Speleological objects of Sokobanja

ISBN 978-86-82623-21-2

Petar Milojević

Irina Kajtez Stefan Milošević

Speleological objects of Sokobanja

as potential Palaeolithic sites

Die Speleologischen Objekte Sokobanjas

als potenzielle paläolithische Fundstätten

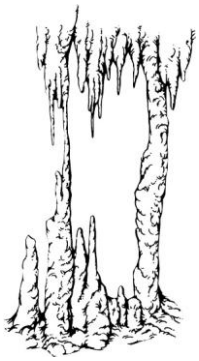
Sokobanja

2015

Petar Milojević
Irina Kajtez Stefan Milošević

SPELEOLOGICAL OBJECTS OF SOKOBANJA AS POTENTIAL PALAEOLITHIC SITES

Public library
„Стеван Сремац“
Sokobanja
2015



Petar Milojević
Irina Kajtez Stefan Milošević

DIE SPELEOLOGISCHEN OBJEKTE SOKOBANJAS
ALS POTENZIELLE PALÄOLITHISCHE FUNDSTÄTTEN

Volksbibliothek
"Stevan Sremac"
Sokobanja
2015

Izdavač:
Narodna biblioteka „Стеван Сремац“ Sokobanja
sbbiblioteka@open.telekom.rs

Za izdavača:
Vitomir Krstić

Назив оригинала:
Спелеолошки објекти Сокобање као потенцијална палеолитска налазишта

Urednik:
Petar Milojević
pertinax1983@gmail.com

Autori:
Petar Milojević
Irina Kajtez
Stefan Milošević

Recenzenti:
prof. dr Dušan Mihailović, Филозофски факултет Београд
prof. dr Vesna Dimitrijević, Филозофски факултет Београд
dr Aitor Ruiz-Redondo, The Cantabria International Institute for Prehistoric Research

Tehnička obrada:
Đorđe Jančić

Lektor:
Ljubica Vesić

Prevod na engleski jezik:
Danijela Stanojević, Dejan Stanojević
cvetkovic.danijela@yahoo.com

Prevod na nemački jezik:
Dejan Stanojević
dexmaster_yu@yahoo.com

Crteži:
Marjana Marinković, Petar Milojević, Irina Kajtez, Stefan Milošević

Fotografije:
Petar Milojević, Irina Kajtez

Štampa:
Copy shop, Niš

Tiraž:
30 primeraka

Knjiga štampana sredstvima
koje je obezbedila Скупштина општине Сокобања

Sokobanja 2015

ISBN
978-86-82623-20-5

TABLE OF CONTENTS

FOREWORD 9

INTRODUCTION 11
Methodology and purpose of the research 12

REVIEW OF THE PAST RESEARCHES 14

SPELEOLOGICAL RESEARCH OF THE SOKOBANJA REGION 14
Earliest records of caves in the Sokobanja region 14
Onset of the scientific research of caves in the Sokobanja region 15
Modern speleological research in the Sokobanja region 18

PALEOLITHIC RESEARCH IN THE SOKOBANJA REGION 19

NATURAL AND GEOGRAPHIC PROPERTIES OF THE SOKOBANJA BASIN 21

GEOGRAPHIC SETTING OF THE SOKOBANJA BASIN 21
The Sokobanja basin 21
Moravski golak 21
Traffic communication and roads 22

RELIEF AND GEOLOGICAL COMPOSITION 23
LOWLAND BELT 24
River terraces 25
The fourth highest terrace 27
The third lower terrace 27
The second terrace 28
The first, lowest terrace 28

TRANSITIONAL BELT – HILLSIDES 28
Lake terraces 29

MOUNTAIN BELT 31

PEDOLOGICAL COVER 31
Loess sediments 33

HYDROGRAPHY 33
The basin of the Moravica river in Sokobanja 33

CLIMATE 34
Some features of the Pleistocene climate in the South Morava river basin 35

FLORA AND FAUNA 37
Pleistocene ecosystems 39
of the Sokobanja basin in relation to neighboring Balkan regions

SPELEOLOGICAL OBJECTS IN THE SOKOBANJA REGION 43
Map of speleological objects in Sokobanja region 43

REGISTRY OF PITS 44

JELENSKA PEĆURA 44
RUPA PROZORKA 45
ORLOVAČKA JAMA 45
JAMA POD OŠTROM ČUKOM 46
ZVERKA PORICA 47
RTANJSKA LEDENICA 47
VELIKI LEDENIK 49

REGISTRY OF ROCKSHELTERS 50

TATUMIROVA ROCKSHELTER 50
GRADAŠNJIČKA ROCKSHELTER 51
MEČJA ROCKSHELTER 52
RAVAN ROCKSHELTER 53
CRKVIŠTE 54
GOLEMOPADINSKA ROCKSHELTER 56
SOKOGRADSKA ROCKSHELTER 56
POLJANSKI KAMEN 58
VRELSKA ROCKSHELTER 59
HAJDUK VELJKOVA CAVE 60
LEPTERIJSKE ROCKSHELTERS 60

REGISTRY OF CAVES 61

OZRENSKA CAVE 61
MEČJA RUPA 62
CRVENA RUPA 64
LEDENIK 65
PEĆINA KOD STRELIŠTA 66
GOLEMOPADINSKA CAVE_1 67
GOLEMOPADINSKA CAVE 2 69
LEPTERIJSKA CAVE 70
MARKOVA CAVE 71
POPOVIČKA CAVE 72
VLAŠKA PEĆURA 72
JEZERSKA CAVE 74
VLASINA CAVE 74
RADENKOVSKI KAMEN 75
GOVEĐI PEŠTAR 76
ČITLUČKA CAVE 77
DUGOPOLJSKA CAVE 79
TAMNICA 80
CAVE IN STRUNJAK 81
PEĆURSKI KAMEN 82
NOVAKOVCI CAVE 87
SESALAČKA CAVE 88
MILUŠINAČKA CAVE 1 91
MILUŠINAČKA CAVE 2 93
RUJIŠKA CAVE 94
BUKOVIČKA CAVE 95

REGISTRY OF COLLAPSED CAVES 97

STOŽER KAMEN 97
KOSINJA PADINA 98
KRUŠJANSKA CAVE 99
RUJIŠKA ŽLEBINA 100

THE REGISTRY OF LOCALITIES – OPEN-AIR SOURCES OF RAW MATERIALS 101

KREMENAC – ČITLUK 101
KREMENAC – VRELO – GORNJI KRUPAC 102
VRELSKA ČUKA 103
LIPOV TRAP – ČITLUK 104

Tabular review of speleological objects in the Sokobanja region 105
Charts with basic characteristics of speleological objects in Sokobanja 106

NATURAL AND GEOGRAPHIC FEATURES OF CAVE SITES IN THE REGION OF THE WARM-TEMPERATE CLIMATIC BELT 107

ARCHEOLOGICAL SITES IN SOUTHEAST EUROPE 108
Archeological sites in Slovenia 108
Potočka Zijalka 108
Mokriška jama 108
Betalov spodmol 108
Divje Babe 109
Archeological sites in Croatia 109
The rockshelter in Krapina 109
Velika cave 109
Cave Vindija 110
Veternica 110
Mujina cave 110
Šandalja 111
Archeological sites in Bosnia and Herzegovina 111
Badanj 111
Cave Rastuša 111
Archeological sites in Serbia 111
Hadži-Prodanova cave 111
Šalitrena cave 112
Smolućka cave 112
Рисовача 112
Balanica cave complex 113
Pešturina 114
Baranica 114
Mirilovska cave 114
Спелеоархеолошка налазишта у Румунији 115
Peştera cu Oase 115
Peştera Murierii 115
Coliboaia 115
Archeological sites in Bulgaria 116
Kozarnika 116

Temnata dupka 116
Bačo Kiro 117
Arkata cave complex 117
Archeological sites in Montenegro 117
Mališina stijena 117
Medena stijena 117
Trebački krš 118
Vruća pećina 118
Bioče rockshelter 118
Odmut 118
Crvena stijena 119
Archeological sites in Albania 119
Blazi 119
Konispol 119
Archeological sites in Greece 119
Asprochaliko 119
Theopetra 120

Cave sites in Southeastern Europe 121
Tabular review of basic features of cave findings in the region of SE Europe 122

CONCLUSION 123

The archeological relevance of pits 123
The archeological importance of caves and rockshelters 124
The archeological potential of speleological objects in the Sokobanja region 125
The Sokograd gorge 126
Gradašnjička gorge 128
The Izgare river 130
The Vrelska valley 132
The Sesalačka River 133
The Urdeška gorge 134
The Bela reka gorge 136
Vrmdžanska River 138

ZUSAMMENFASSUNG 142

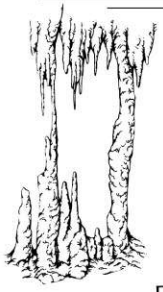
LIST OF FINDS 144
TABLES OF FINDS 145

ALBUM OF PITS 157
ALBUM OF ROCKSHELTERS 163
ALBUM OF CAVES 171
ALBUM OF COLLAPSED CAVES 195

BIBLIOGRAPHY 199

Petar Milojević
Irina Kajtez Stefan Milošević

Speleological objects of Sokobanja
as potential Palaeolithic sites



Die Speleologischen Objekte Sokobanjas
als potenzielle paläolithische Fundstätten

Sokobanja
2015

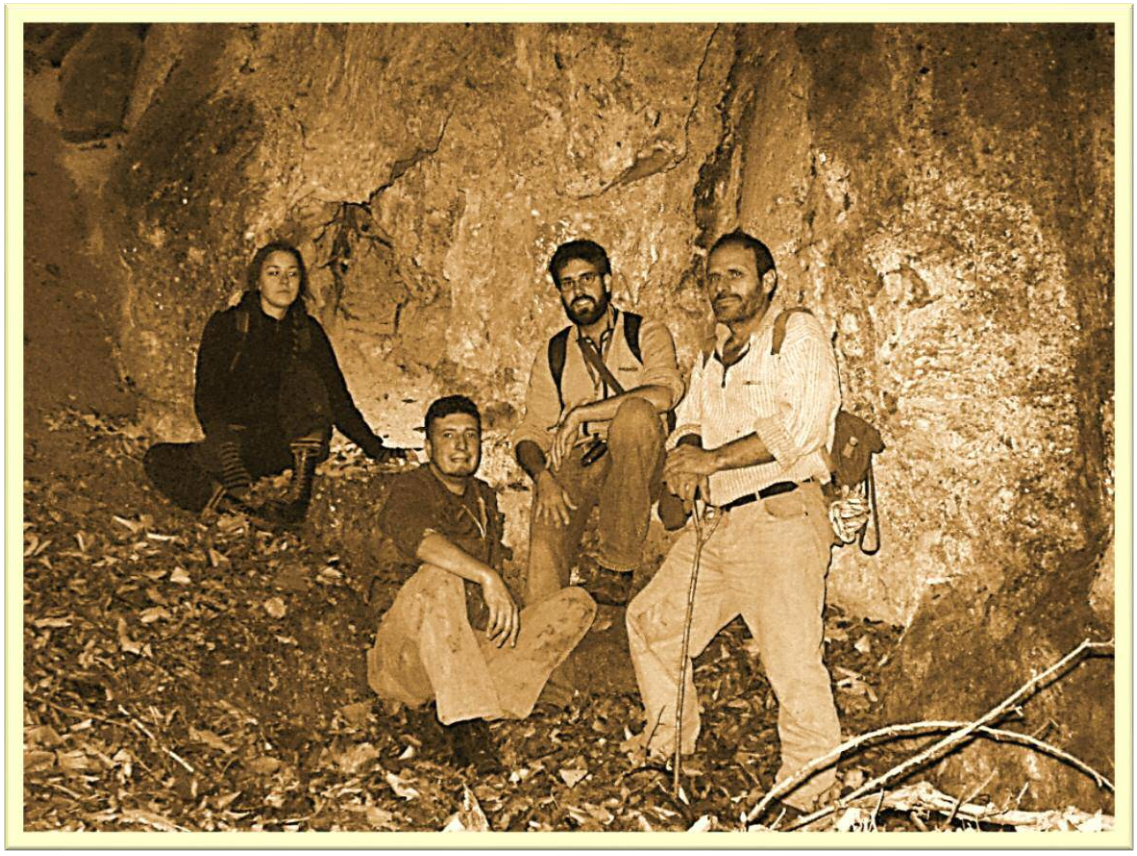
FOREWORD

This monograph connects to the research results Petar Milojević presented in his graduation paper titled "The Survey of potential Paleolithic sites in the region of the Sokobanja basin and closer vicinity" the research for which was conducted within the project "Research of the transition from the middle to the upper Paleolithic in eastern Serbia" conducted by the Faculty of Philosophy from Belgrade in cooperation with the University of Arizona from Tucson (USA), under the auspices of Dušan Mihailović and Steven Kuhn. The research was conducted based on data collected by a team of three authors during only two research campaign each of which lasted two weeks conducted during 2012 and 2013. Such a speed of work would not have been possible without the generous assistance of the population from the Sokobanja basin, who have shown great interest for our research at every site we have visited in their area. They have not just pointed their fingers at topographic maps we carried with us or just pointed in the direction we should go; they assisted us as guides often neglecting their personal affairs. Thus they have spared us from wandering around during the localization of speleological objects, which were quite often covered by vegetation and difficult to notice even from close distance. They have also spared us the risk of getting lost and walking in circles in landscapes such as are the numerous sinkholes on Mount Devica. We owe special thanks to: Saša Stevanović, who guided us to most of the caves; Igor Lazić, Aca Marinković, Zoran Stojadinović, Stevan Bašić, Miodrag Milutinović, Dragi Stanojević, Dragan Milanović, Đorđe Jančić, Danijela Stanojević, Dejan Stanojević, Marijana Marinković, Jelena Milojević, Prilagija Milojević and Ana Dinić for their personal contribution to our research. Our gratitude also goes to the professors of the Faculty of Philosophy from Belgrade, Dušan Mihailović and Vesna Dimitrijević because without their expert support this research could not have been adequately conducted.

The contribution of this study in the archaeological survey of the Paleolithic represents a standardized and systematic method of collecting data by means of forms and their compiling by applying Geographic Information Systems and the locating of apsolute coordinates by means of a GPS device, which enables any further researcher to conduct a thorough preparation prior to fieldwork by means of selecting data of interest and enabling and entirely independent localization of the mentioned speleological objects. Our objective was also to point out the archaeological potential and instigate further archaeological researches of the Sokobanja region because it belongs to a group of areas with the least number of archeological researches. Besides their importance for archaeology, the presented data is solid starting point for geo-morphological and speleological research. Furthermore, this book is also a tourist and recreation guide of some sort because some of the presented speleological objects are,

above all, impressive natural monuments not only for the tourists in Sokobanja which is, in a tourist sense, one of the most visited regions of Serbia, but also for all the other recreation enthusiasts and fans of extreme sports in nature like mountaineering, hiking, free-climbing, orienting, etc., bearing in mind the fact that a certain number of these objects is situated along well-constructed and marked hiking paths and picnic sites.

We owe special thanks to: the Municipal administration of Sokobanja and Dimitrije Lukić; the National Library "Stevan Sremac" in Sokobanja and Vitomir Krstić, as well as to all the citizens of Sokobanja.



Standard team during the archaeological recognising of speleological objects in Sokobanja (2012-2014.)
From left to right: Irina Kajtez, Petar Milojević, Stefan Milošević and Saša Stevanović

INTRODUCTION

The Sokobanja region belongs to the group of, in archaeological terms, least explored areas especially concerning the research of the Paleolithic which has been neglected in the territory of Serbia for decades. During the past years, research of the Paleolithic has made a significant step forward in Serbia. The most prominent examples of such a progress can be noticed in the Paleolithic sites explored in areas that were only ten or so kilometers away from the Sokobanja basin. Among them we have to emphasize the cave complex Balanica in Sićevo where a hominine mandible and some of the earliest finds of Charentian artifacts were discovered (Михаиловић, 2009в: 3–26; Роксандић и др. 2011: 186–196), Jelašnička cave (Pešturina) near Niška Banja where layers from the Middle and Upper Paleolithic (Михаиловић–Милошевић, 2012: 87–106) period were discovered, then the open-air site Kremenac on the southern slopes of Kalafat hill, where artifacts from the Lower Paleolithic (Калуђеровић–Ђурић, 1996: 289–290; Михаиловић, 2009в; Шарић, 2011: 7–22) were discovered on the surface. Besides in the Niš basin, artifacts of the Upper Paleolithic chipped stone industry were also discovered in the nearby regions of Knjaževac and Svrljig where research was conducted in the caves Baranica (Михаиловић, 2004: 135–144) and Golema dupka. Among other things, one should also take into consideration the exceptional research results obtained from somewhat more distant areas such as the cave located at Tabula Traiana in the Đerdap Gorge (Iron Gates) (Borić et al, 2012), Kozarinka in the area of Vidin (Sirakov et al, 2010: 94–106), Hadži-Prodanova cave near Ivanjica (Михаиловић, Михаиловић, 2006: 13–17), Šalitrena cave near Valjevo (Mihailović, 2008: 101–106), the open-air site near Kraljevo (Михаиловић, Богосављевић-Петровић, 2010: 21–43) and the Petrovaradin fortress in Novi Sad (Михаиловић, 2006: 9–12). Such an improved and clearer picture about the distribution of Paleolithic sites in Serbia caused the greater interest for a closer determination of potential archaeological sites in the Sokobanja region. Numerous speleological objects have incited the research of the Sokobanja region and in some of them, such as the cave Pećurski kamen, Milušinačka cave, Sokogradska rockshelter and Markova cave the existence of Paleolithic layers (Malez, Salković, 1988: 24–25; Михаиловић и др., 1997: 33–44; Kuhn et al, 2014: 97–106) has been confirmed.

The research conducted within the framework of the implementation of the project "Surveys of the transition from the Middle into the Upper Paleolithic in eastern Serbia" conducted by the Faculty of Philosophy from Belgrade in cooperation with the University of Arizona from Tucson (USA).

The subject of the research is based on the examination of speleological objects and open-air sites as potential habitats for Pleistocene communities. Based on modern information about the settlement patterns, economy and the organization of Paleolithic

populations, the tendency was to apply archaeological prospection (of the local natural surroundings, available resources, spatial and morphological features of the subterranean karstic formations) for the recording of archaeological sites as well as the potential for further research. The greatest attention was directed towards the analysis of speleological objects i.e. their geographic position, size, presence of sediments and their typology, genesis and evolution. The framework of interest and time was the entire Pleistocene epoch, and the main specimen is comprised of numerous speleological objects and deposits of rock raw materials in the Sokobanja basin and the ridges of the surrounding mountains (Rtanj, Slemen, Krstatac, Devica, Ozren, Bukovik and Rožanj).

Methodology and purpose of the research

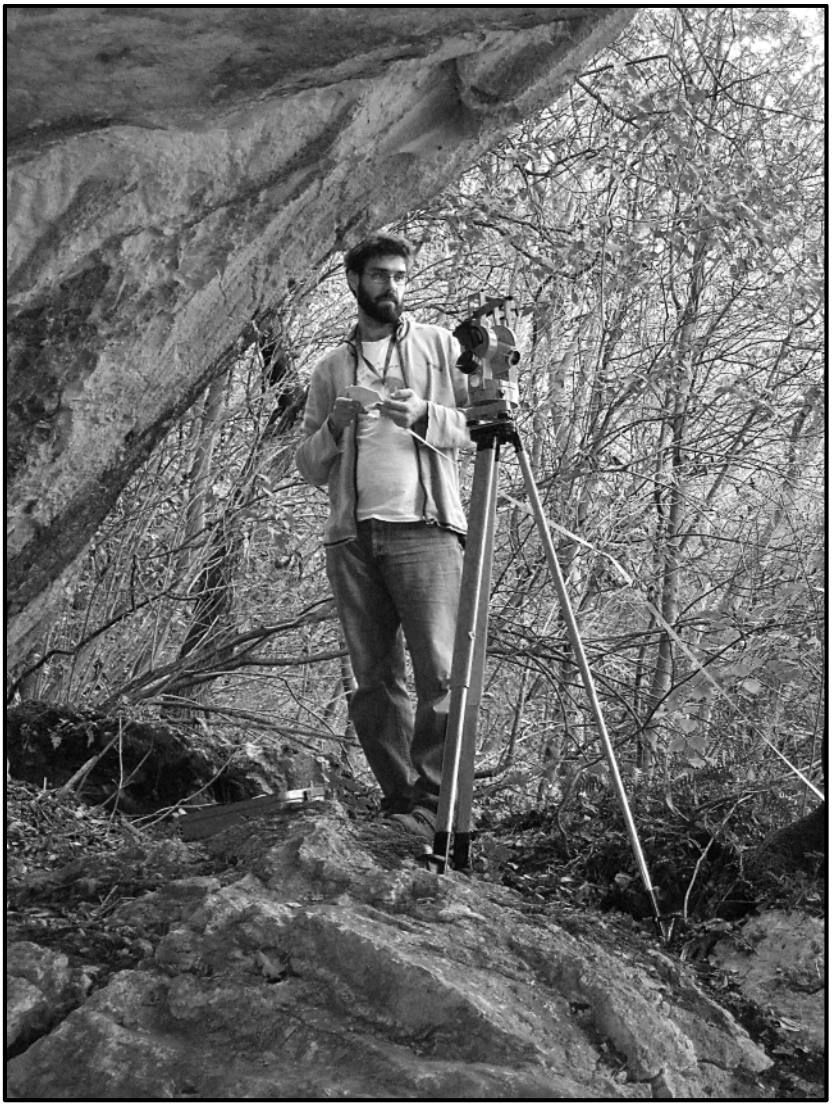
The research methods were based on the collecting of data by means of archaeological field survey and from scientific literature.

The data collected in the course of field survey include: finding and locating of certain speleological objects and open-air sites with their detailed description, survey and description of their surrounding landscape, mapping of the locations with elementary topographic data (altitude, measurements of the object, etc.), technical surveying of the ground plan and cross-section of the speleological objects, photographing, collecting and illustrating of different classes of surface finds, compiling of information from the observations and experiences of the local inhabitants and local specialized persons (geologists, hunters, forest rangers, mountaineers, etc.). The following technical devices were used for the collecting of data in the field: GPS device Garmin Etrex 30, theodolite Carl Zeiss-Jena THEO 015 B and a camera Canon PowerShot A560.

Further work with the acquired data implied their processing by means of GIS software (Global Mapper). Due to the requirements of the research only a basic analysis was performed, which implied the transfer of the objects' location points from the database into the software and their combining with different thematic, previously geo-referenced, maps. These maps include topographic (1:25000), geological (1:100000) and geo-morphological (1:500000) maps. Such a procedure created a spatial distribution and the mutual ratio of the objects presented on the present-day structure of the terrain (by means of topographic maps). Through representing data on geological maps we obtained more detailed information on their genesis and relationship with other surrounding geological formations. Thus, with such a representation we can also establish the relationship of the survey objects with the geological formations that have emerged during the Quaternary, i.e. Pleistocene such as river terraces, which the Pleistocene hunter-gatherers could have used for hunting, settling or as a source of raw materials for chipped stone. Based on these data one could reconstruct the dynamics of the Sokobanja basin layout change during the Pleistocene, however, presently we still do not have absolute dates that could give us a more precise chronological framework of the genesis of the river terraces and other Quaternary structures. The representation of objects on a geo-morphological map in this survey was used due to practical reasons – the resolution of the map, the format of which is presented in this survey. As a

supplement to the geological map, this map shows just those processes that have influenced the creation of the types of relief, and which are still ongoing. An interesting representation of the surveyed objects was created using a three-dimensional DEM (Digital Elevation Model) model of the Sokobanja basin on a grid base (ASTER DEM Worldwide Elevation Data 1.5 arc-second Resolution). In this case, it was used as a supplement to the topographic map because it shows the modern layout of the relief and in this way one can observe the position of the surveyed objects in reference to the surrounding.

The aim of this paper was to collect and systemize various information that would be used as a foundation for future research of the Paleolithic in the Sokobanja basin and its surrounding mountains.



Drawing of ground plan of Golemopadinska cave using theodolite

REVIEW OF THE PAST RESEARCHES

SPELEOLOGICAL RESEARCH OF THE SOKOBANJA REGION

There are four prominent periods in the development of the history of Serbian speleology, as well as the speleology of Sokobanja. The first and earliest period covers the ancient period before the 20th century. The data on caves from this period is mostly of an informational character and can be found exclusively in fragments and casual remarks, most frequently in the works of domestic and foreign authors who, above all dedicated their work to different issues. In these texts caves are mentioned as interesting phenomena and rare natural features of the Sokobanja terrain. Today, this information is interesting only for the development history of Serbian speleology i.e. the period before this signs was elevated on scientific foundations. This is the period when caves were first mentioned.

Earliest records of caves in the Sokobanja region

The earliest written record about a speleological object in the Sokobanja region was taken down during the geological surveying of European Turkey that was conducted by Ami Boué. In August of 1836 he visited Ledenica on Mt. Rtanj. It is interesting that Prince Miloš also accompanied him to Ledenica, which at the same time also marks the first ever recorded tourist visit to a speleological object in Serbia. During that occasion Ami Boué made the following note: *„In the cretacian limestone natural openings are also quite frequent, although seldom so beautifully created like Ledenica in the forest on the southern slope of Mt. Rtanj"*. The same author also mentions Rtanjska Ledenica in his work from 1840, stating that he descended into it by means of a ladder. Its depth is twice the width of its opening. The temperature at the snow-and-ice covered bottom is 2°C, whereas the outer temperature is 23-24°C (Петровић, 1988: 8–9).

