller numbers (Table 6). In terms of cores, pre-cores are not common (9 examples), generally without traces of special preparation, while cores of various types are frequent. Among the single platform cores, bladelet cores with convex striking surfaces and a wedge-shaped end are characteristic, as well as cylindrical cores of chalcedony with narrow striking surfaces which were used to produce straight blades and bladelets. These cores were not prepared, nor were the much more numerous, typical flat cores, often with facetted platforms, on blocks of raw material and pebbles (Fig. 19: 1, 2). Two-platform cores with alternating directions of bladelet removal are very common (Fig. 19: 3). Most commonly one removal surface is on the wider side of the core and the other is on the narrower side of the core. They were discarded at an advanced stage of exploitation. Seven examples of bipolar cores were also recovered.

Among the tools, endscrapers predominate, followed by retouched flakes and denticulated tools, while other types are notably more infrequent (Table 7). The characteristics of this material will be outlined here in a little more detail.

Burins are not particularly characteristic. These include seven ordinary lateral and transversal burins, three burins on breaks, one double burin on a flake, one burin on a truncated blade (Fig. 19: 4), and two dihedral angle burins – one on a blade and one on a very small flake.

Endscrapers are found in a number of types and varieties. Examples made on flakes smaller than 2.5 cm long dominate in this material, although examples are found on somewhat larger flakes (2.5–5 cm long) and on blades (Fig. 19: 5–8). In fact, 29 examples (39.2% of all endscrapers) were made on flakes 1.5 cm in length or less (Fig. 19: 9–12). Four circular scrapers of microlithic dimensions were found (Fig. 19: 13–15), as well as three double endscrapers (e.g., Fig. 19: 16). Sidescrapers are most commonly made on flakes from 2.5 to 5 cm in length, with convex working edges.

Retouched blades and bladelets most commonly exhibit semi-steep retouch – partially, laterally, or bilaterally. Two pointed, bilaterally retouched blades of Upper Paleolithic type were also recovered (e.g., Fig. 19: 17).

In contrast to retouched flakes with shallow retouch and to denticulated flakes, which are not typologically differentiated, are straight blades and bladelets with retouched notches (Fig. 19: 18–20). As a rule, blades have shallow, often denticulated, notches, while bladelets characteristically have somewhat deeper, symmetrically or