The next mentioning of a cave in the Sokobanja region is also related to Rtanjska ledenica and dates from a survey conducted by the great Serbian natural scientist Josif Pančić in 1860 through the Society of Serbian literacy (Јовић, 2002: 147–174). The purpose of the survey was to obtain local geological data, and the survey was addressed to all the doctors from the seven Serbian counties. Among the recorded replies is the letter of Dr. Georgie Klinkovski, a physician in charge of the District of Aleksinac who, among other geological information, gives the following information on the state of the caves: *„In this district we have only one cave in the foothill of Mt. Rtanj and it is called in the Sokobanja region "icy" because it contains a huge quantity of ice even in the middle of summer. It is approximately 10 fathoms deep and in summer its temperature*

is below zero. However, in winter its inside temperature rises and the ice is melting immediately. The entire cave and its surrounding are supported by Basalt formations. The ice inside this cave is absolutely clean and hard, however it is not used for any purpose but by those coming for excursions to "Rtanj" who usually bring chunks of it (...) to Sokobanja" (Јовић, 2002: 155).

During his botanical research in eastern Serbia, Josif Pančić also visited the mountains Ozren and Devica where he discovered new endemic plants species he described in his work: Addendum to the Flora of the Dukedom of Serbia, published by the Royal Serbian State Printing Office in 1884. It is known that, Pančić, besides botany, was also interested in geology and mineralogy, thus he also wrote about the Sokobanja meteorite, the first recorded meteor rocks in the territory of Serbia, that had fallen in 1877 (Диклић, 1996: 32). During his fieldwork in Sokobanja in 1881 Pančić also visited the cave Čitlučka pećina in the vicinity of the spring of the river Moravica, which remained recorded in the biography dedicated to the life and work of Josif Pančić written by Živojin Jurišić in 1889 (Петровић, 1988: 9).

In his voluminous monograph on Serbia, Felix Kanitz presented a detailed study on one period of Serbia's past. While searching for archeological remnants of the Greco-Roman civilization he travelled all over Serbia starting in 1856. On his journey he also visited many caves: Tašmajdanska – Šalitrena cave (Каниц, 1967: 267–268), Vladikina ploča, Dubočka cave, Saint Sava's cave, Lazareva cave, Petnjička cave, Turčinovac cave, Potpećka cave, Hadži-Prodanova cave as well as a few caves in the Svrljig mountains (Каниц, 1985: 232–590). Kanitz descended into the Ledenica cave on Mount Rtanj in 1897: *"Its opening is covered in wines and is about 3m wide, descending into the limestone to a depth of 22m. It took us quite some effort to descend into the cave by means of a ladder made of roughly cut logs heading towards the crack stretching in the north-eastern direction; in early spring it is covered with thin ice that accumulates in summer more and more, and melts in fall"* (Каниц, 1985: 123).

While he was still a student, at the end of the 1880s and at the beginning of the 1890s, Jovan Cvijić began surveying karst terrains in eastern Serbia. In one of his first works, Cvijić visited Ledenica on the Mountain Tupižnica and Ledenica on Mount Rtanj. Cvijić considered the Ledenica on Tupižnica "a sinkhole in development" whereas concerning Ledenica on Rtanj he provides us the following data: *„On one side of Rtanj, at half of its height you can find the cave Ledenica. Its entrance is narrow at the beginning and afterwards it widens. Every spring ice accumulates in this cave and remains frozen all summer long. In fall the ice begins to melt and it completely disappears as late as in winter" (Цвијић, 1889: 94).*

Onset of the scientific research of caves in the Sokobanja region

The onset of scientific research of caves during the development of Serbian speleology is actually the period of the biggest and most prolific surveys of caves and pits in Serbia conducted by Jovan Cvijić. This period stretches from 1888, when Jovan Cvijić established the scientific bases for the surveying of caves and pits as a separate

geo-morphologic discipline. His great contribution to the speleological understanding of Serbia is reflected in the number of surveyed caves and pits; mostly in eastern Serbia. Besides Cvijić his few students and followers have also greatly contributed to the promotion of Serbian speleology, and their works have found resonance also in scientific publications of Europe. One of such publications was drafted as a result of speleological surveys in the Sokobanja karst.

Cvijić's monograph on caves and underground hydrography in Eastern Serbia published in 1895 is the most important publication for understanding Sokobanja's caves as well as the development of Serbian speleology in general. This monograph is a synthesis of Cvijić's speleological surveys he had begun as early as in 1888 but also a speleological handbook elaborating the theoretical basis of speleology. In the mentioned monograph Cvijić has studied and drafted plans of nine caves and some ten rockshelters situated in the then county of Sokobanja. Later on, these observations were supplemented by the survey results of three more ice-pits on the mountains Devica and Rtanj. These surveys include: Sesalačka pećura, Čitlučka pećina, a cave on the spring of the river Moravica, Tamnica cave on Devica, the cave in Strnjak, five caves near Milušinac on Mount Krstatac and a collapsed cave in the village of Rujište. As concerns rockshelters in this area, he visited quite a few of them around the Sokograd fortress, as well as a few of them in the gorge, a few kilometers east of the village of Čitluk. On Devica he visited the ice-pit under the Lazarevica summit and Vlaška cave in the vicinity of the village Dugo Polje, which is also an ice-pit, whereas on Rtanj he visited the already famous ice-pit Rtanjska ledara (Цвијић, 1895: 32–85).

In his next publication, published in 1897 (Cvijić, 1897) in French, Cvijić mentions Čitlučka cave, as an additional tributary of the river Moravica spring, in connection with the occurrence of karst springs. He compares its hydrographic features with the cave springs from Lazareva cave, Vrelska cave, Pećura at the spring of the river Crni Timok and the cave on the island of Perast.

The next publication of Cvijić's works about the caves in Sokobanja had to wait as late as until 1914, when he published two shorter publications about Hadži-Prodanova cave near Ivanjica and the already mentioned Čitlučka cave near the spring Istoci at the foothill of the mountain Devica (Цвијић, 1914: 215–219). This publication is the beginning of the development of a genetic correlative method for the establishing of the caves' age, which is based on the dating of the age of other synchronous elements of the nearer and further surrounding relief. Thus the foundation was established for analyzing caves by means of applying geomorphological methods for the surveying of their surrounding relief.

After World War I Cvijić published in Grenoble a paper in French on the subterranean hydrography and morphological evolution of karst, which was also published in Serbian 30 years after his death. This paper, which has the features of a monograph, is especially important for the development of speleology for it contains theoretical hypotheses on the standard hydrological evolution of river caves. In explaining the process of river cave destruction, Cvijić mentions in his paper the

Milušinačka cave for which he presented evidence about the phases of its collapse (Цвијић, 1957: 26–27).

The publication of the second book, Geomorfologija (1926), marks the end of Cvijić's years-long survey of speleological objects in the Sokobanja region. The definitions and terminology of karst formations mentioned in the book are explained by means of some examples from the Sokobanja region, which have served as a basis for the later classification of speleological objects and their types (Петровић, 1988: 50).

The period of Serbian speleology dominated by the works of Cvijić's former students starts with the work of P. S. Jovanović about the survey of the relief in the Sokobanja basin, published in 1924. In this work special attention was given to the karst relief and it contains basic information on the Porica pit above the village of Šarbanovac and the Rujiška pećura (Јовановић, 1924: 80–81).

During the subsequent years, Serbian speleologists have not surveyed a single cave in eastern Serbia. The reason for that is that they were engaged in field surveying the areas of the Dinaric karst. Only as late as 1936 the speleological scientific literature is enriched by S. M. Milojević's publication on the genesis of the spring Istoci, the main spring branch of the river Moravica. His observations concerned the development of the hydrographic zone, i.e. its deepening into the karst of the northern foothill of Mount Devica. Milojević conducted his speleo-morphological surveys on the top-most periodic spring which originates from the cave Čitlučka cave. Essentially, the results of his surveys were different from the conclusions previously reached by Cvijić. Based on the example of the spring Istoci S. M. Milojević raised the essential issue of the successive lowering of karst springs as the reason for the gradual loss of the hydrographic function in cave canals. Cvijić interprets this mechanism by a simple lowering of the hydrographic zone in depth through the gradual widening of cracks in the normal morphological and hydrological evolutionary process of the karst. However, according to Milojević's research, this may be the consequence of the new, lower crack creation through erosive processes (Милојевић, 1936: 77–78). Later, Milojević elaborated this theoretic issue of speleo-hydrology in a separate work on that subject.

The onset of World War II caused the abrupt termination of the developmental period of Serbian speleology, which may be described as a period of important achievements in solving basic speleo-morphological and speleo-hydrological issues of karst in general, which have been, to a great extent, studied using examples from the Sokobanja region. The entire property of the Geographic Institute, the Geographic Society and the Speleological Section stored in the building of the Faculty of Philosophy was burnt in 1944 after the building was deliberately set on fire by retreating German soldiers. The library and collection of valuable maps were also burnt, as was Cvijić's library containing all publications in the subject matters of karst and speleology of that time (Петровић, 1988: 64).

Modern speleological research in the Sokobanja region

Following the tragic consequences World War II had had on further speleological research of Serbia the conditions for a new beginning were created as late as in 1950 following the renewal of the Speleological Section. Unfortunately these early years of modern Serbian speleology have generated almost no new works about the caves in the Sokobanja region.

The only works mentioning Sokobanja's speleological objects are publications of a general character containing a collection of general discussions on the underground karst of a wider region. Works with such content start with a summary review of researches that had been conducted in underground karst formations so far (in Serbia there were 610 at that time) published by D. Gavrilović in 1965 (Гавриловић, 1965). Jovan Petrović (1974) continued in the same spirit. Analyzing the karst of eastern Serbia, he presented a synthesized overview of underground formations 290 of which had been recorded by then, out of which 134 were caves longer than 30 m and 27 were pits deeper than 10m (Петровић, 1974). Sometime later (1976) he published the first list of speleological objects in Serbia. This list contains the descriptions of some of the caves in the Sokobanja region accompanied by brief morphographic, morphologic and morphogenetic data. Most of the caves' data were illustrated by plans and longitudinal profiles, as well as by the physical, geographic and geo-tectonic conditions of the general development of the karst relief (Петровић, 1976). Writing about the speleological division of eastern Serbia, D. Gavrilović, also presented a series of statistical data in which the karst of Ozren and Devica and the karst of Rtanj (Gavrilović, 1975: 35–45) were statistically presented in separate tables.

Further improvement of complex speleological research continued the practice of presenting summary results of newly-researched karst formations in Serbia. Articles of that sort are instructive and thanks to them we can follow the general progress of speleological research that was due to the team work of younger speleologists. In 1982 began important systematic researches of caves and pits in Serbia for the purpose of producing a basic speleological map at the scale of 1:100.000. Each topographic section is accompanied by a legend containing speleo-morphological and speleo-hydrological data on each registered cave and pit. After quite some time a monograph on Sesalačka cave in the north-eastern part of the Sokobanja basin is published in 1984 (Петровић, 1984: 9–18) as the result of the research conducted by Dragutin Petrović. For the purpose of preparing the material for the MA thesis of Mlađan Janković, associate professor of the Faculty of Geography in Belgrade, two research campaigns were organized with the following participants: M. Janković and R. Lazarević (19-21 February 1995), and in the second campaign M. Janković, R. Lazarević, J. Tomić MA, and B. Kirbus MA (23-29 May 1995). The research included 19 caves belonging to the river basin of Južna Morava (code 8.1.), i.e. of its tributary, Sokobanja's river Moravica. Plans and longitudinal profiles were drafted for most of the caves but Janković gave up on his MA studies thus the results of the research were never published (Лазаревић, 2008: 21–28).

Based on the research of ice-pits and pits in eastern Serbia, among which the ones from Sokobanja were also studied, Č. Milić established their stages of evolution and physical and geographic changes during the Quaternary epoch in the highest region of eastern Serbia (Милић, 1968: 69–81). The spheres of speleological research are slowly expanding thus resulting in works in the areas of speleo-climatology, bio-speleology, and economic speleology. One of such works was published in 1988 by M. Malez and S. Salković as a result of Quaternary-geological and paleontological research conducted in the cave above Hajdučki izvor at the village of Čitluk (cave Pećurski kamen) (Malez, Salković, 1988: 89–99). A work on a similar subject, but within wider geographic framework, was published by Vesna Dimitrijević as part of her PhD thesis about the Upper Pleistocene mammals found in cave sediments in Serbia. The PhD thesis contains analysis of osteological remains found in 19 caves in Serbia, the cave Pećurski kamen (Димитријевић, 1997б:179–370) in Sokobanja being one of them.

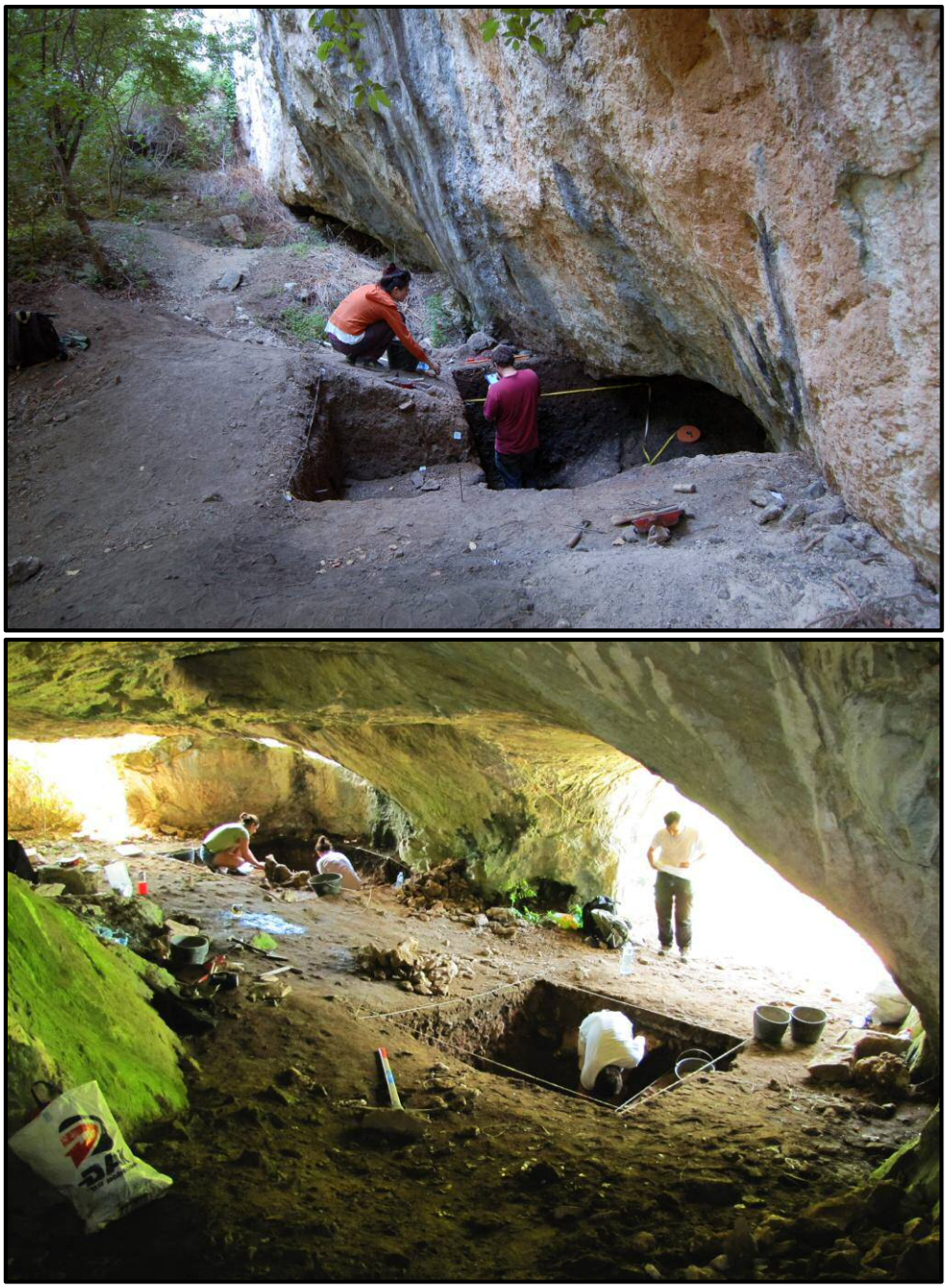
PALEOLITHIC RESEARCH IN THE SOKOBANJA REGION

Publications on Palaeolithic research in the Sokobanja region are few and these are only a few articles and a few casual mentions. In the mid 1970s Mirko Malez conducted Paleontological excavations in Pećurski kamen. The name of the cave was published incorrectly – cave above Hajdučki izvor near the village of Čitluk (Malez, Salković, 1988: 89–99). During the excavations a trench was opened in the entrance hall center the size of which was 3x1.5m and inside which sediments were excavated until a depth of 4m, but the parent rock was not reached. Malez mentions that two flint flakes were found in layer „f“, but these do not represent defined tools. Unfortunately, these artifacts are not shown in the drawing or on the photograph but were only described (Михаиловић и др, 1997: 36).

In 1993 and 1995 Zvonimir Kaluđerović from the Archeological Institute in Belgrade conducted archeological researches in the cave of Pećurski kamen. The results of the research are published in their abbreviated version in the scientific magazine Starinar (Калуђеровић, 1996: 290–292). During these researches four flint artifacts were found, one of them being an atypical specimen found at the depth of 1.5m, whereas the other three were found in layer 7 (Malez's layer „f“) at an approximate depth of 3m. According to their typological and technological features, the artifacts found in layer 7 are ascribed to the Middle Palaeolithic Period (Михаиловић и др., 1997: 36; Калуђеровић, 1996: 291).

After these researches, during the period from 1995-96 Kaluđerović performed the surveys in the canyons of the rivers Moravica, Gradašnica and Bela reka. At that instant he conducted a few probing excavations but the results of these researches have never been published in detail. The excavations were conducted in the Sokograd rockshelter, Markova cave and Crkvište near the village of Labukovo. According to a brief published report he only found a flint core in Markova cave of which he reports to originate from the late stages of the Upper Palaeolithic Period (Калуђеровић, 1996: 291–292).

The latest researches of Paleolithic settlements were conducted during 2011 and 2012 within the project „Middle to Upper Paleolithic transition in eastern Serbia“ that is being implemented in a cooperation of the Faculty of Philosophy from Belgrade and the University of Arizona from Tucson (USA). In 2011 fieldwork was conducted in a few caves in the gorges of the rivers Moravica and Urdeška; and in the following year (2012) archeological excavations were conducted in the Sokograd rockshelter and the Milušinačka cave. In both of these locations the existence of Paleolithic artifacts has been established, and more detailed research results are published in the international proceeding (Mihailović, 2014a: 107–121) and collective international monograph (Mihailović, 2014 b).



Photos during the archaeological excavation of Sokograd rockshelter (above) and Milušinačka cave (beneath) summer 2012. (photo: Mihailović, D. and Milojević, P.)

NATURAL AND GEOGRAPHIC PROPERTIES OF THE SOKOBANJA BASIN

GEOGRAPHIC SETTING OF THE SOKOBANJA BASIN

The Sokobanja basin is situated in the central part of eastern Serbia, in the space between the Timočki and Moravski basin. Regionally speaking, the municipality belongs to a mountainous-valley-plateau macro-region, the meso-region of eastern Serbia and to the micro-region of Balkan Serbia (Мишовић, 2004: 270–275).

The municipality of Sokobanja belongs to the administrative district of Zaječar and consists of 24 village settlements: Beli Potok, Blendija, Bogdinac, Vrbovac, Vrmdža, Dugo Polje, Žučkovac, Jezero, Jošanica, Levovik, Mužinac, Milušinac, Nikolinac, Novo Selo, Poružnica, Radenkovac, Resnik, Rujevica, Sesalac, Trgovište, Trubarevac, Cerovica, Čitluk and Šarbanovac. Two separate geographic units are also located within the present municipal boundaries i.e. these are the Sokobanja basin with the surrounding mountains and a part of the Moravski Golak.

The Sokobanja basin

The Sokobanja basin is located in the summit of the Carpatian and Balkan mountains, between the Crnorečka, Svrljiška, Aleksinačka and Knjaževačka basins (Марковић, 1977: 40). The boundaries of the basin are clearly defined because the entire area is surrounded by mountains of medium height (up to 1600m). The high and long ridge of Mount Rtanj separates itself from the Crnorečki basin in the north. Further to the east, towards the Timočki basin the boundary stretches over the mountain Slemen and the ridge Krstatac where it descends and cuts across the canyon of the Skrobnička river. From the Moravska valley and Golak in the south separately are stretching the massifs of Ozren and Devica, whereas the western boundary is separated from the valley of the Velika Morava by the mountains Rožanj and Bukovik (Јовановић, 1924: 7). The boundaries of the basin are at the same time also the municipal boundaries of the five neighboring municipalities: to the north of Sokobanja the boundaring municipality is Boljevac, in the east it is the municipality of Knjaževac, in the south-east the municipality of Svrljig, in the south the municipality of Aleksinac, and the municipality of Ražanj in the west.

Moravski golak

Moravski golak implies an area along the southern slopes of the mountains Ozren and Devica which constitute the smallest areal unit of the Aleksinac basin. This

area covers the south-eastern part which is at the same time the highest one, having summits of an altitude from 500 to 900m. In administrative terms, this area is divided between three municipalities – Aleksinac, Svrljig and Sokobanja. The boundaries of Golak are not that clearly defined and its territory mainly encompasses the vicinities of the following villages: Vrelo, Gojmilovac, Gornji Krupac, Jezero, Labukovo, Novo Selo, Pirkovac, Popšica, Prekonozi, Radenkovac and Rsovac (Костић, 1969: 531–534). Roughly speaking, this territory stretches from the highest peaks of Mount Ozren (Leskovik 1174 m) and Devica (Čapljinac 1187 m) in the north stretching all the way down to the foothill of Ljuti peak (784 m) and Svrljiški Timok in the south, from Svetostefanska river in the west to Bela river in the east. Most of the above mentioned villages belonged to the Sokobanja municipality until the middle of the last century, and today to this municipality also belong the vicinities of three more villages: Jezero, Novo Selo and Radenkovac.

Traffic communication and roads

Mobility is a key requirement for adaptation to the surrounding. It includes moving through the surrounding as well as immobility and the performing of other actions at a certain location. Mobility is the tool for exploiting various resources belonging to the surrounding's structures. Movement through the surrounding enables the collecting of information crucial for a successful adaptation, thus creating further possibilities for a more organized movement across a certain territory, thereby minimizing risks. In that sense any movement of a group of people through a certain surrounding is not futile because the quantity and quality of gathered information influence future decision-making (Langley, 2013: 614–629).

By its position, the Sokobanja region represents a separate, well-defined geographic unit which, however, is not entirely isolated (Дакић, 1967: 1) thanks to its certain morphologic elements. Here we observe a naturally disposed road running through the valley of the Moravica river along the mountain sides, thus the Sokobanja basin is connected through the Bovan canyon in the west with the Aleksinac and the river Morava basin, whereas through the Skrobnička canyon in the east it communicates with the Knjaževac valley and the Timok basin.

Besides the traffic communications in the valleys, the Sokobanja basin is connected via the mountain sides i.e. the high slopes of Lukavica and Rašinačko sedlo in the north also to the Crnorečka region, and in the south through Ozren and Devica with the Golak villages and the Morava valley (Јовановић, 1924: 8). This is an old heading that was once used for travelling from Crna Reka via Sokobanja to Niš, and besides that there was also the so-called Jerski road that stretched along the western rim of the valley via Golema Negovica on Rtanj and ending in the Crnorečka valley (Дакић, 1967: 85).

Among the modern roads, the most important is the section of the regional road Aleksinac-Sokobanja-Knjaževac which facilitates the easiest connection of this area with the highway E-75, the most important road communication and economic blood

line of Serbia. This communication, in its eastward direction, connects the area of the Sokobanja basin with Zaječar and Bor, and southwards with Niš and other centers of the Republic of Serbia (Јовановић, 1924: 83). Such a position between the highway in Pomoravlje and a regional road in the Timok valley gives Sokobanja an indirect contact position in relation to important traffic communications and important roads in Serbia.

The traffic position of the Sokobanja region is not of great importance concerning the regional traffic network. Reason for this is above all its natural situation, because this basin is situated outside the most important river valleys which enable easy traffic and movement (Павловић, Радивојевић, 2009: 83). Thus its position has mainly a mediatory and transit character among the few regions of greater importance.

RELIEF AND GEOLOGICAL COMPOSITION

The Sokobanja basin is one of many geo-morphological forms in the mountainous and valley relief of eastern Serbia. The basin was created during the forming of the Carpathian and Balkan mountains i.e. the northern orogenic tree of the Mediterranean zone of the European mountains. It is recessed in the area where the meridian Carpathians transfer into the parallel Balkan. Whereas the mountains along its rim are elevated, the valley is lowered thus the proximal movements of the blocks in different directions have caused a considerate pre-Neogene terrain un-leveling and the creation of conditions for the genesis of lakes in a significantly more lowered and morphologically individualized basin. The main, as well as a series of local fissures initiated and compiled the basic outlines of the Sokobanja and Aleksinac basin as well as of their surrounding mountains (Марковић, 1977: 36).

The Sokobanja basin is a tectonic impression lowered along the fissures, therefore they are of special importance for its basic shape. Most important are two parallel fissures; one stretches along the northern sides of the mountains Ozren and Devica (the thermes of Sokobanja rest on it), along which the valley has descended the most. The second fissure is located on the northern part of the basin and runs alongside the villages Jošanica, Vrmdža, Mužinac and Šarbanovac. Besides these parallel fissures, important are also three meridian fissures, the most important of which is one on the western brim of the basin and can be followed from the Bovan gorge northwards via Trubarevac, Vrbovac and Rujevica all the way to Jošanica where it intersects the northern parallel fissure. The weak thermal spring located in the village of Jošanica is most likely connected to this fissure (Мартиновић, Костић, 1972: 49–68). The second meridian fissure is located more to the east from the previous one and stretches from the village of Šarbanovac southwards to Sokobanja. This fissure is even more important because along with it the western part of the basin is more depressed, thus the inclination of the whole Sokobanja basin goes in a westward direction (Јовановић, 1924: 61). The third dominant fissure is located on the eastern end of Rtanj. This is the so-called Rašinački fissure and alongside with it veins of andesite (Цвијић, 1912: 289) may be found.