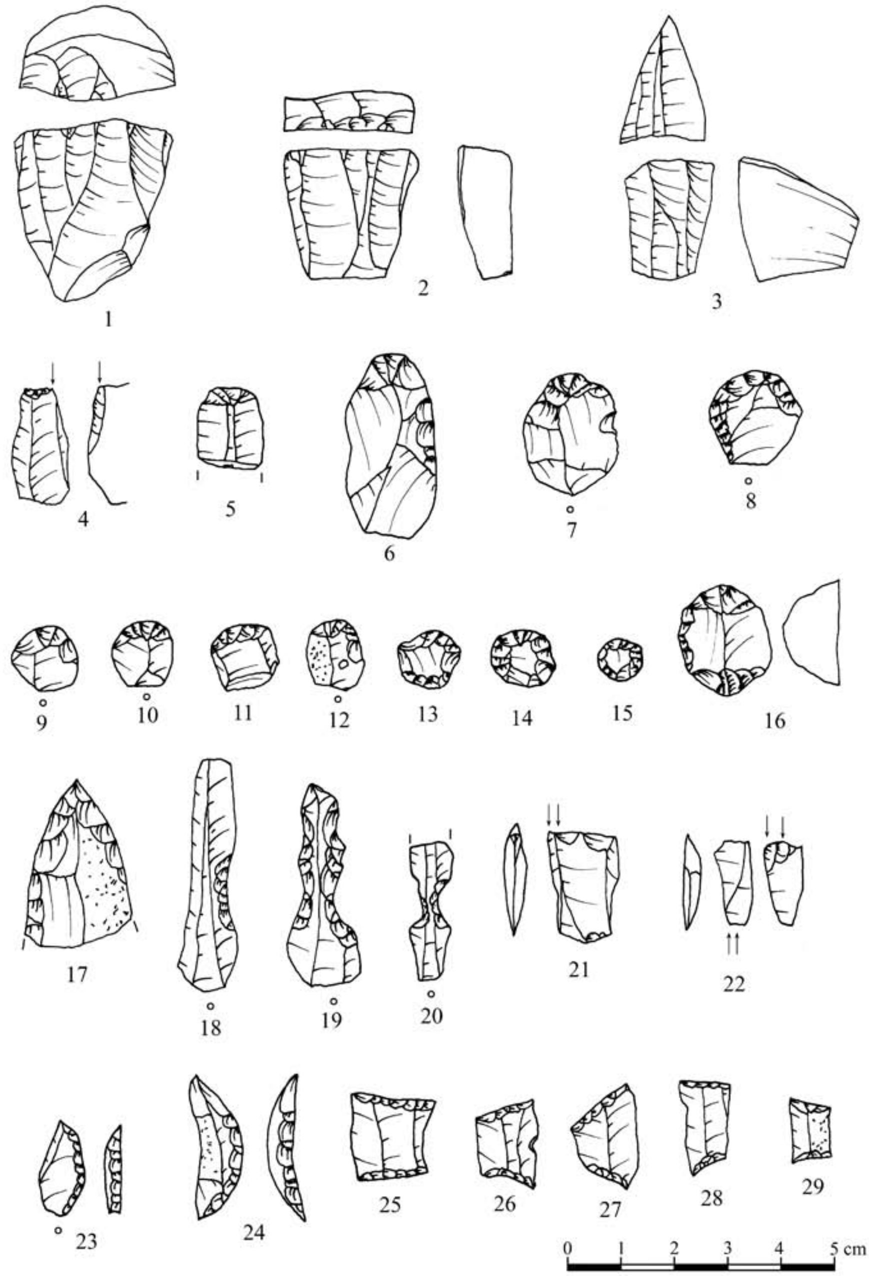

Fig. 19. Selected lithic artifacts from probable Mesolithic–Neolithic context, 2005 excavations at Crvena Stijena

asymmetrically positioned retouched notches on both sides.

Splintered pieces are especially representative of this assemblage. Among them occur typical examples with bipolar, surface damage and removal scars, but examples are found (18) on which only the edge of the flake shows such damage, rather than the surface. These tools are difficult to classify according to the usual criteria. On one hand, we have short blades and laminar flakes whose edges carry burin scars, and, on the other hand, the negative scars evidently come from the application of bipolar flaking (Fig. 19: 21, 22).

Of the other flake tools, we should mention raclettes, with continuous, steep retouch, and perforators and drills, which are in all cases made on flakes.

Steeply retouched tools are generally made on bladelets. Truncated pieces, three tools with curved backs, and three atypical backed tools with retouched truncation also occur. Among the geometrical tools in this assemblage are crescents (8 examples – e.g., Fig. 19: 23, 24) and trapezes, which are relatively common (14 examples – e.g., Fig. 19: 25–29). Trapezes appear in several morphological varieties, but wide examples, characteristic of the Neolithic, were not found.

Combination tools were also recovered: two endscrapers combined with truncations, and one example each of burin-perforator, perçoir-burin, and endscraper-perforator. Except for this last example, all combination tools are made on blades.

Bone and antler tools

From this unsure stratigraphic context come 12 points or awls, 14 projectiles, two polishing tools, two perforated bone items, and number of cervid and caprid antlers/horns with traces of use. Among the antler/horn artifacts, there is only one antler tine with a groove for binding.

Points/awls are made from mammal long bones. No complete examples were recovered. In all cases, these are distal fragments with more or less damaged tips. Among these artifacts, we can distinguish a) massive points (with a width greater than 2 cm) made on long bones split lengthwise (5 examples), and b) points/awls on narrow (width less than 2 cm) lengthwise fragments of long bones.