The modern relief of the Sokobanja basin and its surrounding mountains is a neogenous and quaternary creation grafted onto the already existent paleo-relief. Younger erosive processes have significantly changed the tectonic foundation of the fossil relief thus it is hard to reconstruct it. Conclusions about it are drawn based on the height, physiognomy, vastness of shapes, superposition, stratigraphic elements, reconstruction and correlation (Марковић, 1977: 43). The entire relief of this area was generated under the influence of various factors – tectonic processes, abrasion, erosion, accumulation and river flow, and therefore the area of the Sokobanja basin can be divided into three units:

1. ***The lowland belt*** includes the alluvial plain of the river Moravica and its tributaries. This belt is approximately 1km wide and in light decline follows the flow of the river, thus in the western part of the valley (at the entrance of the Bovan gorge) it is 252 m high, whereas at its eastern part (estuary of the Čitlučka river and northwards alongside the Sesalačka river) it is somewhat higher, climbing up to an altitude of 390 m (Дакић, 1967: 3).
2. ***The transitional belt - hillsides*** is a transitional belt from the lowland belt towards the brim of the basin. This hillside is also elevated on its southern and northern direction from the river Moravica. At its western, more lowered, part of the basin, the altitude is up to 420 m, whereas in its eastern part that boundary stretches up to an altitude of 620 m (Дакић, 1967: 3).
3. ***The mountain belt*** represents the brim of the basin and its heights in the northward direction is from 420 m i.e. 600 m up to 1560 m (Rtanj - Šiljak), and at its southward direction from 420 m to 1174 m (Ozren - Leskovik) and 1187 m (Devica - Čapljinac) (Дакић, 1967: 4). In the east, the topmost summits of Slemen (1099 m) and Krstatac (1070 m) do not exceed the height of 1100 m, whereas the mountains to the west like Bukovik (894 m) and Rožanj (897 m) have its summits at an altitude of 900 m.

LOWLAND BELT

The lowland belt covers the central part of the analyzed area (bottom of the basin) stretching along the river Moravica thus covering even the areas surrounding the estuaries of its tributaries. These are mainly Quaternary alluvial plains generated by the accumulative action of the rivers.[1] They consist of river deposits of clay mixed with fine river sand, cobble stones and in some places fine river silt (Новаковић и др., 1970: 294). The largest belt of Quaternary river accumulations is located around the Moravica river between the Sokograd and Bovan gorge and is up to 5m thick (Марковић, 1977: 39). Near Aleksinac the Quaternary deposits of the river Moravica connect in a wide

[1] Geological map – Aleksinac 1:100 000.

belt with the Quaternary deposits of the South Morava at Aleksinac and in this location a mammoth tusk was found (Жујовић, 1893: 275).[1]

The remaining Quaternary structures represented by deposits of tufa-travertine, screes and humus. The tufa deposits, as sub-aeran structures are located in numerous locations within the Sokobanja basin especially in the close vicinity of springs and waterfalls where they are being created until the present day. Larger batches of these structures are located on the right bank of the Jošanička river, at the spring of Vrmdžanska river, as well as at the spring of the river Gradašnica. Screes were noticed on the northern slopes of Devica near the village of Dugo Polje and at the spring of the river Moravica, and they are exclusively made of crushed limestone which, among the tiniest fragments, also contains large limestone blocks.

A larger portion of the lowland belt does not contain any subterranean karst formations in its relief. Such relief formations are present only in one cave at the very spring of the river Moravica, and in the canyon of the mentioned river near Sokograd. This is the place where the Moravica river intersects the northern rim of the Ozren limestone massive thus creating a gorge that Jovan Cvijić considers an epigenetic lowland. The canyon contains a few caves and rockshelters (some of them are underwater) that are also present on many different levels in the canyon part of the river Moravica.

Mamouth tooth found in the vicinity of Aleksinac (Heritage Museum of Aleksinac)

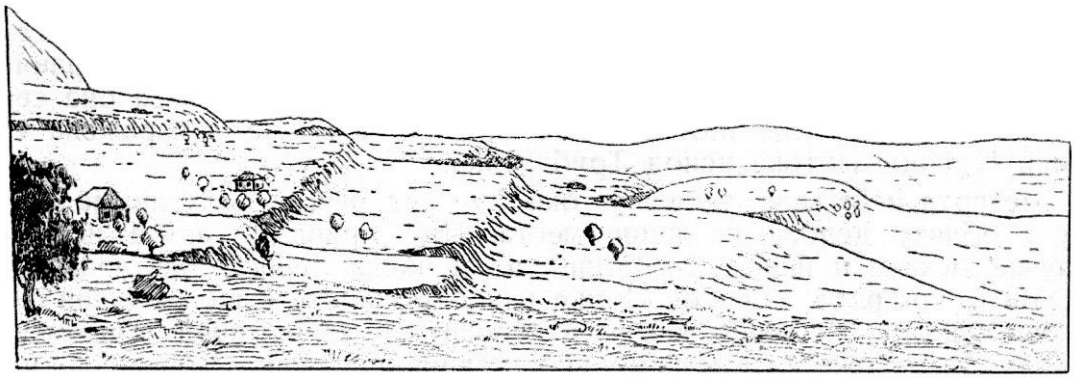
River terraces

River terraces are a characteristic form of relief connected, among other things, to the climatic changes during the Pleistocene in periglacial areas. Under humid climatic conditions, similar to the ones we have today, these areas were once covered by forests due to which the intensity of superficial denudation was low, as a consequence of which the rivers rich in water carried usually small-grained materials. During intensive cool-downs, the forests gave way to a low vegetation cover such as

[1] The tusk was found in the vicinity of Moravica and Južna Morava confluence by the end of XIX C (Žujović J. 1893. 275 p.), and today it is kept at Heritage Museum of Aleksinac.

tundra and steppes whereas the rocks began to mechanically decay under the influence of frost thus creating large amounts of coarse-grained materials. The rivers had low quantities of water because of the dry climate, except for the spring thaw when large amounts of gravel, sand and sometimes even big stone blocks were transported and accumulated by the rivers. Once the conditions of a humid climate had again set in, the rivers began cutting into the accumulated layers of gravel thus creating river terraces (Stevanović, 1992: 128). Each terrace could correspond to a period of warmer climate – one inter-glacial. The oldest terraces are the highest ones and sometimes they are even a few kilometers away from the river whereas the youngest are lower and usually next to the very river banks.

Recent researches concerning the number of terraces in the river basin of Južna Morava have, depending on the author put emphasis on 2-3 terraces originating from the Upper Pliocene Period, 3-4 from the Pleistocene Period and one terrace from the Holocene Period (Stevanović, 1992: 162; Rakić, 1977). River terraces can be especially interesting for researching the Paleolithic Period because they represent remains of the former river banks which people and animals used to inhabit due to the proximity of drinking water whereas intense erosion in such relief formations help in the physical detections of these sites.



River terraces of Moravica (drawing: Jovanović, 1924.)

Along the brim of the lowland belt the multi-millennial activity of the river Moravica has marked the outlines of the river terraces thus leaving traces of its former river bed. Such a fluvial relief formation was created as a consequence of post-abrasive processes caused by the cutting-in of rivers into the Neogene terrain following the recession of the Pliocene lake. The emergence of the river Moravica on the central lake plateau of the Sokobanja basin began at an absolute altitude of 700-650 m, i.e. the appearance of South Morava in the Aleksinac basin began at an altitude of 550 m (Марковић, 1977: 54). Due to the softness of the Neogene material and influenced by erosion and denudation, the present river terraces have been destroyed to a larger extent.

River terraces in the Moravica basin were first registered by Petar Jovanović during the 20-ies of last century. Jovanović established the existence of four terraces he divided according to their age (I - the oldest, IV - the youngest) as compared to their relative altitude in relation to the present-day river bed (Јовановић, 1924: 74–76). The

figures of the altitudes are not in sync with the level of terraces of the South Morava river, and the difference is manifested in the decline of the Moravica in the terrain between its exist into the Bovan canyon and its present estuary (205-155 m/altitude) (Марковић, 1977: 54–55). Here we shall give a comparative presentation of the Moravica and Morava lake terraces and their possible relative chronology.

The fourth highest terrace is located at approximately 65 m above the river and its traces are best visible in the east-most part of the basin. The terrace is also visible at the village of Dugo Polje at the localities of Krušovo and in the village cemetery but it is best preserved in the canyon near Sokograd where it is cut into the limestone. From the left river bank these traces can be seen above the village of Blendija and in the estuaries of Sesalačka river and Moravica river. Within the valley of Sesalačka river a part of this terrace also belongs to the northern end of the village Bogdinac and the terrace in the lower end of Medenjak Polje. The terrace can also be observed in the basin of the Bogdašinska river where in the form of a higher terrace it stretches along the river from Prevalac to the village of Nikolinac. In the western part of the basin this terrace was discovered in Trgoviška river and on this terrace lies one part of the village of Trgovište. This is the same case with the Jošanička river where traces of the terrace appear above and in the very village of Jošanica (Јовановић, 1924: 76).

According to Rakić's analyses the fourth river terrace (t 4, 90-110 m) in the basin of the South Morava river is mostly eroded and observed only in Leskovačko polje and on the right bank of Toponička river. Present are mostly heterogenous psephytes, red sands and clay red soils, whereas among the cobble stones most dominant are quartz and hornstone, slate, red Permian sandstones and Mesozoic limestone which is proof of the quantitatively new processes in the South Morava basin. Thus the supposed age of this terrace is assumed to be during the glacial period of Günz (Rakić, 1977: 28).

The third lower terrace, with a height of approximately 35 m, accompanies the Moravica river almost along its entire length. In the eastern part of the basin it is clearly pronounced in Pašino polje below the cemetery. It is also clearly pronounced in Vetrilima on the right bank of the Moravica river, as well as above the village of Blendija where it is composed of thick gravel deposits. It transverses into the Sesalačka river and the lower end of the village of Bogdinac lies on it. It can be clearly seen below Prevalac where it is composed of a thick layer of gravel. From there it stretches along the left bank of the Moravica all the way to the Bovan canyon. On the right side of Moravica it can also be seen below the village of Žučkovac (Јовановић, 1924: 76).

The third South Morava river terrace (t 3, 50-60 m) was observed in the form of isolated parts along the entire length from the Grdelička canyon to the Stalaćka canyon. As opposed to the low terraces, the level of 50-60 m differs by its unified facial composition and the bond of psephites which is of a red soil type. Thus M. Rakić relates the first appearance with the dynamic evolution of the valleys whereas the second appearance is in relation with climatic changes. The greatest importance for the stratographic determination of the third terrace has the species Cyclocypirs tribeli. The mentioned form was discovered in the sediments of the Holstein interglacial in the

vicinity of Berlin, and later in the age layers of Mindel interglacial near Solnik in Hungary. In our region the third terrace was classified based on a bio-statigraphic analysis and its position in relation to other high and low terraces and thus was classified into the Mindel glacial period (Rakić, 1977: 26–29).

The second terrace is located 15 m above the Moravica river and it is clearly expressed along its entire flow. It is more dominantly expressed on Vrelo, Prevalac and near Dugo Polje. In Sokobanja most of the houses together with the church and school were constructed on top of this terrace. From there it stretches in the direction of the present-day regional road to Aleksinac and all the way to the Bovan canyon (Јовановић, 1924: 76). With the river Moravica low terraces (from 10 to 15 m) the fasciae of the river bed are clearly differentiated so one could conclude that these are typical alluvial sediments.

The second river terrace of the South Morava river (t 2, 25-35 m), was observed on the brinks of Leskovačko polje, on Bubanj along the Nišava river and in Aleksinačko pomoravlje near the villages of Vrtište, Bobovište and Deligrad. The features of the second terrace show that its sediments have no connection with the alluvial fascia of the river bed. They were created by flows of an interim character that were flushing the alluvial plain creating a system of flooding cones in it. Such intensive flushing with deluvial and proluvial agents is directly related to young tectonic motions and was most likely synchronous with climatic changes. According to the understanding of M. Rakić, this terrace could be classified into the youngest part of the Middle Pleistocene i.e. into the glacial period of Riss in a broader sense (Rakić, 1977: 24–26).

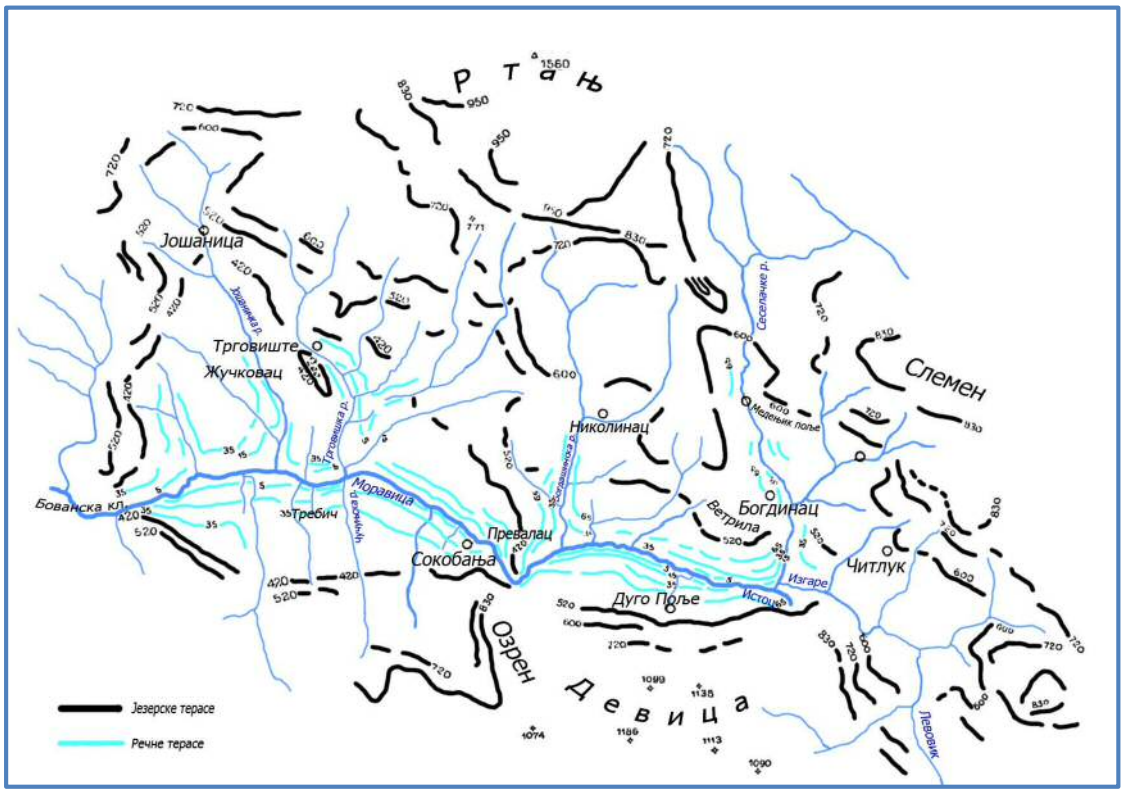
The first, lowest terrace is located at an altitude of 5 m above the river and is Holocene by age. It is partly preserved in a few locations near the villages Čitluk and Blendija as well as on a low terrace near Lepterija in the Sokograd canyon. It is the widest at the entrance into the Bovan canyon and was registered in almost all tributaries of the Moravica river (Јовановић, 1924: 76). This is the terrace in which the existence of Vinča culture settlements was confirmed, and the same applies to the locality Trebič (Петровић, 1969: 132–135), a few kilometers downstream from Sokobanja, at the left bank of the Moravica.

The first river terrace (t 1, 10-15 m) is clearly visible on multiple locations in the basin of South Morava. Based on the names Elephus primigenius, Equus caballus and Bos sp. one can with quite an amount of certainty claim that the lowest terraces were created during the youngest Pleistocene, i.e. the glacial period of Würm (Rakić, 1977: 26–28).

TRANSITIONAL BELT – HILLSIDES

The second unit represents a transitional area between the Moravica basin and the surrounding Sokobanja mountains. It is characterized by mildly sloped hillsides up to an altitude of 620 m which together with the basin belt constitute the Sokobanja basin. The creation of this belt's relief was mostly influenced by abrasive processes during the lake phase in Tertiary.

The transitional belt is mostly filled with neogene sediments. The middle Miocene series that can be observed on the surface are present in one part of the terrain stretching from the coal mine "Soko" and the village of Čitluk all the way to the village of Orešac where grayish-white compact marlstone was observed together with sweet water fauna (Limnea, Planorbis, Hyidrobia, Pisidium and ostracoids) (Новаковић и др., 1970: 285). The dominant sediments of the transitional belt belong to the series of the fresh water Upper Miocene (Panonian) and are more numerous in the western part of the basin where they cover a vast surface reaching from the steep sections of Ozren and Leskovik in the south all the way to the southern corner of Mount Rtanj's limestone massif (Јовановић, 1924: 60; Новаковић и др., 1970: 287). In this area V. K. Petrović found Pliocene fossils (Melanopsys, Prozostenia, Planorbis, Congeria) (Петковић, 1935: 135). The sediments from the final Pliocene series construct mostly the middle parts of the Sokobanja basin and lay on top of the formations from the Paleogene series. They are exclusively composed of coarsely clustered rocks of different fractions (Новаковић и др., 1970: 291–292).



Lake and river terraces of Sokobanja basin layout (according to drawings of Jovanović, 1924.)

Lake terraces

The studying of the structure of lakes in the Sokobanja basin was the subject of our renowned geomorphologists J. Cvijić (1913, 1924, 1926) and P. S. Jovanović (1924), and in modern times J. Đ. Marković (1977). The mentioned Neogene sediments in the Sokobanja basin are undoubtedly witnesses of a lake phase. This is also

confirmed by expressive shapes of the lake relief that dominates the transitional belt i.e. hillsides. The Aleksinac-Niš lake was an integral hydrologic unit of the large basin of the Morava with which the Sokobanja and Knjaževac lakes were connected (Марковић, 1977: 46).

Cvijić and Jovanović have in the northern part of the Sokobanja basin established six phases of the rhythmical recession of the lake level. These are shown on the plateaus of 940, 830 and 680 m and paleo-abrasive terraces of 600, 500 and 400 m of absolute elevation (Јовановић, 1924: 65–73). Marković considers this statement unfounded, stating that there are no lake formations in the Sokobanja basin below the altitude of 650 m whereas the terraces of the central lake plateau at the altitudes of 680-730 m are unpreserved, rare and scarce, leaving no possibility for a precise determination of their origin (Марковић, 1977: 46–49). The gradual recession of the lake was accompanied also by the rivers moving them from higher to lower surfaces. This caused the rivers, especially in the lower parts to more deepen their river beds and in that manner they have modified the lake formations of the relief creating their own shapes which have finally defined the morphology of the area. Therefore the lake relief is considerably changed and the lake districts are broken into countless slopes (Дакић, 1967: 5).

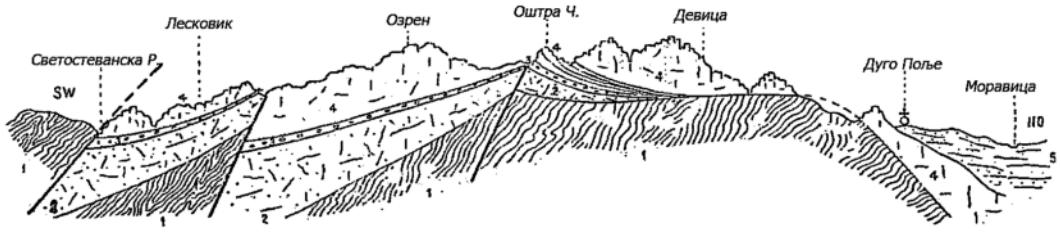
The lake terraces are important for the studying of the Paleolithic epoch because although they represent hunting areas they can also be layers of flint and quartz materials, as is the case with the site Kremenac near the village of Rujnik in the Niš basin (Šarić, 2013).

Site Kremenac near the village of Rujnik (air-photo Milojević, P.)

MOUNTAIN BELT

An important feature of Sokobanja's geographic position is the fact that it, in regional and geographic terms, is part of the vast Carpathian and Balkan mountain system whereas only a small part of it (towards the west) touches into the zone of the old Rhodope mass (Ршумовић, 1974: 176). The mountains Rtanj in the north, Slemen and Krstatac in the east and Ozren and Devica in the south belong, tectonically speaking to the younger Carpathian-Balkan system of eastern Serbia's mountains, whereas the mountains Bukovik and Rožanj on the western rim belong to the old Rhodope mass (Марковић, 1962: 11–29).

The elevation of mountains in the Moravica basin had begun as early as in the Cretaceous in a shallow and warm sea, and was accompanied by volcanic activities. The corrugation reached its paroxysm during the Alpine orogenesis (27-23 million years ago). The mountains of eastern Serbia obtained their basic outlines already at the beginning of the Miocene. Due to the resistance of the old sunken Pannonian and Romanian (Walachian) mass and the resisting Rhodope mountains, the Carpathians became corrugated and elevated. A series of rifts in the area of intensive corrugation led to the intertwining of the radial and tangential tectonics. In between the mountains there are numerous valleys creating a ''chessboard relief''. The epeirogenic movements increased the heights of the mountain ceiling between the Morava and Timok rift, whereas the ground along the Morava dislocation and Timok rift intensively sank thus forming the basins. The Sokobanja basin was already lowered in the Oligocene between the elevated mountains Rtanj, Devica and Ozren and the even older mountains Bukovik and Rožanj, and Aleksinac basin (Марковић, 1977: 43) had sunk between the Stalać mountains, Jastrebac, Bukovik and Ozren. Caves and other forms of karst relief are mostly concentrated in the mountain belt of the Sokobanja basin.



Geological profile of Ozren and Devica mountain
1. Crystals shale of second group (On the Devica mountain paleozoic phyllite and sandstones);
2. Red sandstone; 3. Dolomite; 4.Limestones; 5. Neogene (drawings of: Petković, 1935.)

PEDOLOGICAL COVER

Pedology is concerned with studying the surface layer of Earth's crust that has emanated as an independent natural creation i.e. soil which was created through processes of transformation and transaction of organic and mineral matter as a result of the mutual interaction of climate, mother substrate, relief and living organisms

(Шкорић, 1986: 11) By analyzing the soil one can establish the manner of its formation, its age, moistening intensity, the vegetation it used to be covered with, as well as some activities performed by man in the past (Кукин и др., 1992: 19–20). Unfortunately, insufficient soil research in the Sokobanja region does not offer us such possibilities therefore we must dwell within the framework of the present research.

The pedological soil composition in the Sokobanja region is diverse. Alluvium is present around the Moravica and Sesalačka river, and it is also present around the tributaries of the Moravica in their upper stream and in the narrow belt of the rivers themselves (Дакић, 1967: 15). In comparison with other types of soil alluvium is the most fertile one. It contains large amounts of humus and limestone matter which make it very fertile. Its fertility is renewed each year by each new flood.

The second body i.e. hillside is covered with a thick layer of lake clay, marl, sands and gravel mixed with sandy clay (Јовановић, 1924: 72). These lake sediments belong to a type of soil called vertisol. The layer of this loose earth becomes even thinner the more we move northwards or southwards (Дакић, 1967: 16) from the alluvial plain. This type of soil contains less humus and limestone materials than alluvium and is more susceptible to degradation in its lower parts whereas in its higher parts it is susceptible to washing away and erosion. To a lesser extent cambisol is present in the higher hillside sections, while podzol is to a lesser extent present in the foothill of Rtanj. The formation process for podzol requires approximately 1500 years (Кукин и др., 1992: 20), which indicates that this area was covered by forests for a shorter period of time while today it is mainly covered with grass and no trees.

The basin mountain belt, especially its northern, eastern and southern rim is dominated by limestone – skeletal and skeletoid podzoic soil. This somewhat barren, rocky soil may also have a fertile loose layer which is located in the lower contaminated zone (surfaces 720m). Dominating there, although in small quantities is colluvial gravel mixed with red soil. The layer of loose soil in karst parts is very thin, almost inexistent, except at the bottom of karst depressions (ravines and sinkholes) where terra rossa is exclusively present. Because of copious amounts of colloidal particles the red earth can take in lots of water hence its volume varies making it impermeable to water. This feature is important for the hydraulic conditions of karst and the subterranean water circulation inside limestone terrains (Petrović, 1967: 172).

The basin mountain belt with skeletal soil is covered by meadows on its northern rim while meadows and forests cover its southern and western rim. On the higher sections of Ozren and Devica i.e. their summits are covered with barren limestone soil. The eastern rim of the basin is also dominated by barren limestone soil which on the northern rim alternates with meadows. The western rim of the basin with the mountains Bukovik and Rožanj is abundant in forest vegetation.

Loess sediments

The presence of loess was not established in the Sokobanja basin but in the Moravica valley towards the exit of the Bovan canyon there are some larger loess oases close to the villages Kraljevo and Subotinac. North of this settlement the Moravica river terrace near Most at an altitude of 210 m and relatively at 8-10 m is composed of loess, as well as in the vicinity of the village of Subotinac it is located near the buildings of the mining colony at an altitude of 220 m and relatively at 20 m (Костић, 1969: 505–506). The loess in Subotinac is composed of dark-red soil with gravel and typical continental loess with lots of limestone concretions. The loess layer depth in both locations varies from 1.5 to 2 m. The loess is of a carbonate type and therefore very different from the other loess oasis in southern Pomoravlje (Марјановић-Марјановић, 1957: 110). The loess horizons are continuous in their bases and thus very important for the chrono-stratigraphic determination of the Quaternary, especially if they are present in the river terraces' composition.

The cross sections of the loess plains offer a plain sight view at the darker colored layers which represent the history of particle deposition. The loess contains magnetic particles which comprise less than 1% of the specimen mass i.e.: magnetite (Fe_3O_4), maghemite (γ-Fe_2O_3) and hematite (α-Fe_2O_3). The varying amounts of these particles are indicators of ice age stages. The process of loess formation is quite uniform offering a stable dating background and therefore the measuring of magnetic susceptibility per specimen which increases in intensity by two orders of magnitude during the interglacial period. The magnetic dust record corresponds in time with the so-called oxygen isotope stages in marine sediments, which are a global water content indicator in the polar ice caps (Evans, 2005: 150–153). Thus loess research is important for studying the ice age cycles.

HYDROGRAPHY

Rivers could appear in this region only when the lake level was on such an altitude that there was enough land above for their formation, and this happened right at the time when the lakes' level descended to 830 m. The further development of rivers depended on the condition of the lake itself the bottom level of which was their lower erosive basis (Јовановић, 1924: 73). All forms of water bodies have always been a refuge to a large number of plant and animal species, which was especially important during climatic fluctuations in the time of ice ages. For these reasons, all the micro areas of the rivers are inseparably related to the existence and activities of the prehistoric men, granting them the status of sites containing the complete image necessary for the understanding of Pleistocene biomes.

The basin of the Moravica river in Sokobanja

The main river body in this area is the Moravica river in Sokobanja which is the right-hand tributary of the South Morava. It springs from Tisovik and Izgare, and the

name Moravica emanates from the strong Čitluk (Moravica) spring called Istoci (Марковић, 1977: 40). Tisovik and Izgare constitute the eastward extension of its basin. The upper and middle part of Moravica runs through the Sokobanja basin whereas its lower part, after passing the Bovan canyon, runs into the Aleksinac basin. At its estuary west of Aleksinac, the Moravica makes a sharp turn in a very characteristic adaptive bend which indicates that it was independently formed from the Morava i.e. it was first formed towards the banks of the Aleksinac basin and later tucked into the Morava basin (Костић, 1969: 507). The Moravica cut its basin along the southern rim of the Sokobanja basin hence the characteristic asymmetric shape of its basin. All its tributaries join from the right hand side while only a few smaller rivers join at its left hand side (Милић, 1976: 8).

Besides the Moravica, important for the hydrography of this area are also its tributaries. There are 11 right hand tributaries and 8 left hand tributaries, and besides these rivers there are numerous seasonal creeks and springs enhancing its water level in spring. The most important right hand tributaries are: Izgare, Sesalačka river, Adžica, Nikolinska river, Vrmaška river, Jošanička river, Vrbovački creek, Mratinja etc. The most prominent left hand tributaries are: Duboki creek, Gradašnica, Čučunjski creek, Poružnička river, Lukovički creek etc.

CLIMATE

The climatic features of Sokobanja were the study subject of numerous researchers. One thing all the authors concur with is that its relief and specific geo-morphologic structure of its terrain are the main factors influencing the climate in the basin. Besides the general climatic factors, such as longitude and latitude the climatic features of the Sokobanja basin are influenced by the altitude, exposure of the terrain, direction of the mountains and valleys and the openness of the basin towards the south (Радојковић, 1904: 11). Bordered and almost completely enclosed by high mountains this area has a unique climate and significantly differs from other areas by its specific variations in temperature, quantity of precipitation and wind frequency. Such morphologic features influenced the creation of a special climate, the temperature variations, schedule and quantity of atmospheric precipitation, the wind speed and frequency i.e. the creation of special climatic features of the basin (Јовановић, Радивојевић: 2006: 146). Based on the performed climatic zoning of Serbia, the Sokobanja basin is placed in the Sokobanja-Knjaževac climatic zone with a moderately continental climate with warm summers and mild winters, and annual temperature amplitudes of up to 23 ºC and a pluvial regime with partially present Mediterranean influences (Ракићевић, 1980: 132).

According to Đukanović's analysis, the average annual temperature in Sokobanja is 10,3ºC and is lower than the one in Niš and Aleksinac by 1,5ºC (Đukanović, 1960: 41). The difference in temperature between the Sokobanja and South Morava basin is explained by the size of the basin and influence of the surrounding mountains. The lowest temperatures are in December, January and February and they

are always a bit lower than the surrounding temperatures in the South Morava basin. Temperatures below 0ºC are possible also in April, May and October. Air temperatures above 10°C appear in the valley belt of the basin by the end of the first decade in April and last until the end of the second decade in October. The interval of such temperatures is 179 to 193 days (Pavlović et al. 2011: 18). Daily high temperatures during summer are not unbearable because cold air masses descend from the surrounding mountains while the warm masses are rising making the nights even more pleasant. Due to such temperatures as well as other climatic factors Sokobanja enjoys the reputation of a famous climatic health resort.

The thermal regime of the Sokobanja basin is characterized by shifts of hot and fresh summers with cold and mild winters. The winter temperatures change considerably more than the summer ones, which means that the differences in the observed periods of summer temperatures are small, whereas the temperature differences between certain winters are more prominent. When this area is under the influence of continental polar air masses, the average winter temperatures are low. The winters are mild and warm when this area is under the influence of oceanic air masses or continental tropical air currents (Димитријевић и др., 2002: 152–153).

Some features of the Pleistocene climate in the South Morava river basin

A significant feature of the Quaternary is the exceptional dynamics of geological, climatic, hydrographic and biological processes i.e. the revival of orogenic and tectonic movements, the creation and disappearance of vast ice covers, fundamental and multiple climatic changes, the rise and descend of the sea level accompanied by corresponding paleo-geographic changes, as well as changes in the flora and fauna (Šegota, 1979: 21). We have only a general knowledge about the features and the facts of the Pleistocene climate in the territory of Serbia, while the specifics of some regions are still not researched. We can gather some uncertain data from analyses of the Quaternary sediments in the Niš and South Morava basin, based on which we can construct only a general outline of climatic changes in a region which according to present climatic features is close to the Sokobanja basin.

The cross-section profile of the Nišava basin, which cuts across the terrace at Donja Vrežina (30 m) and the terrace of the RR Institute (10 m), simultaneously shows also their climatic history. The phases through which the mentioned relief has passed indicate a considerable number of climatic oscillations in this area. Four layers of gravel, three layers of loess and three layers of fossil earth indicate considerable interchanging climatic extremes. Besides that, the morphology of these terraces indicates climatic changes. It has been shown that vertical erosion occurred five times, which means that the climate became moister five times. To this one has to add also a cold-moist boreal climate that was in place during the formation of the higher terrace of Niška Banja (with Betula pubescens) and one steppe climate which froze together with it (with Succinea oblonga) at the same basin bottom of the Nišava at depth of 46 m (Марковић-Марјановић, 1978: 56–57).

The forming of the terraces (of 46, 30 and 10 m) is related to the period between the glaciation Riss and the final phases of the glaciation Würm and the climatic oscillations according to Marković-Marjanović are identified in the following manner:

1. Boreal climate (Betula pubescens), followed by cold – dry climate (Succinea oblonga) – Niška Banja terrace 46 m;
2. Wet climate (vertical erosion, potholes);
3. Wet climate, perhaps of a Mediterranean type somewhat drier than the previous (accumulation of river conglomerates and red formations);
4. Arid climate (first loess formation);
5. Pro-Mediterranean climate (vertical erosion, first reddish soil formation);
6. Arid climate (second loess formation);
7. Pro-Mediterranean climate (vertical erosion, second reddish soil formation with lots of water precipitation);
8. Wet climate (accumulation of second gravel of the 10m terrace);
9. Climate moister than the previous (vertical erosion in the accumulated gravel);
10. Arid climate (drying-out of the Nišava river and third loess formation);
11. Moister climate (accumulation of the third gravel on top of the loess without stronger cuts of the river bed);
12. Extremely wet climate (vertical erosion with deep cutting-in of the river bed);
13. Climate drier than the previous (accumulation of the fourth recent gravel).

According to Rakić's observations made on the lower terraces of the Moravica river (t 1, 10-15 m) south of Aleksinac, the following fauna is present: Pisidium amnicum, Pisidium nitidum, Sphaerium corneum, Vallonia pulchella, Vallonia excentrica, Vallonia tenuilabris and Valvata macrostoma. Based on the findings of the teeth of Elephus primigenius, it can be supposed that the youngest layers of the terraces deposited in the Late Upper Pleistocene (Rakić, 1977: 24).

The observed malacofauna, although of a limited stratigraphic importance helps considerably in the explaining of paleo-ecologic conditions. Thus, for example numerous priscidiums on the Moravica terraces indicate swamps and barely mobile environments. On the other hand, the families of snails Aegopinella nitens indicate wet environments with intensive decomposition of plant matter from which it can be concluded that the once alluvial plain of the first terrace was covered by forests (Rakić, 1977: 26). However, it still needs to be established whether this was a local phenomenon or an ecologic feature of the entire complex.

According to some researchers, Vallonia pulchella, which can be mostly found in grassy and muddy shore-parts of the river beds, whereas in the Quaternary it appears only in warm periods (interglacials and interstadials) (Ložek, 1955), which is proof that these areas were not under direct influence of glaciations. This does not imply that the South Morava basin did not suffer the consequences of the cold climate, because the numerous alevritic underwater facies were only one type of change within the

perstrative dynamic phase that occurred along with climatic fluctuations in the northern hemisphere. Findings of mammoths also indicate a cold climate but this does not always mean that the South Morava basin was a direct extra-glacial zone (Rakić, 1977: 26).

By analyzing the micro-fauna from Mala and Velika Balanica near Niš it was established that the Middle-Pleistocene horizons with Mousterian artifacts were dominated by warm animal species (Apodemus sylvaticus/flavicollis, Apodemus mystacinus, Muscardinus sp., Dryomys nitedula, Rhinolophus ferrumequinum), while there is a lesser percentage of zones with steppe species (Ochotona pusilla, Allocricetus bursae, Lagurus sp.) (Mihailović, 2014: 110). Since these layers most likely correspond to the phases MIS 9-7 (344-244 thousand years), i.e. the time period characteristic for its frequent climatic fluctuations, it can be assumed that the existence of Pleistocene people in these areas was possible during the colder as well as during the warmer phases of the Middle Pleistocene, which corroborates the assumption of a moderate climate in the South Morava basin during the ice ages (Mihailović, 2014: 110).

FLORA AND FAUNA

Since Sokobanja is situated at the foothill of karst areas in eastern Serbia, the vegetation of this region is very diverse. Forests once used to cover vast surfaces of this area but due to human activities they were considerably degraded in size and also suffered structural changes. Especially affected were forests of good quality (oaks, beech and conifers) foremost in the valley-part and along the northern and western mountain rims. Bearing in mind that the entire area was settled by numerous scattered human settlements, the vegetation underwent antropogenic changes. Thus natural forest complexes, associated with only one type of soil, appear only in limited and hardly accessible mountain areas.

Like the climatic and pedologic belt, the vegetation belts also keep changing from the foothills towards the summits in the following sequence: a) belt of white hornbeam mixed with Turkey oak and Hungarian oak; b) belt of white hornbeam and maple; c) belt of Turkish hazel; d) belt of beech forest which on hidden slopes and mountain sides not facing the sun continues into juniper and spruce forests (Атанацковић, 1959: 129–139). There are also black pine and fir forests on the prominent mountain tops and steep cliffs of Rtanj. As a whole karst terrains are dominated by mixed forests spreading over the plateaus and mountain plains and slopes. Above the forest floor there are meadows with steppe grass on areas with abundant sunlight and arctic-alpine floral elements on sides that are hidden from the sun. The natural vegetation of beech forests is best preserved in the entire area. The largest complexes can be seen on higher and inaccessible limestone mountains. Forests of smaller heights were mostly destroyed by excessive exploitation and partly by forest fires in the lower areas during the past 150 years (Diklić, 1962: 49–83).

An oasis with a natural sequence (bottom-to-top) of relict plant communities was preserved in the gorges, canyons and coves of the southern slopes of Mt. Ozren (Leskovik) near the village of Lipovac. The lowest parts are populated by the

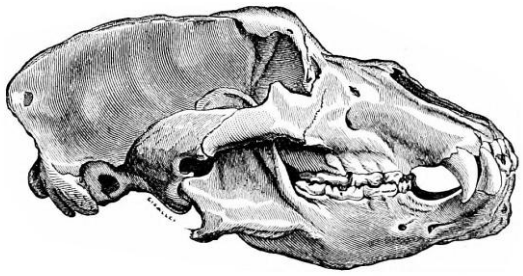
communities of oaks (Q. cerris, Q. frainetto, Q. petreaea) and Turkish hazel (Corylus colurna) which is a relict species dating from the Tertiary. Immediately above the sequence continues with a community dominated by manna ash (Fraxinus ornus) and Turkish hazel (Corylus colurna). The third member of this sequence is the community of plants belonging to the family Syringa represented by lilac (Syringa vulgaris), Montpellier Maple (Acer monspessulanum) and Turkish hazel (Corylus colurna). At the same time in the gorges and canyons of the Lipovac terrain, on its steep limestone rocks often can be seen the relict community of lilac (Syringa vulgaris) and Mahaleb cherry (Prunus mahaleb) (Ranđelović i dr., 2006: 36–37). Mount Rtanj also is the center of relict and endemically-relict Tertiary flora. The most important of Tertiary relict species on this mountain are the Turkish hazel (Corylus colurna), chestnut (Juglans regia) and European bladdernut (Staphylea pinnata) (Jovanović-Dunjić, 1956).

The total geographic, orographic and hydrographic conditions, as well as the rich vegetation of the Sokobanja area provide conditions for the life of different sorts of wild animals. The areas with meadows on low altitudes, hillsides and hilly mountainous areas intersected by a dispersed network of rivers with abundant vegetation and forest plants make ideal conditions for wild game habitats. The abrupt increase of population, deforestation, construction of roads and settlements, wars and poaching contributed to the depletion and migration of hunting game. Due to the reasons mentioned above and while in search for more peaceful habitats wild animals have moved from their original habitats to more secluded and sparsely inhabited areas where they manage to survive with the assistance provided by additional nutrition and care of the appropriate authorities. The most interesting specie of hunting game are: roe deer, wild boar, rabbit, fox, wolf, jackal, chamois, partridge, pheasant, quail, snipe etc. Protected species are mostly representing by the grey hawk nesting in the gorges of Sokograd and Levovik (Јевремовић, Јованчић, 2009: 19).

According to written documents people started settling more actively in the territory of the municipality of Sokobanja in relatively recent times, during the 18th and 19th century (Јовановић, 1924). At the beginning the population was far and few in numbers in comparison to its present size so there was enough hunting game in larger and unpopulated areas. According to old archived documents there are records that Sokobanja was a place for the sale and processing of furs of badgers, weasels and foxes the population of which was abundant. It was also recorded that the last bear was killed most likely in 1901 when it barged into a cattle farm in the vicinity of the village Dugo Polje killing one calf. Proof of the existence of bears are also numerous toponyms that were preserved in the names of sites in the Sokobanja basin: Mečji vrh (Bear's summit), Mečja glava (Bear's head), Mečja rupa (Bear's lair), Mečji vis (Bear's top), Debela mečka (Fat bear) etc.

Pleistocene ecosystems of the Sokobanja basin in relation to neighboring Balkan regions

Based on Paleontological research of the Mirilovska cave in the valley of Ravanica (Димитријевић, Јовановић, 2002: 113–124), Baranica cave (Dimitrijević, 2011: 69–85) and Vasiljska cave near Knjaževac, Vrelska cave near Bela Palanka, the Popšička and Prekonoška cave in the vicinity of Svrljig, as well as Pećurski kamen on the brim of the Sokobanja depression the existence of 48 species of mammals in the Upper Pleistocene layers (Димитријевић, 1997: 179–359) has been established. Layers with remains of Pleistocene mammals and Paleolithic flint artifacts are known to have existed in Baranica, Mirilovska cave and Pećurski kamen, while such layers were also identified in many other caves during researches conducted during the past few years: Milušinačka cave (Sokobanja), Velka cave (Žagubica), Selačka cave (Knjaževac), Kozja cave (Pirot), Donja cave (Bela Palanka), Mečja Dupka cave (Niš) (Kuhn et al, 2014: 97–106) and Velika Balanica cave (Niš) (Marin-Arroyo, 2014: 121–129). The most numerous remains found were those of the cave bear, cave hyena, types of chamois living in high mountains, Alpine chamois, deer, rabbit, wild boar, wolf, bison, and numerous small mammals, whereas the rhinoceros, snow leopard and cave lion were only discovered in rare individual finds. Besides that we know that in the lake and river terraces of eastern Serbia remains of bigger mammals were found in the basins of the Danube, South Morava and Moravica and this consisted of remains of the southern elephant, wooly mammoth, horse, aurochs, bison and hyena (Димитријевић, 1997).

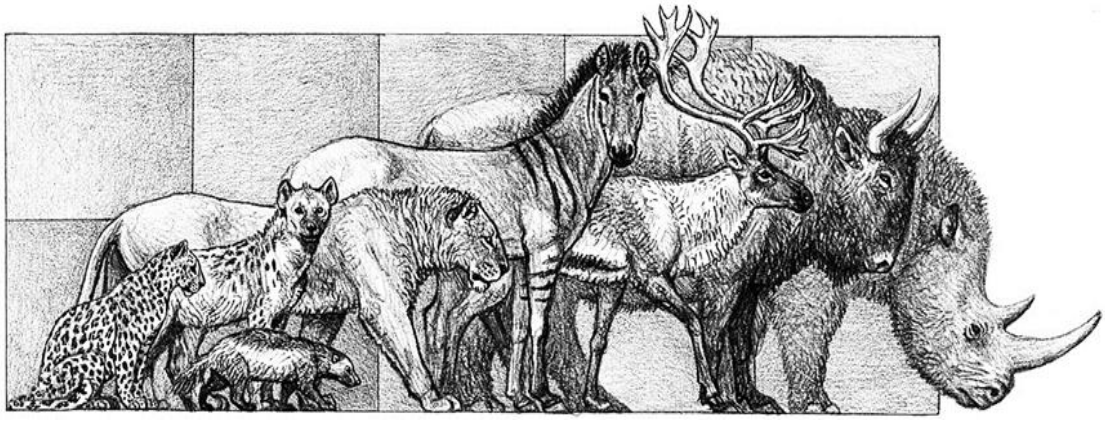


Skull of cave bear (Ursus spelaeus)

The mentioned research provided a basic picture on the ecology of the central Balkans during the Upper Pleistocene. It was established that the fauna characteristic for steppe ecosystems was highly numerous, with less numerous remains of species that used to inhabit forests, out of which a very small number of those who used to inhabit deciduous forests. The exclusive presence of boreal species such as reindeer, moose, polar rabbit, polar fox or wolverine has not been confirmed. Remains of the cave bear can already be found in the zones of the mountain hillsides, while they are frequently numerous in appearances at higher altitudes. The steppe fauna is widely spread in the central Balkan plains, stretching from the basins of central and eastern Serbia to the southern rim of the Pannonian plain. Based on Upper Pleistocene fauna found in cave layers it is certain that the central Balkans are characterized by the presence of mosaic ecosystems in valley regions. The rhinoceros of the warm climate (Dicerirhinus hemiothoecus), wild boar, roe deer and giant deer, as elements of the warm and humid

climate are noticed in the fauna of Risovača indicating the existence of a deciduous or mixed forest and swamps during the warm climatic phases of the Upper Pleistocene.

Another feature of the central Balkans compared to the neighboring regions is the existence of a Morava basin valley corridor that traverses the peninsula in a north-south direction. However, the Balkans remain a dominantly hilly and mountainous area where the relief with altitudes below 200 m covers less than 20% of its territory, but even such a corridor was enough to facilitate the influx of steppe climate and animal species that are characteristic to it. Another short valley pocket is the Timok basin in southern Serbia on the margins of the Velikovlaška plain in which, concerning the climate and fauna one would expect a larger influence of the Black Sea plains (Stewart et al. 2003). Therefore the most important paleo-ecologic issue of the central Balkan



Pleistocene fauna from cave sites in Serbia: *leopard - Panthera pardus, hyena - Crocuta crocuta spelaea, badger - Meles meles, lion - Panthera leo spelaea, European ass - Equus hydruntinus, reindeer - Rangifer tarandus, Steppe bison - Bison priscus, рунасти носорог - Woolly rhinoceros (illustration: Mauricio Anton)*

Pleistocene is the issue of the translocation of animal bio-matter between the Morava basin as the margin of the Pannonian plain, and the Timok basin as the margin of the Velikovlaška plain. Since these two regions are separated by the Carpathian massif, the contact between these two valley eco-systems may have occurred in the valley of the Black Timok via Čestobrodica or via the valley of the Moravica through Bovan since these two valleys have an altitude of 300-350 m, mountain slopes at an altitude of 500-600 m, while the transition between the springs of Mlava and Zlot, Svrljiški Timok between the Svrljiška and Knjaževačka valley and the valley of the Trgovački Timot and Pirotska valley are characterized only by steeply cut limestone canyons inaccessible to migratory herds of large mammals such as the bison, horse and mammoth. Another possibility was that the valleys of the Morava and Timok were, in a paleo-ecologic sense, two completely separate steppe ecosystems during the Pleistocene i.e. that the barriers between them were insurmountable for big mammals which prevented large seasonal migration of herds of big mammals. Also, it remains to be established whether these spots of translocation were permanent or passable only during interglacial conditions. The presence of horses, larger bovidae, rhinoceros and hyenas in Pleistocene layers of Milušinačka cave 1, i.e. remains of a wild boar in Pećurski kamen are presently the only indications for such a hypothesis because similar

fauna was found in Pleistocene archeological and paleontological sites in regions surrounding the Sokobanja basin.

The Pleistocene flora of Sokobanja has not been researched in more detail but based on the current climate, the complexity of the plant cover and its altitudinal stratification it is supposed that this region represented a refugium core for enclaves of deciduous species during the glacial periods of the Pleistocene. By analyzing the coprolites and Upper-Pleistocene layers of the Baranica cave, which is regionally and climatically very close to the Sokobanja area, the existence of 7 plant taxons has been established. Trees are mostly represented by heliophyllic, pioneer genus of pine (Pinus) and juniper (Juniperus). Of deciduous trees the only present was ash (Fraxinus), a tree that requires moist soil and lots of light and its appearance is most likely related to the close proximity of a river. Of grasses and shrubs present are wormwood (Artemisia), then plants from the family Asteraceae of the type Carduus, and one grain of Poaceae, Ranunculaceae and Scrophulariaceae, respectively. Of course, based on such a small number of pollen grains it is impossible to reconstruct the vegetation, however, it is evident that these were open areas with the presence of steppe elements under harsh climate conditions. These were conditions corresponding to the last glacial i.e. concurrent with the age determined based on faunal remains (Argant, Dimitrijević, 2007: 73–80).

Besides the settling of lowland ecosystems, Paleolithic settlements in mountain areas, above an altitude of 500 m are nothing new and as such have already been researched in Serbia, Montenegro, Slovenia and Romania and therefore the potential of the speleological objects of Ozren and Devica on higher altitudes should not be discarded considering the feeding economy that was based on ecosystems with mid-sized herbivores in scattered groups, such as red deer or ibex (Fiore et al. 2004). Important for further research of the Upper Pleistocene fauna of the central Balkans is a more precise chronological integration of the systematically explored Upper-Pleistocene archeological and paleontological finds so as to determine whether and to what degree the climatic changes could have influenced the composition of the Pleistocene fauna in different ecosystems i.e. whether the central Balkans were a refugium during the Glacial, and if so, where these can be located and in what time periods.