A large number of fragments were found of bone projectiles with elongated, beveled bases, which are longer than the distal part of the artifact in the majority of cases. In cross section, the distal ends are as a rule circular and the proximal ends half-round. This type of projectile was also found in the earlier excavations (Benac, 1975; Mihailović, 1998).

Only two fragmentary tools were found that might have served for polishing. In the first case, traces of polishing appear on the distal end of a bone, while in the second cse traces of polishing occur not only on the tip but also on the edge of a lengthwise fragment of a somewhat larger long bone.

Perforated artifacts consist of a phalange transversally perforated at the distal end (grooves remaining from the drilling can be observed at the opening of the perforation), and one bone plaque with two perforations and a groove around the edges.

Discussion and conclusions

Low occurrence of Upper Paleolithic lithic tools (especially backed elements) and tool types of later periods support the supposition that the majority of lithic and bone artifacts in the assemblage recovered from cleaning the entrance on the western side of the shelter derive from the Mesolithic, or eventually the Neolithic. This is also indicated by the fact that numerous parallels exist between the materials in this assemblage and those recovered between 1954–1956 in Strata IV and III.

It remains unclear, however, whether, or to what degree, artifacts from Strata VII–V appear in this assemblage. Only the microlithic, circular scrapers and the few backed tools could be assigned somewhat more surely to this phase, considering that these types have not been found in the late Mesolithic horizons IVb_1 and IVb_2 (Mihailović, 1998). On the other hand, crescents could come from either earlier or later periods. Not a single crescent was found in Strata VII–IV (Mihailović, 1998), but it is known that this type of microlith appears also in later periods.

The majority of the elements observed in the analyzed material can be related to the industry from horizons IVb_1 and IVa, and perhaps to Stratum III. The assemblages from horizons IVb_1 and IVa present a high frequency of high-quality raw material and a specific repertoire of cores, bladelets, and tools on bladelets characteristic of the local Castelnovian (Mihailović, 1998). Judging from everything, high-quality raw materials were not acquired from local sources (they do not appear in earlier layers) and they are used almost exclusively for the production of bladelets. In the analyzed collection, as in the industry from horizons IVb_1 and IVa (as well as in the industry from Odmut), faceting is found both on cores and on bladelets (Kozlowski *et al.*, 1994; Mihailović, 1998; 1999). Diverse tools are made on bladelets: denticulated bladelets, bladelets with unilateral and bilateral, retouched notches, truncations, trapezes, perforators, and combination tools.

Almost all elements characteristic of horizons IVb_1 and IVa appear in the 2005 assemblage analyzed here, but the diversity of tools is somewhat less. The variability of trapezes is surprising, as well as the fact that among the finds from the excavations of this area and the still intact Mesolithic layers are examples of the application of microburin technique – not found during the earlier excavations. The new excavations at Crvena Stijena confirm that virtually all phases of the late Mesolithic occur at this site. Especially important is the fact that these excavations have provided the first dates for the developed phase of the Castelnovian (mid 7th millennium cal BC), to which, judging from all the evidence, Layer 2 of the *in situ* sediments on the western edge of the top terrace belongs. The Mesolithic levels at Odmut are somewhat later, and belong the end of the 7th and beginning of the 6th millennium cal BC (Srejović, 1974; Kozlowski *et al.*, 1994). Everything supports the idea that Castelnovian influences spread at the end of the 7th millennium from the coastal zone toward the interior.

PLANS FOR FUTURE RESEARCH AT CRVENA STIJENA

The 2004–2006 excavations have already given useful and interesting results. However, we feel that the greatest potential of further research at Crvena Stijena has yet to be tapped. We plan to continue to seek funding and to continue our project at this site into the foreseeable future. The main goal of future research will be the exposure and careful excavation of the Middle Paleolithic layers. These layers are rich in archaeological materials, have been determined from micromorphological analysis to be not disturbed or reworked, and show much of the extensive use of fire in some layers, and not in others – in other words evidence for different activities characterizing different layers. These factors, plus the promising find of Neanderthal physical remains, offer encouraging prospects for productive research into the rich Middle Paleolithic occupations at Crvena Stijena.

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