SPELEOLOGICAL OBJECTS IN THE SOKOBANJA REGION

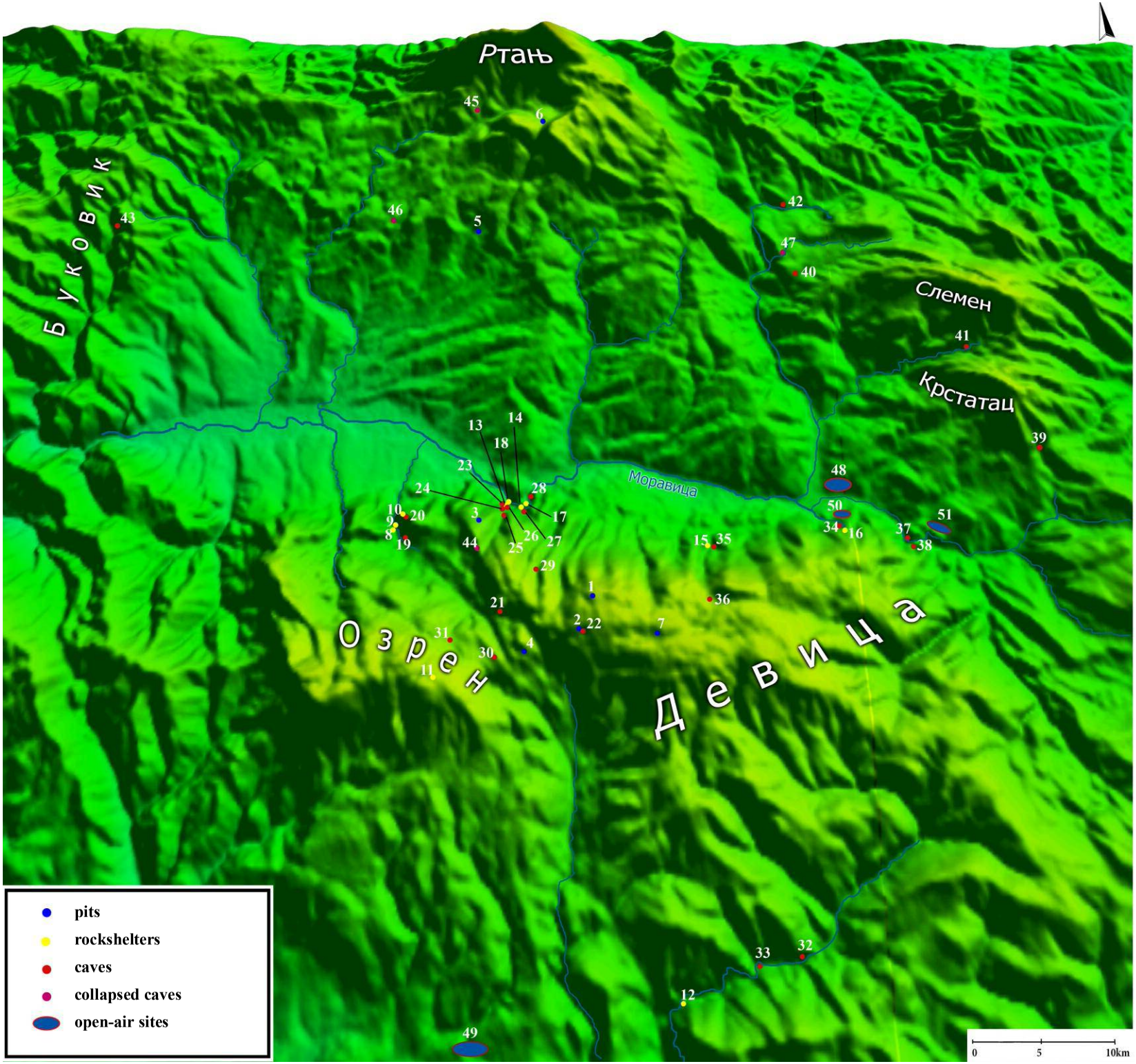
The Sokobanja basin with its surrounding mountains represents a typical karst area in which karst forms of relief are represented on a surface of 464 km², which puts the Sokobanja area in the second place according to the distribution of limestone masses in eastern Serbia, immediately after Kučaj (652 km²) (Гавриловић, 1965). The considerable expanse of limestone in the Sokobanja basin and its surrounding mountains also implies numerous corrosive superficial and speleological formations. When the karst relief is observed as a whole, noticeable are two separate groups of formations: one group occurs on the surface of limestone terrains – these are superficial karst formations, while others occur inside the subterranean masses – these are subterranean karst formations. Erosive subterranean formations, which are primary, include all categories of subterranean karst formations that were directly generated by karst erosion, as well as those generated by its direct action – the breaking and collapsing of limestone layers inside the limestone masses. The Sokobanja region displays four dominant types of speleological objects: pits, rockshelters, caves and collapsed caves.

1) Pit, abyss, chasm, beast, downfall but a few of names used for vertical geomorphological formations in the karst relief with an inclination of the main canal of 45° to 90°. Furthermore, this is a very common speleological type in the high karst of Sokobanja where the local population commonly calls them downfalls.

2) Rockshelters, holes or semi-caves are the names of short caves in which daylight can enter up to their very end (Petrović, 1967; Petrović, 1968) or, according to another definition these are short karst recesses the depth of which is smaller than the size of its opening (Krešić, 1988: 39).

3) Caves represent subterranean karst formations whose size of the opening is smaller than the total length of the inside part of the object. They were used by people as refuges and shelters for millions of years and many myths and legends have originated from caves. In Serbia they are also called peć, pećurina, pešter, peštera, tamnica, glama, dupka, whereas their Wallachian name is čaura (Цвијић, 1895: 1).

4) Collapsed caves are former cave canals whose ceilings are completely or partially destroyed so they look like smaller gorges with a dead end.



SPELEOLOGICAL OBJECTS IN SOKOBANJA REGION

1. Jelenska pećura
2. Rupa prozorka
3. Orlovačka jama
4. Jama pod Oštrom čukom
5. Zverka porica
6. Rtanjska ledenica
7. Veliki ledenik
8. Tatumirova rockshelter
9. Gradašnjička rockshelter
10. Mečja rockshelter
11. Ravan rockshelter
12. Crkvvište
13. Golemopadinska rockshelter
14. Sokogradska rockshelter
15. Poljanski kamen
16. Vrelska rockshelter
17. Lepterijske rockshelter
18. Hajduk Veljkova cave
19. Ozrenska cave (Delta)
20. Mečja rupa
21. Crvena rupa
22. Ledenik
23. Strelište cave
24. Golemopadinska cave 1
25. Golemopadinska cave 2
26. Lepterijska cave
27. Markova cave
28. Popovička cave
29. Vlaška pećura
30. Jezerska pećura
31. Vlasina cave
32. Radenkovski kamen
33. Goveđi pešter
34. Čitlučka cave
35. Dugopoljska cave
36. Tamnica
37. Cave in Strunjak
38. Pećurski kamen
39. Novakovci cave
40. Seselačka cave
41. Milušinačka cave 1 and 2
42. Rujiška cave
43. Bukovička cave
44. Stožer kamen
45. Kosinja padina
46. Krušjanska cave
47. Rujiška žlebina
48. Kremenac – Čitluk
49. Kremenac – Vrelo
50. Vrelska čuka
51. Lipov trap

REGISTRY OF PITS

JELENSKA PEĆURA

Type of find	Pit	Orientation of entrance	NE
Guide	Aca Marinković Jezero	Max. entrance width	12
Speleological mark	/	Max. depth	15
Altitude	1159	Max. width	20.6
Coordinates	N43°36,361' E021°55,135'	Max. length	16.5

Jelenska pećura is located at the high plateau of Devica, somewhat lower than its highest point Visoki vrh (1172 m). From that point, Devica steeply descends towards the Moravica River in the Sokobanja basin. This is a densely forested area dominated by large beech trees. Except for two seasonal creeks sprouting from the slopes north of Visoki vrh there are no other water bodies so that this area is rather waterless.

According to its shape, the pit Jelenska pećura is rather different from the other pits on Devica and Ozren. It was created in the urgonian limestone formations at the brim of vast well-like sinkhole. The basis of the pit is T-shaped so that the vertical branch (N-S direction) is a steep canal without a ceiling descending into an even horizontal branch (E-W direction) which by its morphology completely corresponds to the shape of a rockshelter. However, the present shape of the object was mostly created by the process of recessing of the parent sinkhole, which has destroyed a larger portion of the ceiling and this is demonstrated by large limestone blocks scattered on the basis. Besides crushed rock there is also forest chernozem which is quite wet in the rockshelter section due to water dripping from the lateral recesses.

While writing about the karst of Ozren and Devica, Miloš Zeremski visited this pit and mentioned it by the way as an object and labeled it „star-shaped formation“ (Зеремски, 2002: 3). During the mid 1970s the cave was also visited by Zvonimir Kaluđerović during his research of the Paleolithic Period in eastern Serbia but there are no written records of this exploration[1]. Due to its high altitude and aridness of the terrain, Jelenska pećura does not seem a place suitable for human settlement during the Paleolithic Period.

[1] Verbal information obtained from Vladimir Blagojević, mining geologist of the Coal Mine “Soko”, team member during the mentioned surveys (1995-1996). Kaluđerović mentions in his report (Калуђеровић З. *Палеолитска налазишта Сокобањске котлине*, Старинар 47, Београд 1996, p. 291) that he has visited several smaller caves with preserved sediment on the northern slopes of Ozren and Devica but does not provide any further details.

RUPA PROZORKA

Type of find	Pit	Orientation of entrance	/
Guide	Aca Marinković Jezero	Max. entrance width	4.3
Speleological mark	/	Max. depth	7.7
Altitude	1123	Max. width	6
Coordinates	N43°35,873' E021°54,909'	Max. length	12.5

Rupa prozorka is also known under the name Ledenička pit, not because it belongs to the type of speleological objects in which snow and ice are deposited but rather because its name was derived from the local toponym „Ledenik“, which is the name of the surrounding forests and meadows. This pit is located on a high karst plateau of Devica stretching between the tops Džambinac (1185 m), Čapljinac (1187 m) and Aleksin kamen (1100 m). The entire area is riddled with numerous sinkholes stretching over the surrounding meadows. The presence of sinkholes, monotonous terrain and low visibility has a bad influence on orientation thus it quite frequently happens that people get lost.

The pit is situated at the bottom of a plate-like sinkhole and consists of a larger hall that can be reached by two passageways. The larger and completely vertical opening is located in the ceiling of the main hall, while the other, smaller entrance is located in the south-western part of the pit-hall to which it leads to a shorter horizontal canal. Most likely the smaller opening once used to be the only entrance to the pit, whereas the other opening was created as a consequence of the increased collapse of the ceiling. The pit walls are coarse and uneven whereas the basis is covered with reddish-dark earth mixed with limestone blocks on top of which moss layer has developed.

ORLOVAČKA JAMA

Type of find	Pit	Orientation of entrance	/
Guide	Saša Stevanović Sokobanja	Max. entrance width	1
Speleological mark	/	Max. depth	5.5
Altitude	757	Max. width	8.7
Coordinates	N43°37,669' E021°52,854'	Max. length	9.3

Orlovačka jama is situated at the northern slope of the hill Orlovac (867 m) after which it was named. These are the northern most slopes of Mt. Ozren from which this mountain gradually sinks into the Sokobanja basin. The easiest way to reach this pit is by the asphalt road Sokobanja-Jezero where at the spring called Barudžija (location is marked by a sign post) a turn has to be made towards the eastern earthen road that leads

to Kulinom vrh via Orlovac. Further along the road at a distance of at most 1 km, Orlovačka jama is located on a small meadow on the northern side of that road. It is difficult to find this speleological object, therefore it is recommended to visit it only in the company of an experienced guide.

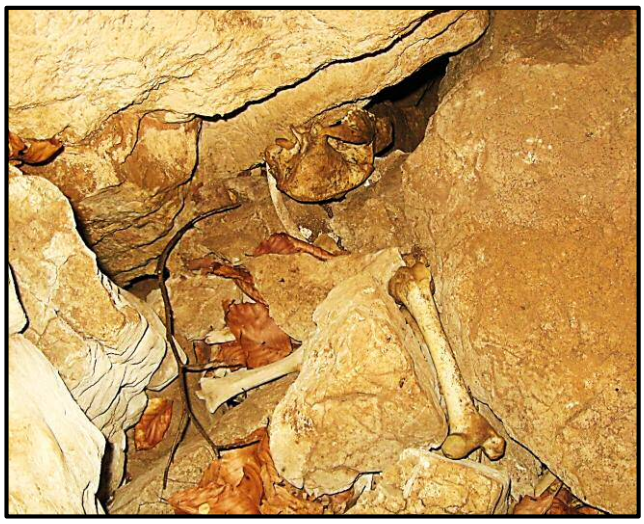
The entrance to the pit is located on a mildly inclined hill-slope in the cretaceous limestone of the Urgonian phase. The entire object consists of a narrow canal which after 2 m descends into a more spacious hall the shape of a hemisphere with a maximal height of 3,5 m. The large amount of deposited coarse crushed rock indicates a collapsing process of the entire inside. This pile of rock is mixed with a layer of dark sediment which was most likely washed in from the surface. The walls of the hall are uneven with lots of protrusions and recesses. One interesting feature is the eastern „speckled“ wall covered by a layer of dried moonmilk.

JAMA POD OŠTROM ČUKOM

Type of find	**Pit**	**Orientation of entrance**	**/**
Guide	**Aca Marinković Jezero**	**Max.entrance width**	**1.3**
Speleological mark	**/**	**Max. depth**	**2.7**
Altitude	**964**	**Max. width**	**1.9**
Coordinates	**N43°35,639' E021°53,934'**	**Max. length**	**6.6**

The pit is located on the southern foothill of Oštra čuka (1075 m), the limestone top of Devica, which protrudes from the Vlasina plateau like a sharp point. The easiest way to reach this object is from the nearby village of Jezero which lies at the foothill of Oštra čuka at a direct distance of only 2 km from the pit that can be reached by an earthen road. The entrance to the pit is hard to be seen because the surrounding area is covered by forest growth and besides that the entrance of the pit is covered by a large rock, placed there most likely due to safety reasons.

This pit is a typical example of a tectonic pit that was formed along the top of an anticline at the boundary between two mountains Ozren and Devica. It consists of a narrow triangular entrance opening that directly descends into a somewhat wider elongated horizontal crack. The interior of the pit is filled with large blocks of collapsed limestone dug into a layer of reddish soil. It is interesting to mention the finding of recent



Bones found in the bottom of the pit

skeletal remains of a wolf and a sheep whose mutual destiny in this cave can only be assumed. However, this is one of many examples illustrating the various possibilities of depositing osteological materials in pits.

ZVERKA PORICA

Type of find	Pit	Orientation of entrance	/
Guide	/	Entrance width	8
Speleological mark	/	Max. depth	10
Altitude	672	Max. width	10
Coordinates	N 43°43,138´ E 021°50,402´	Max. length	66

Zverka Porica is located in the limestone north of the village Šarbanovac. It has a circular opening approximately 8 m in diameter under which there are vertical walls rising up to a height of about 10 m. Two branches lead from its even bottom. The western branch gradually descends downwards and ends after 30 m with a deposit of crushed rock. Inside the vertical walls at 6 m distance from the entrance there is a shaft running into a canal which gradually narrows to its 10th m of distance from which one has to crawl a few meters through a very narrow opening that leads into a circular widening of about 6 m long and 2 m in height where this canal ends. The sediment in this pit consists mostly of bigger and smaller crushed rocks, except at the entrance of the pit which is covered with forest dark soil that was slid there from the surface. The lateral canal in the pit's vertical wall is completely washed out and contains no sediments.

RTANJSKA LEDENICA

Type of find	Pit	Orientation of entrance	/
Guide	/	Entrance width	15
Speleological mark	/	Max. depth	45
Altitude	924	Max. width	15
Coordinates	N 43°44,937´ E 021°53,661´	Max. length	63

The ice-pit on Mount Rtanj is located south from the highest mountain top Šiljak (1560 m), in an area called Ledničke strane situated on the north-western slope of Gola planina (1113 m). On its iced sides, between the main ridge and Gola planina, the slopes of Rtanj have a milder inclination and are furrowed by numerous sinkholes of considerable size in between which there are deep furrows in the ground. This is an area without surface run-off, covered with grass and low shrubs. The ice-pit is located at the bottom of a shallow sinkhole above an old karst valley that traverses the iced sides.

The entrance to the pit is located in a shallow depression (sinkhole) 25 m long and 15 m wide, that is mildly inclined towards the north-east. The pit consists of a simple inclined canal stretching in the direction of the paraclase (SW-NE) which emphasizes it and has a length of 10-12 m and width of 2-5 m. At a depth of 30 m the pit becomes a larger hall. The hall is almost completely horizontal and circular in shape, about 10 m wide and 3-15 m high. The bottom of the hall is relatively covered with clay and limestone blocks whereas its sides are smoothened out. The lithological basis of the pit is comprised of thick layered and chunky displaced limestones. The canal is 63 m long, whereas the pit is 40 m deep (Нешић, 2002: 46–47).

The main features of the Rtanjska Ledenica are its large depth and very narrow canal connecting the sinkhole to the hall, and a spacious hall at the bottom, hidden by an overhang. The pit was created by the corrosive action of sipping waters running through a series of crack in the direction SW-NE, whereas the hall was created by collapsing. The hydrological features of the ice-pit are manifested in the accumulation of large amounts of snow and its transformation into ice. Thanks to the configuration of the sinkhole and its large crater as well as the northern winds, large quantities of snow are blown into the ice-pit. The snow accumulates in the lower part of the entrance canal (stromora), immediately below the narrowing and slowly slides towards the bottom of the hall. Its transformation into ice begins when the snow on the surface is melting. Then the water from the upper part of the sinkhole sips into the hall with a subzero temperatures transforming the snow into ice with a grainy structure (Петровић, 1976: 165).

The pit Rtanjska Ledenica used to have great economic importance. Farmers used it to excavate ice, and melt it for drinking and watering the cattle. The importance of the ice-pit was such that each year it used to be rented for a fee. During summer, and especially during summer fairs and festivals the leaseholders of the pit excavated ice and carted it to Sokobanja, Knjaževac and Boljevac (Цвијић, 1895: 55). Today this ice-pit is out of commission.

Ice from the Rtanjska ledenica 25.07.2012.

VELIKI LEDENIK

Type of find	**Ice-pit**	**Orientation of entrance**	**SW**
Guide	**/**	**Max.entrance width**	**3-8**
Speleological mark	**/**	**Max. depth**	**22.5**
Altitude	**1123**	**Max. width**	**16**
Coordinates	**/**	**Max. length**	**51**

The Veliki ledenik is located on a high plateau of Mt. Devica near its top Lazarevica (1154 m) inside a forested slope that cuts diagonally through the mentioned plateau. There are numerous toponyms for this ice-pit in literature: ”Ice-pit on the Devica” (Цвијић, 1895) and ”Lazar’s ice-pit beneath the summit of Lazarevica” (Марковић, 1977).

The entrance of the pit is shaped as a vertical crack 3-8 m wide running in a south-western direction from where it spreads into a large hall 16 m wide and 14-19m high. The crack of the entrance part intersects with the paraclase in a NW-SE direction at the entrance of the big hall. Based on the genetic features of the described cracks it is to be expected that tectonic activities have caused breaks, creating the great hall and destroying the former karst pits of which only parts of the canal have remained (Нешић, 2002: 46).

During the second half of the 1990s, Dragan Nešić conducted some speleological and climatologic research in Veliki ledenik and these consisted of measuring the basic climatic elements by creating measurement profiles from the surface and entrance down to the bottom of the pit during different seasons and daytimes so as to obtain a clearer picture on the general climatic situation of these objects. The climatic elements included the measuring of the temperature and relative air humidity from a stand elevated by 1 m from the ground along the mentioned measurement profiles. The results of the speleological and climatologic measurements mainly indicated the basic climatic features of this object. Namely, elements of "primary climatic statics" were established pertaining to the features of general repetition and duration of the primary climatic trends and features inside this objects, as well as the features of "secondary climatic dynamics" which are of such an extent that they do not violate the general static climatic features and trends of the researched ice-pit (Нешић, 2002: 49–50).

REGISTRY OF ROCKSHELTERS

TATUMIROVA ROCKSHELTER

Type of find	Rockshelter	Orientation of entrance	NE
Guide	Saša Stevanović Sokobanja	Entrance width	15.2
Speleological mark	/	Entrance height	6
Altitude	519	Max. width	15.2
Coordinates	N43°37,567' E021°51,161'	Max. depth	4-5

Tatumirova rockshelter obtained its name from the remains of the ancient city of Tatumir which was erected on the same limestone rock. This city most likely dates back to the period of fortress reconstruction during the emperor Justinian which is indicated by finds of coins (Рашковић, 2011: 181) but it is not excluded that this fortification might have been used even during earlier times. The entire complex is located on Mt. Ozren, more precisely on the south-eastern rim of the hill Koviljača (618m). There the hill ends with a completely vertical limestone ridge beneath which the river Gradašnica formed the famous Ripaljka waterfall – the highest waterfall in Serbia. The rockshelter is located on the top of the hill, on a limestone cascade above the mentioned ridge.

This speleological object is most easily reached from within the compound of the Ozren Special Hospital. Near the hospital's heating plant there is a somewhat overgrown path leading to the plateau of the ancient structure above the ridge. The plateau is covered by scattered heaps of carved stone and bricks that once comprised the city walls. Somewhat eastwards from this location there is a steep section comprised of the mentioned limestone cascade. This section should be followed so as to find a suitable place for descending towards the base of the rockshelter from which it is easy to be found.

Tatumirova rockshelter spreads over a rock whose higher part is inclined 1.5-2 m in relation to its base. However, inside the earthen base of this object noticeable is a pair of narrow but deep tunnels dug by some animal (most probably a badger's layer), leading into the inside of the rockshelter at least for another 2-3 meters (we were unable to fathom the final depth). This occurrence suggests that this may be a considerable deeper speleological formation whose cavities were filled in time, maybe even by the rubble from the upper part of the city that is visible on the surface. In front of the rockshelter there is a short plateau which after 2-3 m steepens descending eastwards. Besides numerous fragments of Roman teguale and bricks, on the plateau were also

found a few fragments of vessels one of which was a decorated fragment with coarse walls made without the use of a pottery wheel, most likely in the Early Bronze Age[1].

The rockshelter was formed in Mesozoic sandy limestone. It is completely dry except for the fact that a larger portion of its interior is exposed to atmospheric precipitation. The surface sediment consists of sandy forest soil mixed with fine crushed limestone. In front of the entrance, there are no rocks at all while the intensive forest vegetation consisting of larger hornbeam trees indicates the existence of a deeper earthen layer.

Significant is the exceptional view from that location which encompasses a larger part of the Sokobanja basin, the Gradašnica valley and the Ozren basin shaped like an amphitheater. Furthermore, this location is relatively easy accessible from all three areas that might have been a rich source of hunting game. However, the rockshelter sits on a sudden steep beneath which stretches a vertical and very high cliff. The space underneath the rockshelter is too short, thus if this object is deeper and filled with speleological material it could have hardly been suitable for any longer habitation of human communities.

GRADAŠNJIČKA ROCKSHELTER

Type of find	Rockshelter	Orientation of entrance	E-NE
Guide	Saša Stevanović Sokobanja	Entrance width	28.5
Speleological mark	/	Entrance height	6
Altitude	460	Max. width	28.5
Coordinates	N43°37,647' E021°51,150'	Max. depth	6.5

The Gradašnjička rockshelter is located in the valley of the same river, at only 300 m downstream from the Ripaljka waterfall. It belongs to the limestone formations of Mt. Ozren and is situated in the eastern foothill of the hill Koviljača, 20-30 meters above the Gradašnjica riverbed. This area lies directly underneath the cliffs of Tatumir's city.

It is quite easy to find this rockshelter if one disregards the thick forest growth that inhibits the visibility and movement. The left river bank can be reached from the vicinity of the waterfall or the compound of the Ozren hospital, and from there the road leads downstream to the foothill of a hill that is mostly fenced with vertical rocks. Although the object is of considerable size it is not easily noticeable due to its distance and the thick and tall forest.

The speleological object itself resembles a spacious semi-hemispheric recess inside the flat parent rock. The walls of the rockshelter are extremely smooth while the uneven sections and recesses on the ceiling illustrate the process of frequent collapse. This is also indicated by larger piles of rubble following the rim of the entrance arch.

[1] *Dragan Milanović*, Archeological Institute Belgrade, personal communication.

The rockshelter was created in the Jurassic and chunky limestone and dolomites which in their close vicinity are joining a layer of river tufa. It is completely dry, except for being partially exposed to atmospheric precipitation. Its sediment consists of a-few-centimeters layer of forest dark soil underneath which lies a thicker layer of sandy red earth with lots of fine crushed rock. This layer of red earth dates back to the Pleistocene which is indicated by the find of the fossilized tibia belonging to the family *Canis*[1]. On the surface there are no traces of illegal excavations or any other disturbances. Actually, the entire location leaves the impression that it has not been disturbed by people for years although it is located in close proximity to one of the most visited parks in Serbia.

The close proximity of water and waterfall, the fastest communication with the valley connecting Moravica and the Ozren amphitheater-like basin, as well as a Pleistocene layer almost on the surface of the rockshelter appear to be good indicators of archeological potential. Furthermore, the deposited layers of tufa from the Gradašnjica valley containing numerous fossil remains of the flora and fauna (Marković, 1950: 119–130) are witnesses of the existence of an abundant life during the earlier phases of the Quaternary.

Red clay soil in which pleistocene animal bone was found.

MEČJA ROCKSHELTER

Type of find	Rockshelter	Orientation of entrance	SW
Guide	/	Entrance width	11
Speleological mark	/	Entrance height	2.8
Altitude	530	Max. width	11
Coordinates	N43°37,785' E021°51,329'	Max. depth	4.1

The rockshelter is located on the same limestone ridge as the Mečja Rupa but at an altitude lower by only a few hundred meters. This is actually a small short shelter underneath a rock, with even and smooth walls and a small elliptic recess in its northern wall. The earthen layer is shallow and the limestone massifs protrude from the basis which is most likely due to the westward inclination of the terrain. Due to this fact this speleological object has no predispositions for any archeological research.

[1] According to the analysis of Stefan Milošević, Faculty of Philosophy Belgrade.

RAVAN ROCKSHELTER

Type of find	Cave	Orientation of entrance	NE
Guide	Saša Stevanović Sokobanja	Entrance width	28
Speleological mark	/	Entrance height	4.5
Altitude	857	Max. width	28
Coordinates	N 43°35,296´ E 021°52,267´	Max. length	8.5

The rockshelter is situated southeast of the village Jezero somewhat below the peak called Ravan (1116 m) by which this object was named. The easiest access to this rockshelter is by the asphalt road Sokobanja-Jezero, and after entering the village a turn has to be made onto the west-bound earthen road heading to Leskovik. After travelling for 1.5 km along this road there is a saddle between two peaks from where this rockshelter should be looked for on the northern slopes of the southern peak „Ravan“. The rockshelter has a bad visibility since it is located between two hills, while the only nearby source of drinking water is at the spring Stalovac, at the distance of 1 km southeast from the speleological object.

This spacious rockshelter has a crescent base, the water dripping line of which does not exceed more than 3.5 m in relation to the object walls. At the center of the rockshelter there is a small semi-circular opening 0.6 m high and 2.6 m wide with a corridor of 3 m in length leading to a smaller circular hall 2.5 m wide and 2.1 m high. It is interesting to mention that the dripping line of the water from the ceiling is followed by a dry rock wall from its base upwards and this wall is made of bigger stone blocks that were roughly piled up to a height of 0.5 m. It is possible that this wall used to be somewhat taller but has collapsed which can be seen by the carved blocked that are scattered around. A few meters from the northeastern dry wall there is a building constructed of carved rock, with a circular base of 2.3 m in diameter. This building has no passage way, thus its purpose remains unknown.

The surface sediment within the object is of a very dark color (forest dark earth). Based on the digging marks left behind by scouts for precious metals in one of the dry walls, there is a visible potential Pleistocene layer of reddish-yellow color at the depth of 0.6 m. The discarded soil revealed a fossilized bone and two ceramic fragments of a

Pit made by looters at the Ravan rockshelter

bulgy shape one of which was made without the use of a pottery wheel, has a coarse texture and might originate from a younger prehistoric period.

CRKVIŠTE

Type of find	Rockshelter	Orientation of entrance	W-NW
Guide	Saša Stevanović Sokobanja	Entrance width	11
Speleological mark	/	Entrance height	18-20
Altitude	520	Max. width	11
Coordinates	N 43°31,606´ E 021°56,705´	Max. length	9.5

The rockshelter is located in the estuary of Bela reka not far from the village Labukovo. More precisely, the object is situated in the karst of the hill Rajkovica which together with the hill Gradac builds a shorter canyon slightly north of the village Labukovo. The Crkvište rockshelter is located within the cliffs, some 40 meters above the present water level of the river at its very exit out of the canyon. After the canyon the river mounds into a spacious valley riddled with meadows, gardens and smaller forests.

The local population relate the name of this rockshelter to the nearby foundations of the church „Spasovdansko slovo“, its type of construction indicating an early Byzantine construction style. This is also indicated by the pottery and Roman tegulae fragments that are especially abundant near the top of the hill Gradac where remains of foundations were also noticed, most likely being the ones of a four cornered tower. Furthermore, the remains of the church are even today revered by the villagers while for the rockshelter it is believed to once have been a recluse for hermits.

The entrance of the rockshelter is of a pompous size with tall and smooth walls ending at the top with an ideal arch. The entire opening is slightly inclined towards the sky thus the interior is excellently illuminated. The walls of the rockshelter are almost ideally even and smooth, except for the western wall out of which stair-like rock is protruding. Along the eastern wall, at 2 m in height there is an opening of approximately 1.5 m in diameter leading into a smaller room. The arch of the rockshelter resembles a dome with two dominant larger siphons.

Sharp and vertical points of the parent rock protrude from the base of the rockshelter at several locations but it appears that the remaining parts of the cave are well filled with sediment. The surface sediment consists of reddish-brown loose soil mixed with crushed rock, and as much as can be noticed from the already filled archeological trench from 1996, such sediment remains up to a depth of one meter without noticeable changes.

The rockshelter was archeologically surveyed in 1996 within the archeological research conducted by Zvonimir Kaluđerović. The excavations have reached the depth of 2m. The excavated sediment revealed prehistoric ceramics and fragmented animal

bones, however, the Paleolithic layers and rocky bottom of the cave were not reached. Kaluđerović mentions also a nameless cave opposite to Crkvište whose sediments were illegally excavated by treasure hunters who have destroyed almost the entire potential Pleistocene layer (Калуђеровић, 1996: 291).

During our visit, the discarded soil revealed a few animal bone fragments, while close to the mentioned remains of the church a fragmented and very corroded human tibia was found. Since the human tibia was found in the profile of the hill intersected by an earthen road it is supposed that it originated from a gravesite in a necropolis where priests used to be buried or the inhabitants of the nearby late-antique fortification on the hill Gradac.

Remains of „Spasovdansko Slovo“ church near Crkvište rockshelter

Furthermore, the entire landscape surrounding Crkvište is very interesting, above all for resettlement. Because the rockshelter is located in a canyon, it is protected from winds and other atmospheric influences. This object does not provide a good view of the surrounding terrain but the lack of a view is amended by the hill Gradac on the opposite side of the river that provides an excellent view over the Labukovo valley and the upstream part of Bela reka before it enters the canyon. Besides that this area has a settlement continuity stretching from the younger prehistoric period[1] until the Middle Ages thus any further archeological excavations might yield certain results.

[1] This is the site called Jaz, not far away from Crkvište where a stone axe from the Eneolithic was found: Филиповић, В. *Праисторијска налазишта у околини Сврљига*, Зборник бр. 16-17, Народни музеј Ниш, Ниш, 2008. 28 стр.

GOLEMOPADINSKA ROCKSHELTER

Type of find	Rockshelter	Orientation of entrance	E-NE
Guide	Saša Stevanović Sokobanja	Entrance width	11.5
Speleological mark	/	Entrance height	3.5
Altitude	422	Max. width	11.5
Coordinates	N43°38,055' E021°53,201'	Max. length	5

The rockshelter is located on the edge of a vast ridge that steeply descends northwards along the western bank of the seasonal creek Golemopadinski potok. Otherwise, Golema padina (Big slope) is a toponym describing a steep and long limestone crevice that was carved in by the mentioned creek – the northern tributary of the Moravica. The crevice stretches in the direction north-south along the space between the hills of Orlovica and Kulin vrh on Mt. Ozren. This creek was once more powerful and along its way to the estuary it took part in a creation of a few subterranean karst formations. The easiest way to this object leads along the forest path heading from the local shooting range eastwards and towards Golema padina. After some 400 m there is a creek bed that is usually completely dry. The mentioned rockshelter is located somewhat upstream from this position at the left bank of the creek.

The rockshelter itself has the shape of a lengthwise split dome impressed into the rock. The outlines of the entrance connect at the top of the opening almost in straight lines thus making the outline of a triangle. The object, as well as the entire limestone ridge, follows the southward inclination of the terrain. The surface is covered with dark sandy sediment mixed with bigger and smaller pieces of the parent rock. It is difficult to estimate the depth of the sediments without a test probing because the parent rock is nowhere to be noticed in the base. The close proximity of the creek and the inclination of the terrain cause reasonable doubt that the Pleistocene sediment was washed away during past floods.

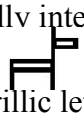
SOKOGRADSKA ROCKSHELTER

Type of find	Cave	Orientation of entrance	NW
Guide	/	Entrance width	71
Speleological mark	/	Entrance height	35
Altitude	381	Max. width	71
Coordinates	/	Max. length	8

Sokogradska or Sokolska rockshelter is a part of the speleological complex situated within the cliffs below the Sokograd fortress. The steep limestone ridge on the top of which Sokograd was erected separates itself like a peninsula from the Ozren

massif. It stretches in the direction north-south, where its northern end leads to the river Moravica thus creating the cliffs of its canyon, whereas the northern end of the ridge dives into the northern slopes of Ozren underneath Kulin vrh (1076 m). The rockshelter is situated along the western cliffs of the ridge, which on this side stretch in the shape of a mild curve. At the location of the rockshelter the cliff is almost completely vertical, and only slightly inclined on the top reaching a height of 70 m.

Besides the rockshelter, in this part of the cliff there is also a smaller system of caves belonging to the Sokogradska cave which connects by means of narrow and steep corridors in several levels ending in a few opening inside the cliff. However, due to their height these cave openings are difficult to access while their interior is completely washed out and without any sediment thus it is not interesting in an archeological sense.

The rockshelter part covers a vast space about 50 m long. The walls of the cliff are extremely smooth and even with only a few spots of dripping and oozing water so that the light-grey color of the limestone is riddled with black veins in places where the water is running down. It is interesting to mention that there are two engravings on the cliff walls and according to their intensity of oxidation it is presumed that they date from an archeologicallv interesting period[1]. One of the engravings could represent the stylization of a deer,  whereas the other engraving entirely corresponds to the shape of a capital Cyrillic letter „Д“.

View of limestone formations of Sokogradska rockshelter from the Sokograd ramparts

[1] Engravings were made with the use of metal tools - personal communication with Aitor Ruiz-Redondo, The Cantabria International Institute for Prehistoric Research.

The rockshelter itself is almost completely covered with sediment and therefore it can only be recognized based on its uncovered ceiling. The surface displays visible traces of construction materials from the nearby fort, which is nothing out of the ordinary bearing in mind that the western wall and the donjon tower were constructed immediately above this object. Therefore, a large portion of the sediment could have found its way into the rockshelter by being slid down from the walls or the throwing of garbage, as well as during construction activities that have most likely occurred in this part beneath the fort. Three trenches were opened during trial archeological excavations conducted under the leadership of Zvonimir Kaluđerović in 1995. The first two smaller trenches reached a depth of 1,8 m but further excavations were impossible due to large rock blocks discovered at this depth. The third trench reached a depth of slightly more than 2.4 m, where excavations had to be stopped due to the same reasons (Калуђеровић, 1996: 291). The excavation report does not contain any specific information.

Within the project "Surveys of the transition from the Middle into the Upper Paleolithic in eastern Serbia" conducted in 2012, surveying researches of the Sokogradska rockshelter were conducted under the leadership of Dušan Mihailović and Steven Kuhn. Although at that time flint artifacts have been found, the homogenous Paleolithic horizon could not be reached because of century long disturbances of the earthen layer mainly caused by human activities underneath the Sokograd fortress[1].

POLJANSKI KAMEN

Type of find	Rockshelter	Orientation of entrance	E-SE
Guide	Saša Stevanović Sokobanja	Entrance width	17.8
Speleological mark	8.1-15.	Entrance height	3.4
Altitude	558	Max. width	17.8
Coordinates	N43°37,392' E021°57,246'	Max. length	5.5

Poljanski kamen is a rockshelter that was formed on the eastern slopes of the hill Grapčina (616 m) – the southern slope of Mt. Devica. This rockshelter is situated in the middle of a limestone ridge that stretches in fragments running like a meridian from the foothill to the hill top. The foothill runs along the Dugopoljski creek, which when observed from the ridge runs into its small canyon that ends a few hundred meters to the south. The rockshelter is approximately some 100 m higher than the level of the riverbed.

The easiest way to reach Poljanski kamen is from the village of Dugo Polje i.e. from the village church. The asphalt road ends near the church and from there leads an earthen road which follows Dugopoljski creek, runs through its small canyon and

[1] Dušan Mihailović, PhD and personal communication on his personal observations during the research.

continues towards the southern slopes of Mt. Devica. At the location of its exit from the canyon, the earthen road forks in two directions and this is the location from where the road leading to the limestone ridge of Grapčina hill has to be taken. There is almost no pathway leading to the rockshelter because the entire hill is covered with low-grown hornbeam forest and thorny forest shrubs making the climb difficult. An alleviating circumstance is that there is only a distance of 100-150 m to be covered until the rockshelter is reached. Otherwise, during the non-vegetation period the opening of the rockshelter can be observed from the road or the nearby meadow.

The spacious semi-circular entrance has the shape of a half moon arch carved into the next 5 m of rock mass. The entrance arch has the shape of a human upper lip and retains this shape along the entire length of the ceiling. The walls are pretty smooth showing a stark contrast of black and white color appearing in strips. On the western wall there are two deeper recesses which follow the outline of the bottom and ceiling part of the wall. In front of the entrance there is a short plateau (4-5 m long) which is identical to the width of the entrance part. Both sides of the plateau are framed with limestone rocks giving the impression that it was once covered by a cave arch. Unlike the interior walls, the outer walls surrounding the entrance are very coarse, which is the most likely the consequence of frequent collapses. This process is witnessed by large limestone blocks (a few tons in volume) that are scattered all over the plateau and its vicinity. The speleological object was formed on the boundary of Mesozoic limestone chunks and Paleozoic conglomerates of sandstone, clay slate and limestone.

The surface sediment inside the rockshelter is of a dark-grey color, very loose and mixed with different granulations of crushed rock. Besides that the surface contains also significant remains of ash and soot indicating a frequent use as a fireplace. On the surface of the mentioned „fireplace“ there are fragments of burnt ceramic vessels that give the impression to be a newer-type pottery with glazing. Due to its complete exposure to the sun the base is covered in low grass and shrubs.

VRELSKA ROCKSHELTER

Type of find	Cave	Orientation of entrance	N
Guide	Milan Savić Čitluk	Entrance width	6.2
Speleological mark	/	Entrance height	4.5
Altitude	539	Max. width	8.8
Coordinates	/	Max. length	6.5

The Vrelska rockshelter is located on a hillside northeast from the spring of the river Moravica, on a limestone section in the vicinity of which lies the source of a seasonal creek which feeds into the Moravica along a small steep valley. The rockshelter is very difficult to reach via the recess cut by the seasonal creek (although this is the shortest route) because the plateau of the cave descends cliff-like towards the creek bed. Another way, which is more accessible and therefore longer circumvents

almost the entire hill and leads towards the cave from its upper side from where it is easier to descend to the entrance. Otherwise, the rockshelter is visible from the vicinity of Moravičko vrelo thus it is easy to observe its position. The entrance of the object is topped by an arch the shape of a human upper lip which is retained also in the interior shape of the ceiling. Although the object is in a good position and offers excellent visibility of the surrounding terrain it is short of earthen sediment which has almost completely disappeared from the rockshelter due to its steeper inclination towards the north.

HAJDUK VELJKOVA CAVE

Type of find	Rockshelter	Orientation of entrance	NW
Guide	/	Entrance width	14.5
Speleological mark	/	Entrance height	4.3
Altitude	321	Max. width	14.5
Coordinates	N43°38,131´ E021°53,307´	Max. length	4

Hajduk Veljkova cave is actually a smaller rockshelter located one level above the already mentioned Lepterijske rockshelters. It is located some 20 meters above the water level inside a limestone cliff that stretches along the left riverbank of the Moravica, close to the catering facility „Lepterija“. Although it seems that this rockshelter has lots of sediments, most likely it has been disturbed by anthropogenic and refurbishment activities to make this space suitable for picnics.

LEPTERIJSKE ROCKSHELTERS

Lepterijske rockshelters are a group of 5 speleological objects that are positioned at a close distance and on a similar altitude. All the rockshelters are located immediately along the Moravica riverbed along the line of the resort „Lepterija“–„Stari brest“. The rockshelters are not interesting in an archeological sense because they are too close to the river thus they are flooded during times of high water levels, in most of them the floors are furbished (covered by concret) made suitable for campfires and sitting, thus these rockshelters are exposed to tourist activities during the season.

Lepterijske rockshelters (beneath) and Hajduk Veljkova cave (above)

REGISTRY OF CAVES

OZRENSKA CAVE

Type of find	Cave	Orientation of entrance	W-SW
Guide	/	Entrance width	3.8
Speleological mark	8.1-1	Entrance height	4.7
Altitude	538	Max. width	7.5
Coordinates	N43°37,379' E021°51,529'	Max. length	420

The cave is also called Delta because of its specifically shaped entrance like the Greek letter Δ. It is a part of the Ozren amphitheatre-like basin (Ozren meadows) located at the southern foothull of Mečji Vrh (691m) in the basin of Gradašnička River which runs at a distance of approximately 300 m from the cave. The easiest route to reach the cave is the road Sokobanja – Special Hospital „Ozren". From the entrance of the hospital compound the route leads another 400 m along the southern dilapidated asphalt road leading to the Ozren weekend settlement and the resort Kalinovica. The cave itself is located underneath a spacious semi-circular limestone section near the last weekend houses on the eastern side of the road. The entrance opening is difficult to observe from the road because of dense forest growth around the cave plateau although it is only some hundred meters away from the road.

In front of the cave entrance there is a small plateau which is elevated some 10 meters in relation to the surrounding meadows. As already mentioned, the cave entrance has the shape of the letter Δ, which in its upper corner sharply bends towards the northwest. The short cave corridor, although same in size as the entrance but significantly higher, gradually narrows leading to the first elliptically shaped hall that branches out into two shorter corridors with dead ends. At the highest point of the ceiling inside the first hall there is a chimney (ø=1 m) through which light enters the cave. After this hall the cave corridor steeply descends to the first elbow bend located on a 2 m high step after which it mounts into a narrow and low (1x1.5 m) steep canal (about 30 m long) which then mounts into a smaller but high hall. From this smaller hall, ending with a high step, the canal bends in an angle of almost 360° and continues straight (for the next 50 or so meters) to a collapsed hall from which only a small crevice provides excess to the second part of the hall which is the end of the cave.

The cave was formed in Mesozoic sandy limestone and now it is almost completely dry, even without dripping water during dry months. The cave walls are smooth and even and the ceiling has no cave decorations except for periodical ice stalactites and stalagmites during the winter and spring months. The cave has survived

large collapses, which are most visible in the first 50 m of the cave. The cave sediment consists of bigger and smaller pieces of crushed rock mixed with grayish sandy soil. Based on a trench dug by treasure hunters it can be seen that the sediment is more than 1 m deep (depth observed during the survey) and excavations are made difficult due to large quantities of crushed rock.

The Ozrenska cave is a typical representative of a tectonic-corrosive pit. It was formed by the sinking of atmospheric precipitation along the vertical and deep cracks. The corroded limestone riddled with joint cracks created favorable conditions for collapses. This process also created the halls on the different levels. However, the lateral canals were created by the chemical work of weaker water seepages that have formed and seeped along the narrow cracks between the layers. The lowest canals of the pit descend quite deeply, all the way to the impermeable base of the Sokobanja basin i.e. to the great Sokobanja rift (Петровић, 1976: 162).

Some smaller surveys of the cave are published in the „Caves and pits of Serbia“ by Jovan Petrović in 1976. It is a known fact that during the 1980s there have been some attempts to refurbish the cave for tourist visits but this project was never completely finished thus leaving visible traces of a stone staircase and terraces along the first 50 m of the cave. Data from the tourist brochure of Ozren alleges that during this process a number of animal bones from the Pleistocene Era were found, as well as fragments of Neolithic pottery. During our visits to the cave (in 2012 and 2014), except for a pair of indiscernible fossilized bone fragments we were unable to observe traces of any other archeological material.

MEČJA RUPA

Type of find	Cave	Orientation of entrance	SW
Guide	/	Entrance width	10.1
Speleological mark	/	Entrance height	6
Altitude	624	Max. width	10.1
Coordinates	N43°37,768' E021°51,411'	Max. length	10.2

This short cave (rockshelter) is located on Mt. Ozren within a large limestone ridge on the hill Mečji vrh (691m). The hill is located on the north-western ridge of the Ozren amphitheatre like basin, and therefore acts like a boundary between the mentioned basin and the Sokobanja basin. The limestone ridge on Mečji vrh stretches from the top of the hill and steeply descends towards the foothill and the Gradašnjica river. Since the spacious entrance of the rockshelter is located at the top of the hill it may be observed from the plateau of the „Special Hospital Ozren“ which is situated not far from the foothill of Mečji vrh. Although Mečji vrh is not a very high hill, accessing the cave is quite difficult. The main obstacle is a thick hornbeam forest and thick forest

shrubs which have gradually devoured all pedestrian paths thus access is significantly difficult during the vegetation months.

The entrance of Mečja rupa is of an almost semi-circular shape and that is why the entire rockshelter looks like the quarter of a ball carved into the limestone ridge. It is well lit and exposed to the sun, which has fostered the presence of abundant vegetation inside the rockshelter. The walls of Mečja rupa are mostly even and smooth and without any cave decorations. The entrance is preceded by a spacious plateau that has a slight southwestward inclination. This location provides an exceptional visibility of the terrain in the valley of the Gradašnjica River, Ozren meadows as well as over larger portion of the Sokobanja basin. Immediately above the rockshelter opening there is a small window that can be reached by a narrow but passable hallway south of the main cave entrance.

Geological formations comprising the ridge of Mečji vrh consist of chunky and layered limestones and dolomites. The rockshelter is entirely dry during sunny days. The inside sediment consists of dark ashy soil with small pieces of crushed rock. However, it appears that the sediment inside the cave is very thin and is not present on the entire internal surface so on a few spots the massive rocky base protrudes from the ground. The situation on the plateau is somewhat different because here the earthen layer is considerably deeper which can be seen from excavations made by treasure hunters who have dug out a smaller hole 0.70 m deep a few meters from the entrance, at the bottom of which no barren rock can be observed.

The lack of speleothems, as well as a very short canal, was not attractive to researchers thus Mečja Rupa is not mentioned in scientific speleological publications although it is registered by a speleological mark on the cave wall. In an archeological sense, the inside of the speleological object does not possess much potential for further excavations due to a weak presence of sediment which was most likely washed out to a larger extent due to the mild inclination of the terrain towards the south-western slope of the hill. The spacious plateau in front of the cave could, however, provide certain results because part of the sediment from the speleological object could have deposited there. The profiles of the mentioned „illegal trench“ have shown no traces of a Pleistocene layer whereas the excavated soil provided only a few pieces of pottery one of which was a decorated fragment dated to an early Byzantine period. Since Tatumirov city (known from the first chronicles of Sokobanja (Каниц, 1987: 121; Милићевић, 1876: 781)) is located on the opposite side of Gradašnjička River it is not surprising that there is a layer dating from the early Middle Ages. Since Mečji vrh provides a better visibility of the surrounding terrain it would not be surprising that a guard tower or observatory once had been posted in the vicinity of the rockshelter. Certainly, all these topographic advantages of the location may have once been of use to prehistoric hunters.

CRVENA RUPA

Type of find	Cave	Orientation of entrance	SE
Guide	Saša Stevanović Sokobanja	Entrance width	? (0.9)
Speleological mark	/	Entrance height	? (0.5)
Altitude	908	Max. width	8
Coordinates	N43°36,198' E021°53,517'	Max. length	35

The cave is located on Mt. Ozren, on the south-western slope of Blendijski vrh not far from the picnic site and spring called Šopur. The easiest way to the cave is by the Sokobanja-Jezero asphalt road. Along the seventh kilometer of the road, approximately one hundred meters before the mentioned spring Šopur, there is a cobble stone road at the eastern side. This road should be taken towards the cave which is only some 300 m away. Not far from the very entrance of the cave, two seasonal creeks intersect and mound into the river Javor near Šopur. Although the cave is located by the very roadside it is hardly noticeable since its entrance is almost completely filled.

According to the stories of the locals, the old cave entrance was destroyed and closed during the construction of the mentioned road by the German occupational forces in World War II. Thanks to the activities of gold diggers, the cave entrance was reopened approximately ten years ago. It can be assumed that the original wall was bigger because the width of the present arched ceiling at the entrance is about 4 m. However, it remains within the realm of hypotheses since at least first 4-5 m of the entrance space were destroyed. The current entrance space is actually the cave hall that has been artificially filled with earth and crushed limestone (most likely remains of the old entrance). This hoarded sediment gradually descends (the next 10 meters) towards the cave interior where it meets the level of the original floor where the ceiling is 2.5 m high.

The whole cave consists of two larger halls and one short narrow corridor between them giving the cave basis the shape of an hourglass. The narrow corridor that connects the two halls is 4 m long and its width does not exceed 1 m. The corridor ends with one step 1.2 m high after which it descends into a more spacious hall by which the cave ends. The base of the cave (max. length 13 m, max. width 6 m) is of an elongated elliptical shape. In the center of the hall towers a massive cave column, which almost separates the hall into two separate rooms. This space is abundant in cave flowstones thus rows of stalactites, cave tubules, oozing traces, draperies and columns can be observed. There are no stalagmites and it is possible that they were broken since fragments of cave decorations were observed on the cave floor. The cave decorations are of a reddish color and thus the cave was named after.

Crvena rupa was formed on the limestone of the lower part of the Urgonian phases (Cretaceous) which in this area are situated along the border with Neogene

conglomerates of sandstone, clay and limestone. Except for a lot of dripping water from the ceiling the cave does not show any other hydrologic activities. The sediment in the hall with cave decorations is most likely the only visible „original“ sediment in the cave since the sediment inside the entrance hall was imported during the construction of the road. The remaining „old sediment“ contains cave clay,dominated by crushed rock and gravel.

There is no previous research known about this cave. In its present condition the cave appears more interesting for speleological research due to the presence of nicely formed cave decorations. The archeologically most interesting entrance part of the cave is completely destroyed whereas the entrance hall is covered with a thick layer of imported earth. Therefore, the precondition for any future excavations would be the widening of the existing cobble stone road and the removal of a large quantity of rubble from the entrance hall.

LEDENIK

Type of find	Cave	Orientation of entrance	SW
Guide	Aca Marinković Jezero	Entrance width	8
Speleological mark	/	Entrance height	6
Altitude	1124	Max. width	8.6
Coordinates	N43°35,847' E021°55,056'	Max. length	19.4 (+15)

The cave is located on a high, even plain on Devica within the area known under the toponym Ledenik, located between the tops of Džambinac (1185 m), Čapljinac (1187 m) and Aleksin kamen (1100 m). This barren surface the size of a few hectares is covered with grass and withered forest shrubs and was used by the villagers of Jezero for grazing their cattle. Due to the specific surrounding relief riddled with numerous sinkholes, it is difficult to locate the cave without the help of a guide. Some smaller morphological researches of this object were published by M. Zeremski (2002) in his paper „The karst of Ozren and Devica“ (Зеремски, 2002: 3).

Ledenik is a short, simple cave located on the northwestern rim of a forested, well-like sinkhole at a distance of only 200 m from Rupa Prozorka in the south-east. It consists of a corridor with a collapsed ceiling (15 m long) and a covered simple corridor (19.4 m long). At the location of the collapsed canal the sidewalls remained intact and are from 4 to 8 m high. The preserved part of the cave steeply descends towards the end of the cave, thus the difference in height between the present entrance and the end of the corridor is about 10 m. The base of the collapsed canal is far more even, without a steep inclination and bears witness to the collapsing process that was a consequence of the deepening and widening of the sinkhole. The present entrance has the shape of an equilateral triangle that continues to follow the base of the ceiling until the last 5 m of

the cave. There the cave ends in a lower semi-hemispheric recess up to 2.5 m high which can be also described as a separate hall.

On 10 November 2012 the cave was completely dry without snow and ice, however, the wooden troughs positioned at a few spots inside the cave for the purpose of collecting dripping water provide evidence about its occasional hydrological activity. Since this area has no permanent water bodies, these troughs carved from a single piece of wood served the local shepherds as an additional water source. The cave has no forms of cave decorations, while the walls of the corridor are rough and uneven. The collapsing process is quite visible which is evident from the large amount of coarse and fine crushed rock mixed with black earth that was imported from the nearby beech forest.

Its high altitude and aridness of the terrain do not appear to be good parameters for any possible occupation of the cave by Paleolithic communities.

PEĆINA KOD STRELIŠTA

Type of find	Cave	Orientation of entrance	NE
Guide	/	Entrance width	3.8
Speleological mark	/	Entrance height	2.1
Altitude	337	Max. width	5.4
Coordinates	N43°38,085' E021°53,189'	Max. length	14.8

Pećina kod strelišta is situated at the most-northern slopes of the vast hill Orlovac (887m) that belongs to the massif of Mount Ozren. Specifically, this speleological object is located on the western edge of a low cliff belonging to the Cretaceous limestone of the Upper Urgonic phase. Somewhat below the mentioned structure, the slopes of Orlovac meet with the Moravica riverbed, which in this area forms its famous canyon.

The starting point in the direction of the cave is located nearby the city shooting range, placed somewhere half-way along the road Sokobanja-Lepterija. From this shooting ground a forest pedestrian path leads to Golema padina in the east. After some 300 m, the cave entrance is easily visible from the southern side of the path.

The cave entrance has the shape of an ellipse which is slightly out of focus. The interior consists of a simple corridor the height of which corresponds to the height of the entrance for the first 5-6 m and then the ceiling gradually descends reaching a height of only 60-70 cm at the last few meters of the object. The eastern wall of the cave protrudes from the earthen ground at an angle of 45° and connects in a steep semi-arch with the ceiling which is mildly inclined towards the base of the western wall, whereas the western wall descends at the same angle towards the base thus none of its surface is diminished. The surface of the walls and ceiling is rather rough. Interesting to mention is the almost completely white surface of the ceiling with a few cavities from which the

roots of the trees protrude through the limestone platform that is located a few meters above. During dry periods there has not been noticed even the slightest trace of hydrologic activity. It is possible that the cave was once used as a sheep coral because at the entrance there are preserved remains of a stonewall erected without the use of mortar.

The sediment inside the cave consists of sandy red soil mixed with smaller fragments of crushed rock. Based on the configuration of the side walls it may be supposed that the sediment from the first 6-7 m inside the cave has been rather washed out and shallow whereas the other half of the cave appears somewhat more filled with sediment. Generally speaking, the cave has a good position but lacks the thick earthen soil; at least in its entrance part.

GOLEMOPADINSKA CAVE 1

Type of find	Cave	Orientation of entrance	W-NW
Guide	Saša Stevanović Sokobanja	Entrance width	12.8
Speleological mark	8.1-7.	Entrance height	3.3
Altitude	469	Max. width	12.8
Coordinates	N43°37,984' E021°53,209'	Max. length	12

The cave is located on the top of a limestone ridge that is a constituent part of the "canyon" which has the same name. The object is located directly along the western bank of the creek, a little downstream from its big waterfall that was formed underneath the high surface connecting the two summits of Orlovac and Golemi vrh. This is the place from which the mentioned summits begins steeply to descend towards the Sokobanja basin and Moravica river. The easiest way to reach the cave is by the pedestrian pathway heading from the city shooting range to Golema padina. From the location where the pedestrian path meets the riverbed of Golemopadinski potok (usually dry) there follows a climb of 150-200 m from where the cave entrance can be easily seen. The described path to this karst cavity leads by the Pećina kod strelišta and Golemopadinska rockshelter. Furthermore, there is a prominent change of temperature and air humidity on Golema padina so this area is considerably colder than other parts of the hill. The reason for that is its rather weak exposure to the sun since the hillside is cut in deeply but narrowly into the slope of the hill and also oriented north.

The cave entrance has the shape of an equilateral triangle. This shape is maintained also inside the cave and the ceiling has the shape of a roof with only two sides. From the earthen base of the entrance opening protrudes (in relation to the earthen base) a limestone step almost along its entire length (70 cm high) which like a sea reef limits access to the inside of the object. This step continues into the base of the cave along the wall and its surface occupies almost one third of the object (approximately 27

m²). However, it seems that this „reef“ formation sinks like a cliff into the cave sediment and thus does not occupy the space beneath the earthen layer. The walls of this speleological object are smooth but furrowed and contain no cave decorations and no water is dripping from them.

Earth sediment is present in two thirds of the total surface of the cave base (approximately 68 m²). Based on the profile of the „illegal“ trench dug by treasure hunters in the central part of the cave (65 cm deep) three layers are visible: a) surface loose layer of grey-dark soil (visible at a depth of 15 cm); b) whitish ashen layer netted with black soot lines; c) red compact layer of clay (visible at a depth of 45 cm). Here it is worth mentioning that the treasure hunters have not managed to dig down to the rocky base but have only scratched into the first 15 cm of the potential Pleistocene layer. The layer of ash and soot (30 cm thick) is witness of a continuous process of maintaining fires, most probably the remains of some charcoal or limestone pit, whereas the clay sediment in the profile did not indicate the presence of osteological or flint material.

The presence of the nearby seasonal creek, the close proximity of the Moravica river and the visibility of the surrounding areas may have been one of the favorable parameters for the occupation of this cave. The exploitation of such a favorable position may have manifested itself in the fact that Golema padina descends, under a steep but completely passable inclination directly to the place where the canyon of the Moravica begins, which is an exceptional position for possible hunting from stakeouts because from this location it was possible to easily drive the prey into the dead-end canyon at the cliffs of Sokograd. If we take into consideration the distance from Golemopadinska pećina to the banks of Moravica of only 300 m (downhill), it is easy to guess that it may have taken the diligent Paleolithic hunter under a minute to reach his targeted prey. Since the earthen layer in this cave is preserved and in the nearby Markova cave a flint core from the Upper Paleolithic[1] has been found it is assumed that any eventual archeological excavations would not be in vain.

Golemopadinska cave 1 layers up to the 70cm debt

[1] Калуђеровић З., 1996, 291 стр.

GOLEMOPADINSKA CAVE 2

Type of find	Cave	Orientation of entrance	W-SE
Guide	Saša Stevanović Sokobanja	Entrance width	3.2
Speleological mark	/	Entrance height	2.8
Altitude	592	Max. width	4.8
Coordinates	N43°37,894' E021°53,286'	Max. length	10

Golemopadinska pećina 2 is located at the bottom of an isolated rock consisting of Cretacean limestone of the Lower Urgonic phase. It is located on an even surface north of Golemi kamen (794 m), immediately above the right bank of the Golemopadinski potok. The way to reach this cave is along the forest path up the Golema padina which should be followed to the location above a big waterfall created by the named creek from where the cave should be looked for on an elevated surface west of the creek's bed. The cave entrance is difficult to observe because there is no recognizable marker in its vicinity hence even experienced guides have to look for it more diligently in the surrounding area.

The cave entrance has the shape of an acute-angled triangle but this configuration disappears after only a few meters along the corridor and transcends into a considerably lower, semi-circular form. The cave consists of one steeply inclined corridor that descends after 5 m into a smaller hall with an even base. On its way to the hall, the corridor branches into two more narrow and short canals with a dead end. The hall is not wider than the corridor but is, at least, twice as tall (3.9 m) than the corridor. On the ending eastern wall of the cave there is an opening of a smaller profile (ø =0.50 m), which provides access to the opposite end of the parent rock.

The surface sediment of this cave mostly consists of larger chunks of crushed rock, while the dark sandy soil is visible only in the hall. According to the shallow trench dug by treasure hunters in the middle of the hall (approximately 30 cm deep) there has not been noticed the existence of any other layer, nor of the rocky base of the cave. The presence of coarse chunks of crushed rock is the result of the inclining terrain and collapse of the cave canal of which it might be said that it was at least longer by 5-6 m.

Although the surrounding area of the cave provides an exceptional view of the Sokobanja basin, the very object does not appear tempting for living in it and could have only be used as a temporary shelter.

LEPTERIJSKA CAVE

Type of find	Cave	Orientation of entrance	N
Guide	/	Entrance width	11
Speleological mark	8.1.-8.	Entrance height	13
Altitude	419	Max. width	11
Coordinates	N43°38,024' E021°53,279'	Max. length	19.1

This cave is located in the narrow canyon of the Moravica on the southern rim of Mt. Ozren, above the famous resort Lepterija. It is set within the limestone ridge that cuts the hill known under the name Golemi kamen in an east-west direction. At this location the hill itself rapidly declines towards the Moravica and its canyon, whereas the object is located on a position some 150 m above the present river level.

The large opening of the cave is clearly visible from the nearby Sokograd fortress and the southern rim of the hill Popovica located on the opposite side of the canyon. Once the object is visually located, the easiest way to reach it is in a direct straight line from the canyon. The path, with its outlines barely visible is covered in forest shrubs and a low hornbeam forest and therefore a more frequent climbing on this terrain requires its clearing.

The impressive, oval cave entrance has a grandiose size (11x13 m) providing excellent lighting of the interior which can be seen based on the plants growing even in the furthest parts of the cave regardless of the fact that the object is oriented towards the north. The inside of the cave consists of a simple monotonous canal ending with a small rockshelter in the southwestern wall. From the cave opening an arch ceiling mildly descends towards the ending wall thus the initial height of 13 m drops to a height of 5 m in the final part of the canal. The walls of the object are rather smooth and even which can be especially seen on the western wall. Also noticeable are black and dark grey stripes running downwards the whitish surface of the limestone canals. The cave contains no cave decorations or even the least traces of humidity.

The cave base is covered by dark brown loose sediment and almost the entire surface of this sediment is partially covered by grass and smaller trees which is the result of the cave's good illumination. The surface layer is mixed with smaller limestone pieces, whereas larger chunks of crushed rock cannot be seen on the surface. On a few spots visible are the remains of ash and soot originating from a few fireplaces of a newer date. Since there are no trenches dug inside the cave it is difficult to presume the depth of the cave layer.

Lepterijska cave provides an exceptional view over the surrounding area, more remarkable if the nearby Moravica canyon is observed. Its position on the entrance part of the canyon ensures a certain domination and control over the surrounding terrain. The location of the cave is such that a hunter could easily spot and intercept the prey passing through the narrow Moravica canyon. Furthermore, the close proximity of water, exceptional exposure to light and spaciousness of the object, as well as the

proximity of the surrounding of the already confirmed Paleolithic sites (Sokogradska rockshelter, Markova cave) could be indicators that this object was used in the early prehistory. Even the northward orientation of the entrance opening has its advantages because northern winds (Дакић, 1976: 10) are the least frequent winds blowing through the Sokobanja basin.

MARKOVA CAVE

Type of find	Cave	Orientation of entrance	NW
Guide	/	Entrance width	14
Speleological mark	8.1.-5.	Entrance height	4.1
Altitude	441	Max. width	14
Coordinates	N43°38,008´ E021°53,571´	Max. length	20.5

Markova cave is located in the Moravica canyon near the Sokogradska fortress. It is situated on the northern slopes of Mount Ozren beneath the summit of Golemi kamen (789 m) from where the entire hillside begins to steeply descend towards the Moravica river. The limestone formation of the cave connects to the western ridge of the steep Sokograd cliff which stretches in a mild arch in the north-south direction. The object itself is located on the final southern part of the ridge at the very location where the limestone mass descends into the hillside of Mount Ozren.

In 1996 Zvonimir Kaluđerović managed the survey of the cave by means of digging trenches. According to the survey report, two trenches were dug in the inside of the cave, each of them 2x1 m in dimension. The excavation was stopped at the depth of 1 m because of the presence of big rocks. There were no interesting findings however, in the trench dug with the base of 3x1 m underneath the entrance arch of the cave, at the depth of 1.2 m there were sediments found that were most likely deposited during the Pleistocene. Besides the paleontological remains, this layer has also revealed a flint core with technological and typological features indicating that it originates from the late phases of the Upper Paleolithic (Калуђеровић, 1996: 291–292).

The cave has spacious entrance the western part of which is covered by a massive limestone rock. Its interior is spacious to a large extent, except its southeastern part where the ceiling funnels into a descent towards the ending part of the cave. The walls and ceiling are coarse and uneven without any cave decorations. The reason for such a state is most likely to be explained by collapsing witnessed by numerous blocks of parent limestone scattered all over the caves ground. The color of the limestone on the cave walls varies from white, yellow to grey and dark grey.

The earthen layer in the cave consists of dark loose sandy soil mixed with numerous small or big chunks of crushed limestone. The depth of the layer varies but judging by the parent rocks protruding in some spots from the earthen base it seems that this layer is rather shallow. Based on the visible profiles from the archeological

trenches as well as from other two smaller trenches dug by treasure hunters there are no noticeable differences in the color of the sediment. The excavated trenches generally end with a thick horizon of crushed rock (at depths of 0.3-1 m).

The cave has a favorable position since it is located near the river (distance of approximately 100 m) and at the very transition point of the gorge into the Moravica canyon. The view from the cave is limited exclusively to the canyon and the hill Popovica, but the object communicates with the Sokograd cliff which provides excellent visibility of the eastern branch of the Sokobanja basin. The space inside the cave and the size of the cave opening are of sufficient dimensions and the only thing missing is a potential archeological layer. However, since none of the mentioned trenches have shown a visible rocky base but only a dense pile of crushed rock, we may only guess that a rich archeological layer is hidden underneath the present layer which may have been caused and generated as a result of seismic processes. Since Paleolithic finding were discovered in the cave there is no doubt that there should be an attempt to investigate the entrance plateau in which there is a stronger presence of sediment.

POPOVIČKA CAVE

Type of find	Cave	Orientation of entrance	E
Guide	/	Entrance width	15.6
Speleological mark	8.1.-13.	Entrance height	9.8
Altitude	359	Max. width	15.6
Coordinates	N43°38,008´ E021°53,571´	Max. length	26.7

Popovička cave is located at the beginning of the canyon part of the Moravica near its right riverbank at the foothill of the hill Popovica. The cave belongs to the type of simple spring caves. It consists of a monotonous straight canal inclined towards the entrance opening. The cave speleothem consists of smaller draperies on the inner most walls of the cave. The sediment from this object has been completely washed out and thus is of no interest for our research.

VLAŠKA PEĆURA

Type of find	Cave	Orientation of entrance	E
Guide	Dragi Blagojević Blendija	Entrance width	3.4
Speleological mark	/	Entrance height	1.6
Altitude	800	Max. width	14.8
Coordinates	N43°36,935´ E21°54,063´	Max. length	19.5

Vlaška pećura is located on the highest parts of the Glogan slope near the left bank of the seasonal creek. The Glogan slope stretches along the northern hillsides of

Mt. Devica that stretch beneath the tops of Blendijsko brdo (975 m) and Oštra čuka (1001 m). This slope steeply descends towards the river and the Sokobanja basin along its seasonal creek which somewhat to the east of the Sokograd cliffs mounts into the Moravica. The cave is located in the area of the village Blendija, deep inside a thick forest and thus cannot be easily found without an experienced guide.

Jovan Cvijić mentions „Vlaška pećura“ on the northern slopes of Mt. Devica as an ice-cave. He writes that the ice-cave is located under Golemi vrh in the area of the village Dugo Polje and that the easiest way to reach it is by climbing Žlebnik (Цвијић, 1895: 84). Today, toponyms like Golemi vrh and Žlebnik are not present in the area of Dugo Polje but also not in the vicinity of the village Galibabinac on the southern side of Mt. Devica where the toponym Žežinac is located between the mentioned village and the top. We do not know of such ice-caves from this area however, it is not excluded that such an object exists.

The cave consists of a short and low entrance canal and a spacious hall. The entrance corridor once used to be 6-7 m longer but is mostly collapsed thus only the last 2 m are preserved but this part does not connect to the cave hall. The entire corridor is cascadely inclined towards the cave hall.

From the cave entrance a small opening leads into the spacious hall. Immediately after this opening there is a thick layer of crushed rock and earth which gradually descends to the original level of the hall. This mound of crushed rock (max. height of approximately 3 m) at the beginning of the hall was most likely formed as a result of the inclination of the entrance hall thus a larger portion of the stone blocks descended there during the collapse of the ceiling of the former entrance canal. The base of the hall has the shape of an ellipse. The evenness of the hall is surprising since, except for the deposited sediment at the entrance, there are no other inclinations. The ceiling demonstrates a similar situation. The hall walls are rather corrugated but smooth and there are draperies as cave decorations. All the walls, as well as the ceiling of the hall, are utterly humid with lots of dripping water. In the final northwestern part of the basis next to the cave wall there are three shallow sinter pools, the largest of which was mechanically destroyed. The hall is completely dark and cold.

The surface sediment inside the cave consists of light brown to red clay mixed with lots of crushed rock, and a few fragments of cave decorations have also been observed. There are parts of the cave, such as its southeastern end which contains only crushed limestone. The earthen sediment is humid and sticky and there are also sediments of guano. The depth of the sediment is difficult to estimate since there are no excavations and no visible indications of the cave’s rock base.

A few bones of insignificant age have been found on the surface and among them there is the femur of a horse which hardly could have passed through the entrance of the cave, thus it is most likely that this object serves as a temporary lair of vultures. It may be assumed that osteological remains of animals are largely present but as concerns the human exploitation of the object it is highly unlikely. Namely, the cave is located at an altitude of 800 m, it is very damp and cold, and the cave entrance is unsuitable for any frequent communication with the outer space. Of course, such

disadvantages of the object may be useful in cases such as hiding, ambush, ritual space and similar.

JEZERSKA CAVE

Type of find	Cave	Orientation of entrance	NW
Guide	Saša Stevanović Sokobanja	Entrance width	4.5
Speleological mark	/	Entrance height	2.6
Altitude	910	Max. width	6.7
Coordinates	N 43°35,655´ E 021°53,343´	Max. length	8.5

Jezerska cave is located in the vicinity of the village Jezero after which it was named – more precisely on the eastern side of the asphalt road leading from the resort „Vlasina“ to the village Jezero – in the location that the locals call Venčić which lies somewhat more to the west from the peak Oštra čuka (1072 m). It is interesting to mention that the object is located on the edge of a field. The cave entrance can be reached from a rocky recess 5x4 m wide and approximately 2 m deep. The entrance opening is triangular in shape whereas the interior has an almost circular base. The cave ceiling is hollow on three spots through which it vertically communicates with the outside. It is interesting to mention that underneath such a vertical opening a tree has managed to grow out and press its branches through the opening out to the surface. The cave contains crushed rock and dark sediment. Furthermore, the cave base is heavily polluted with piles of plastic and other modern waste and served as a latrine to local farmers.

VLASINA CAVE

Type of find	Cave	Orientation of entrance	NW
Guide	Saša Stevanović Sokobanja	Entrance width	0.55
Speleological mark	/	Entrance height	3.7
Altitude	857	Max. width	5.2
Coordinates	N 43°35,860´ E 021°52,501´	Max. length	10.9

This small and secluded cave lies north-east (about 300 m) from the saddle and resort Vlasina. The object itself is located at the bottom of a shallow sinkhole and covers almost its entire surface. There are two entrances into the cave; one is vertical in the middle of the object, and the other is horizontal the shape of which more resembles a crack in the rock. This narrow but tall crack inclined towards the interior that is 4.5 m high leads into a more spacious hall which is of an almost square shape. The cave walls are even and smooth. Vertically, in the middle of the western wall and along its entire

length stretches a crack 0.1 to 0.4 m wide. The largest portion of the limestone mass is very grey in color with smaller and bigger stains of red.

The entire base of the object is covered with crushed rock of different granulation and the largest concentration of it is around the vertical opening, which has probably collapsed in the recent past. Besides the crushed rock there is also a dark brown clay soil. Inside the object there has been discovered the skeleton of a mammal of a recent date.

RADENKOVSKI KAMEN

Type of find	Cave	Orientation of entrance	SE
Guide	Saša Stevanović Sokobanja	Entrance width	5.5
Speleological mark	/	Entrance height	2.5
Altitude	629	Max. width	5.5
Coordinates	N 43°32,055´ E 021°58,607´	Max. length	8.6

The cave belongs to the basin of Bela reka, one of the tributaries of Toponička river that springs out of the southern slopes of Mt. Devica. The cave itself is located on the right bank on the narrow canyon of Bela reka, between the hills Redak (861 m) and Kulište (706 m). The cave is positioned approximately at the exit of the river from a smaller canyon, some 150 m above the bank. Although the distance between the cave and riverbank is not big it is very difficult to reach this object. Due to a steep inclination of the terrain as well as piles of fine loose soil that additionally inhibits the climbing.

There are two earthen roads leading to Radenkovski kamen both of them are of a very poor quality so that the object is difficult to reach without the use of an ATW. One road leads from the village Labukovo along the Bela reka basin (distance of approximately 7 km). Judging by the road it has been very badly maintained during the past few years so that at certain locations we were forced to remove fallen tree trunks from the road that have probably collapsed onto the road during the past winter. The other road leads from the village Radenkovac to the village Davidovac (distance of approximately 5 km), and this road is in a slightly better condition but the configuration of the terrain's relief makes it very difficult to cross and barely passable.

The cave entrance has a semi-circular shape in front of which the terrain is so steep that it immediately declines towards the river banks. The object consists of a simple and monotonous canal. Four meters from the entrance the corridor mildly bends to the south into a smaller chamber of an almost circular base where it also abruptly ends. The cave walls are more or less even and smooth, riddled with stripes ranging in shades from white to dark grey. Only in the entrance part of the object the walls and ceiling are rough and of a different configuration which is the result of collapse. The walls join at the top thus a larger portion of the ceiling has a triangular profile. Except

for some moisture in the final part of the canal, the cave shows no visible traces of hydrological activities.

The surface sediments consist of dark sandy soil mixed with smaller pieces of crushed rock. The utter end of the cave of a surface of 2-3 m² is covered with dark and light compacted soil, which could be the result of frequent moisture. There are no traces of excavations.

The cave is difficult to access whereas the visibility of the terrain is limited to the river valley and surrounding hills. However, this area is an excellent strategic point stationed in the vicinity of numerous small river valleys leading to the surrounding villages (Radenkovac, Galibabinac, Božinovac, Davidovac, Radmilovac, Labukovo) so it is no wonder that on the hill Kulište (opposite to the cave) there are still visible traces of a fortification, most likely dating from the early Byzantine period. Inside the cave discovered were remains of bird bones of an earlier date and one ceramic fragment of a modern fabrication.

GOVEĐI PEŠTAR

Type of find	Cave	Orientation of entrance	N
Guide	Saša Stevanović Sokobanja	Entrance width	3.9
Speleological mark	/	Entrance height	2.5
Altitude	580	Max. width	3.9
Coordinates	N 43°31,935´ E 021°57,969´	Max. length	10.3

The cave is located near the left bank of Bela reka at its entrance into a short narrow canyon the locals call Tomin kamen. The canyon is narrow and almost completely vertical with a few sharp bends. The canyon is approximately 60 m high. The entrance part of the canyon is somewhat wider with slightly inclined sides. The object itself is located about 30 meters from the bank and 20 m higher than the present level of the river.

The easiest access to the cave is from the village Labukovo along an earthen road which follows the riverbed of Bela reka leading towards the village Davidovac. At approximately 4.5 km along the road there is a seasonal creek Javor which meets Bela reka somewhat to the west from the speleological object. From there it is necessary to find a suitable location for descending down to the Bela reka riverbed and from there one should follow the cliffs along the left bank where, somewhat to the east from the estuary of the two rivers, the cave Goveđi peštar is located.

The cave entrance has the shape of an inclined ellipse and from there leads a corridor with the diameter of a narrowing funnel until 8 m deep from where it narrows into a small opening (0.5x1m) that leads into a small but high room oriented to the west. The entire corridor has a mild inclination towards the entrance which suggests that it has a spring character. However, except for dripping waters there are no other

hydrological activities. The cave walls are coarse and uneven with two smaller siphons in its eastern end.

The cave sediment consists of greasy and moist clay mixed with the smaller pieces of crushed rock. At the very entrance there are visible rocks which, due to the inclination of the terrain make it appear that the sediment is rather washed out and shallow – at least at the entrance part. Further along the corridor there are no visible parent rocks thus it is possible that the sediment is thicker than assumed.

ČITLUČKA CAVE

Type of find	Cave	Orientation of entrance	NW
Guide	/	Entrance width	1.6
Speleological mark	8.1-16.	Entrance height	4
Altitude	410	Max. width	15.5
Coordinates	N43°37,760' E021°59,653'	Max. length	107

The Čitlučka cave was the subject of study to many pioneers of Serbian speleology (Цвијић, 1895, 1914; Милојевић, 1936; Петровић, 1976) and therefore in scientific literature it is also known under other alternative names: Vrelska cave, Pećurski kamen, Pećina pod Devesiljskim kamenom. The cave is located on the north-eastern slopes of Mt. Devica at the foothill of a steep limestone cliff that the locals from the nearby village of Čitluk call Pećurinski kamen. The object is located 200 m eastwards from the main sourse of the Moravica called Istoci. This spring has been landscaped as a tourist picnic area which is accessable via an asphalt road north-west from the village church of St. Ilija. From Istoci spring one has to cross to the left river bank and follow the eastwards heading pedestrian path which alongside the bed of one of the seasonal springs leads to the cave.

The cave has two entrances out of which the visitors can access the smaller horizontal opening in the shape of elongated ellipse, whereas the other entrance is significantly larger (18x14 m) and belongs to the type of vertical pit entrances. At the location of the horizontal cave opening a terrace-like cut 20 m wide is cut into Pećurski kamen and this leads to a ditch which is at times filled with water from the additional springs of Istoci. The smaller entrance mounts into an 8 m long narrow canal which leads to the vast cave hall the ceiling of which has a big penetrating pit opening. The mentioned narrow canal and hall are separated by a completely vertical step that is up to 5 m high (S. M. Milojević attributes to it a height of 8 m, whereas J.Cvijić a height of a full 16 m) whereas the pit opening and the bottom of the hall are covered by a height of close to 20 m. Both entrances are oriented towards the north-west.

The vast hall with the dimensions 23.5x15.5 m is actually the central space out of which branch the other three cave canals (the northern canal – entrance, and two lateral canals – the eastern and western canal). The walls are almost vertical and their

surface is smooth. On the southern wall, at a height of 10 m from the bottom, beside a small recess similar to a rockshelter, a short vertical crack widens into a small canal from which during the rainy season seeps a weak water vein and this has left a thin tufa oozing trail on the wall. Due to the large pit opening the hall is abundantly illuminated. According to the shape and condition of the pit one could say that it was formed as an internal, closed cavity that was then opened by the collapsing of the ceiling. On the bottom of the pit there is a cone-shaped pile of crushed rock, soil and sand mounting up to a height of 3 m up the northern wall. Otherwise the level of the hall's base has two inclinations; one eastward and the other westward. Inside the body of the western wall a spacious rockshelter has been formed. Its base is semi-circular and ends with a short canal as a dead end in the north. On its eastern side the hall mounds into a cave canal which at the distance of 40 m from the opening is so narrow that it can be only crawled through for the next ten meters. This canal is inclined in the direction of its course i.e. towards the north-east, and at the beginning it descends mildly and then more steeper. Cvijić mentions that at the end of the canal there are some permanent springs „oozings" but except for a little dripping water nothing similar to that was observed. The longitudinal direction of the small hall, as well as both of its branches are predisposed by a diaclase that stretches along the cave ceiling in the direction NE-SW (Цвијић, 1895: 43).

The hydrological condition of the cave depends to a larger extent on the external climatic factors i.e. the amount of rain and snow precipitation. Sometimes, during long rainy periods or at the time of snowmelt the bottom of the hall is filled with water. Quite rarely and in irregular periods a small spring sprouts from the entrance canal and this was first recorded in scientific literature in the spring of 1893. Subsequently to that, S. Milojević recorded the sprouting of the spring in 1934 while the oldest inhabitants of Čitluk remember that the last sprouting of the water from the cave to the surface was as early as in the 1950s.

The cave sediment consists of forest chernozem, mud, cave clay and crushed rock. The forest chernozem appears exclusively on the cone-shaped mound above the cave opening from where it had come from the nearby beech forest by means of a natural inclination of the terrain. The cave clay is most prominent in the rockshelter part of the cave whereas the muddy sediment is located directly along the cave walls. Bigger and smaller limestone blocks are scattered all over the cave base and they are most prominent underneath the pit opening.

During a visit in 2012, a mandible of a young large bovid (Bos sp.) was discovered in the south-western part of the big hall. In the rockshelter part of the cave a proximal fragment of the right human humerus was discovered. The position in which the humerus was discovered was covered by a higher concentration of crushed rock from which only a smaller portion of the humerus was protruding. At glance, the bone appears rather fossilized and more robust than modern human humeri however, without an expert anthropological analysis and absolute dates it is difficult to make any estimates.

However, some other parameters indicate the archeological importance of this cave. Actually, the cave lies at a distance of only 1 km from the hill called Kremenac that is abundant in flint material and artifacts made of the same material[1]. The connection between these two locations is quite simple because the space in between them is located on the alluvial plain of the Moravica river and there are almost no larger obstacles along the way.

Across the river ditch in front of the cave entrance there is a small hill known under the name Vrelska Čuka. This hill has a good strategic position and provides a good view over the entire eastern part of the Sokobanja basin. By examining of Vrelska Čuka as well as its surrounding fields it has been established that there are elements of the Vinča, Bubanj and Antique pottery and the presence of flint artifacts from the younger prehistory. Since this is the only cave in the closer vicinity and the entire location indicates a longer period of human occupation (granted by the natural resources and favorable geographic position), we may assume that it was also attractive to the Pleistocene people, which is not unlikely because at only 3 km to the east lies Pećurski kamen, a cave in which the existence of a Paleolithic layer with Mousterian artifacts has been confirmed.

DUGOPOLJSKA CAVE

Type of find	Cave	Orientation of entrance	SW
Guide	/	Entrance width	8.1
Speleological mark	8.1. - 14	Entrance height	3.9
Altitude	597	Max. width	8.1
Coordinates	N 43°37,353´ E 022°57,418´	Max. length	19.5

The cave is located on the northern slope of Mount Devica not far from the village of Dugo Polje after which it was named. More precisely, this object is situated in the cliffs of the hill Ljiljača that were formed as part of the canyon of the creek Dugopoljski potok. The easiest way to reach Dugopoljska cave is from the village church (currently under construction) from where one should take the earthen road along the creek towards the water collector. From the position of the water collector it is easy to observe the cave opening and from there it is quite easy to organize a path towards the object. The safest access to the object leads across the top of the hill – Ljiljača. Namely, the cave is not far away from the road but the hill on which the object is located is covered with thick forest shrubs and lots of thorny bushes which make the access to the cave quite difficult.

[1] Flint, as a sediment rock, consists of crypto-crystalline quartz, chalcedony and opal exists in geological therminology, however, in archeology this term does not have the same meaning because flint is often also the name for artifacts comprised of hornstone and other silicate rocks and minerals (Jović, V., 1997, Kremen, u: Srejović, D. (ur.), Arheološki leksikon, Savremena administracija, Beograd, str. 524.).

The speleological object was formed on the boundary of Paleozoic conglomerates, sandstone, clay slate and Mesozoic slab limestone. The cave consists of a simple cave canal, without a steeper inclination and without large bends. The cave entrance is located at the highest zone of the cliff which follows the south-western outline of the hill. The entrance has an almost regular semi-circular shape in front of which stretches a smaller plateau behind which there are cliffs in the form of a cascade. The interior of the cave is divided into three units: the entrance and the largest hall, well illuminated, 11 m long and 8 to 5 m wide with an average height of 2 m; the smaller cave, utterly dark, 6 m long, 4.5 to 3 m wide with an average height of 1.5 m which is accessible through a very small passage way (0.9 m wide and 1.6 m high); the final hall, utterly dark, with a round base 2.5 m in diameter and 2 m high containing some cave decorations, which is also accessible through a small circular opening 0.5 m in diameter.

The surface sediment consists of grayish ashen soil containing mostly smaller chunks of crushed limestone. A few smaller shallow trenches (up to 0.3 m deep) generated by the digging of animals or by activities of treasure hunters do not indicate any change of color or sediment property nor any visible part of the parent rock. The further most cave hall is rather moist, its floor covered in cave clay but according to the outline and inclination of the walls one could say that this layer is rather thin.

The cave is situated in the vicinity of the crossing of several seasonal creeks comprising the Dugopoljski creek at the very entrance into its small canyon. The cave entrance is positioned just in that direction providing excellent visibility to the expanse where the surrounding seasonal creeks meet with the estuary of the Dugopoljski creek, which is suitable for ambushes. The spacious and flat plateau which is the top of the hill is located immediately behind the cave entrance and offers an exceptional view of the village panorama and a significant portion of the Sokobanja basin and Moravica river. Furthermore, this plateau provides an easy and quick communication of the cave with the Moravica river and its basin. Superficial findings of modern pottery and animal bones do not indicate the presence of a Pleistocene layer at the surface, however, the position of the cave and quantity of sediment may be a favorable indicator that such a layer might also exist in the deeper levels of the speleological object.

TAMNICA

Type of find	Cave	Orientation of entrance	SW
Guide	/	Entrance width	1.6
Speleological mark	/	Entrance height	1
Altitude	980	Max. width	10
Coordinates	/	Max. length	52

The cave is situated on the northern slope of Mount Devica, on its part above the village Dugo Polje, which consists of vertical cliffs that are several hundred meters

high. Immediately above the Dugopoljski spring stretch the cliffs of Golemi strnjar (1160 m), Koviljak (1128 m) and Vesina (1064 m) thus creating a vast semi-circular amphitheatre on which several contact springs penetrate the surface. The spring part of the semicircle is formed from massive limestone slabs of Barremian age that are heavily disturbed and intersected by various cracks (Петровић, 1976: 159). The cave Tamnica or Tmna Dupka is located on the southwestern side of the semicircle above which starts the vast and high karst plateau of Mount Devica.

Among the caves known from pre-war scientific literature, Tamnica was one of the highest caves in the Serbian karst. From a small and narrow cave entrance the cave mounds into the cave canal of the same dimensions which after some 20 meters expands into a smaller hall 10 m wide and 5 m high. The cave further stretches into a canal 3-4 m wide and only 0.5 m high. The cave bottom is inversely inclined from the entrance and the difference in height is 8 meters. In the inside of the hall there are smaller tufa basins and the walls are partially covered with calcite.

Immediately next to the cave there is a large opening of a vertical pit the depth of which, based on a thrown rock was estimated to be more than 200 m. The diameter of the gaping opening is 14 m and the visible part of the pit is entirely vertical without recesses or shelves. There is no doubt that the cave and vertical pit belong to the same subterranean system.

The cave Tmna Dupka was formed along the vertical cracks, immediately above the contact of Paleozoic schist and massive limestone. Since the cave is located above the contact spring it is logical to assume that it was formed by the action of the spring at times when it sprouted above the zone of contact. The vertical pit is located at the end of a short karst valley through which a periodical creek runs in times of great rainfall and snowmelt. The pit was formed along the deep rifting cracks that descend downwards all the way to the Moravica spring (Петровић, 1976: 160).

The surface of the cave is covered with moist cave clay and chunks of fine and coarse crushed limestone. The depth of the sediment in the entrance hall of the cave is rather thin whereas it is difficult to establish the thickness of the sediment layer inside the hall.

CAVE IN STRUNJAK

Type of find	Cave	Orientation of entrance	SW
Guide	Saša Stevanović Sokobanja	Entrance width	9.2
Speleological mark	8.1. - 18	Entrance height	9
Altitude	480	Max. width	9.2
Coordinates	N 43°31,450´ E 022°01,219´	Max. length	34.3

Upstream from the estuary of Čitlučka River the canyon of Izgara is cut into an epigenetic joint gorge 2.5 km long. At this part it has encompassed a portion of the

limestone side of the Mount Devica, cutting between Oštrelj, Momin kamen and Šiljati kamen. The canyon is approximately 300 m deep with almost vertical sides. North of the canyon, at an altitude of 500-600 m there is a limestone plateau formed of slabs and layers of Barremian and Aptian limestone. The corrugated and crumpled Cretaceous limestones are riddled with cracks stretching from the edge of the canyon towards the river bed. The sides of the canyon contain a few smaller rockshelters that are almost completely washed out and without sediment. The cave in Strunjak is cut into the southern ridges of the hill Čuka at the location the locals call Strunjak.

The entrance opening faces the south-west is of larger proportions and has an irregular semi-circular shape. The simple cave canal mostly maintains its dimensions from the entrance opening and continuously climbs towards the interior. The cave resembles a tunnel with an arched ceiling and smoothen sides stretching in the direction SW-NE. In the ending part of the cave its profile is slightly smaller but the direction and the inclination remains the same and the ceiling shows a widened crack until the end. The cave is mostly dry and the dripping waters appear only after heavy rains i.e. in fall and spring. The air temperature in the deeper parts of the cave ranges from 9-12 ºC whereas the air humidity is very variable ranging from 60-90% (Петровић, 1976: 156).

The continuous inclination of the wide and simple canal indicates the spring character of the cave. This also corresponds to its position because it is located in the limestone canyon of the Izgara River. It is of tectonic origin and was formed by the actions of the underground flow of these springs which now sprout in the close vicinity of the river bed (Петровић, 1976: 156).

The cave sediment has only remained in the further most parts of the corridor and consists of guano and cave clay mixed with ample amounts of crushed limestone. Based on the profile of an „illegal“ trench it may be concluded that the thickness of the sediment is approximately 1.2 m after which the parent rock becomes visible.

PEĆURSKI KAMEN

Type of find	Cave	Orientation of entrance	NW
Guide	/	Entrance width	12.5
Speleological mark	/	Entrance height	6.6
Altitude	559	Max. width	13.2
Coordinates	N 43°31,450´ E 022°01,219´	Max. length	64.1

Pećurski kamen is a cave situated on the furthest north-east slopes of Mount Devica in the vicinity of the village Levovik. In scientific literature it is also mentioned as the cave above Hajdučki izvor near Čitluk (Malez, Salković, 1988: 89–99). The cave is situated in the massive limestone cliffs in the southern side of the canyon formed by the river Izgare, slightly below the summit called Momin kamen (687 m). The object is

accessible via the main road Sokobanja-Knjaževac approximately 2 km east of the Coal Mine „Soko“ there is a southern (right) side road (dirt road) towards the ruins of the church „Presveta Bogorodica“ from where it continues along a forest path to the hilltop of Momin kamen from where it mildly descends towards the cave.

The cave opening is situated at the southern end of an elongated limestone cliff stretching in the direction north-south. The very entrance has an elliptic shape. The spacious interior of the cave consists of three larger, interconnected halls with no visible harsh changes in their base. The first and second hall both have the profile of one half of an hour glass whereas the transition from the second into the third cave is represented by a mild narrowing and a small step thus the third hall is slightly lower and elevated. The entrance hall is narrowing in the shape of a funnel and has an almost flat arch and is entirely dry whereas the second and third halls have some cave decorations and active dripping water.

The north-eastern hillsides of Mount Devica are formed by a thick series of brackish and massive zoogenic limestone of Barremian age whereas the foothill of the mountain is filled by Pliocene sediments present mostly by sands and clays with coal layers (Петковић, 1933) that are excavated from within the coal mine „Soko“ near Čitluk. The cave was formed in the grey Barremian limestone along multiple tectonic cracks, mainly along joints and diastems. During its speleogenesis the cave has passed through many phases of development manifested by the change of erosive, corrosive and accumulative processes. Nowadays the cave is in its adult phase with dominant corrosive processes accompanied by the accumulation of sediments created by the decomposition of Mesozoic layers and the intake of organogenic sediments from the surface (Malez, Salković, 1988: 90).

The floor of the cave is almost completely even and covered with thick layers of Quaternary sediment. The position of Pećurski kamen, its subterranean morphology and presence of clustered sediments indicated that this is a very promising object for researching the geological genesis of the Quaternary and thus in 1984 paleontological excavations were conducted in the cave under the auspices of Mirko Malez and Semedin Salaković (Malez, Salković, 1988: 89–99). During the excavations a trench of the dimensions 1.5x3 m was dug in the center of the entrance hall. The sediment layers were excavated up to a depth of 4 m after which the parent rock still could not be reached (Malez, Salković, 1988: 91). Numerous findings found in the excavated strata showed that the cave represents an important paleontological and Paleolithic site in this part of Serbia. The remains of Pleistocene mammals collected during this excavation are kept in the Institute for Quaternary geology and paleontology of the Croatian Academy of Science and Arts in Zagreb (Димитријевић, 1997: 192).

Since almost all the layers contain skeletal remains of different animals (except for the sterile stratum (e)) based on the determined families and species, sedimentological features as well as the analogies with other researched sites in Serbia, the scientists drafted a differentiation of the strata based on the Alpine scheme of the Quaternary division (Malez, Salković, 1988: 91). The excavated series of sediments is

very interesting and observed from top to bottom the following stratigraphy has been established:

a) Black humus soil mixed with guano, fragmented sheep and goat bones and fragments of modern pottery. The thickness of this stratum varies from 20 to 40 cm. The layer has a humus texture thus its sedimentation occurred exclusively during the Holocene.

b) Reddish-brown loam mixed with sharp-edged crushed rocks and animal bones with a thickness of the layer of 120-150 cm. This layer contains skeletal remains of the fossil brown bear and step fox which indicates its sedimentation in the Late Glacial i.e. in the period from the oldest to the youngest Triassic.

c) Grey sandy loam with crushed rocks and animal bones with a layer thickness of 50 cm. This layer contains larger quantities of skeletal remains of the cave bear with a few individual findings of the alpine ibex. This association indicates a colder and harsher climate whereas the sharp pieces of crushed rock indicate a frequent freezing of the water in the cave cracks which caused the collapse of certain portion of the cave ceiling. Based on these indicators this layer is classified into the second part of the third Würm phase (Würm 3).

d) Brown loam containing crushed rock and animal bones 40 cm thick. This layer contained only a bone of the alpine jay, whereas sharp pieces of crushed rock indicate a sedimentation during a cold climate, thus the entire stratum is classified into the first half of the third Würm phase.

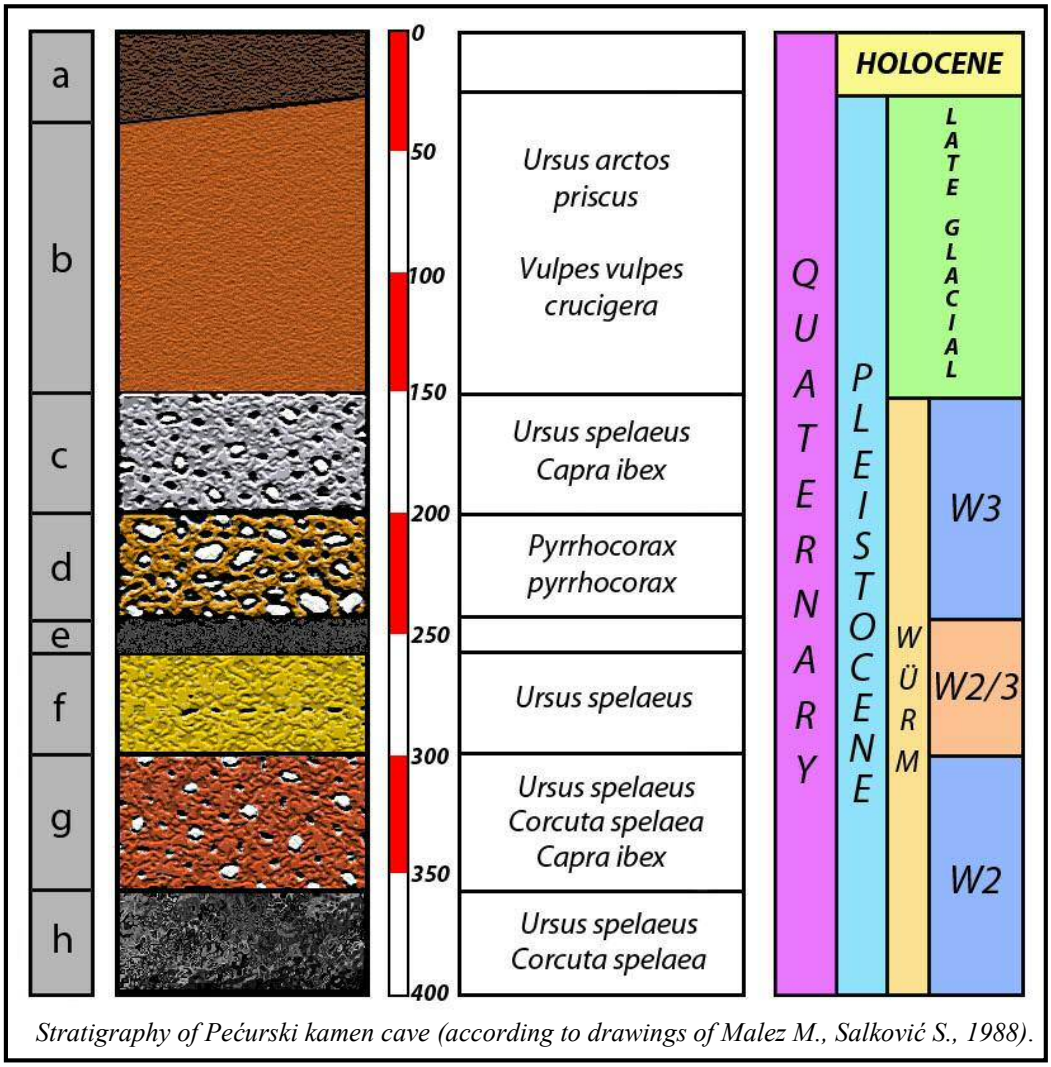
e) Dark ash-grey soil without findings, 20 cm thick. Since this stratum does not contain any paleontological findings and its dark-grey color and large content of powdery travertine indicate a very humid and relatively warm climate, this sediment is classified into the final phase of the second Würm Interstadial (Würm 2/3).

f) Brown sandy loam without rock and with rare findings of bones, with a layer thickness of 40 cm. The sediment structure and bones of the cave bear indicate that the sedimentation occurred during the second Würm Interstadial.

g) Reddish-brown loam containing fine corroded crushed rock, bones of Pleistocene mammals and flint chips, 60 cm thick. This layer contains plenty of skeletal remains of the cave bear accompanied by individual findings of the cave hyena and alpine ibex. Most of the finer crushed rocks are corroded to a larger extent because of diagenetic processes. According to the superposition and the mentioned facts it can be concluded that this layer was deposited during the second Würm phase (Würm 2). The flint artifacts mentioned by Malez unfortunately are not presented by drawing or photographs thus it is difficult to conclude from the dry description to which Paleolithic industry they belong (Михаиловић и др., 1997: 36).

h) Grey sandy loam with small quantities of crushed rock and Pleistocene mammals, excavated from a depth of 40 cm. The features of this layer are mostly identical to the previous one, thus it was also placed into the second Würm stadium[1].

[1] All data concerning the determinating of layers from Pećurski kamen are taken from: Malez M., Salković S., (1988), 91-93. str.



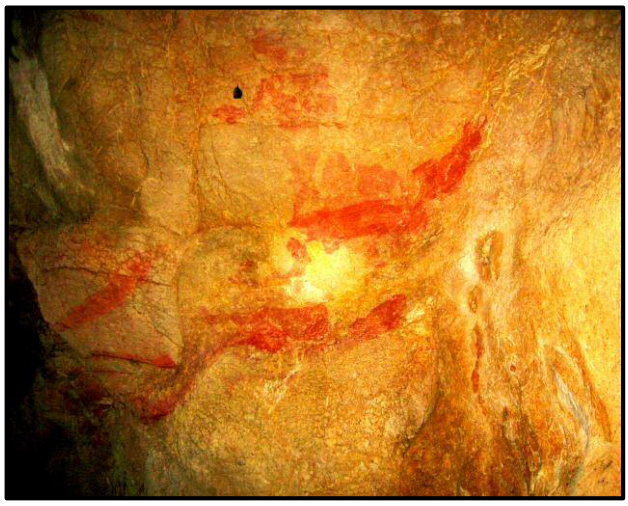
Stratigraphy of Pećurski kamen cave (according to drawings of Malez M., Salković S., 1988).

The team from the Archeological Institute led by Zvonimir Kaluđerović conducted in 1993 probing excavations in Pećurski kamen. On that occasion it was confirmed with certainty that the cave was inhabited in the Paleolithic. The thick layers of sediment that were excavated up to a depth of 4 meters during which the bottom of the cave was not reached, presented a lot of Paleontological remains from the Pleistocene Era (Калуђеровић, 1996: 290–291). The archeological findings consist of four flint artifacts out of which one is a typical and excavated from a depth of 1.5 m while the other three artifacts are found in layer number 7 (Malez's layer f or g) at the depth of approximately 3.2 m from which one of the tools was classified as a Mousterian sidescraper (Михаиловић и др., 1997: 36). Probing excavations under the same management were repeated also in 1995 although in a limited scope since the open trench had reached the layer of large limestone blocks which made the team give up any further digging (Калуђеровић, 1996: 291).

The osteological findings collected during these surveys are kept today in the collection of the Faculty of Mining and Geology in Belgrade. The mammal fauna is represented by the following species: Vulpes vulpes crucigera, Ursus arctos priscus, Ursus spelaeus, Felis silvestris, Sus scrofa, Cervus elaphus, Rupicapra rupicapra, Carpa ibex. Especially important are the findings of the cave bear (Ursus spelaeus), cave

hyena (Crocuta spelaea), wild boar (Sus scrofa) and ibex (Carpa ibex) that were found inside the layer with the Paleolithic artifacts (Димитријевић, 1997: 192).

During the survey performed by the author in 2013 inside the cave on the surface a few fragments of modern pottery and a few bones of insignificant age were found. In the soil excavated by Kaluđerović from the trench there were many smaller bones of Pleistocene age which suggested to the author that the excavated sediment may not have been sifted. Among the Pleistocene bones, the most dominant are bones originating from the cave bear among which there are a few dozen teeth. Furthermore, lots of natural ocher were registered on the cave walls but attention was raised by a field (1x1m) of the western wall which showed certain outlines that may have been traces of cave paintings. Actually, these are a few thicker lines 5-7 cm wide that do not follow the cave cracks out of which the natural ocher may have permeated. However, this collection of lines does not have a recognizable shape (perhaps a running horse) thus this theory is questionable and requires further analyses[1].



Possible traces of cave art in Pećurski kamen cave

The cave itself has a favorable position since it is located on the boundary between the Sokobanja basin and the Skrobnica expanse. The river Izgare runs near the cave in the direction east-west cutting its canyon in its region. Somewhat westwards from Pećurski kamen there is a creek running in the direction north-south but this creek creates only a small basin before it mounds into the river Izgare. The location of the estuary is some 200 m below and in line with the cave opening and thus makes a good spot for hunting from an ambush. The excellent visibility of the terrain provided by the nearby summits facilitates a view from the both sides of the Izgara canyon. Besides that, in a circle of only three kilometers in relation to the cave position there are two registered deposits of flint material of which the closest one is Lipov trap less than one kilometer away in a straight line. Bearing in mind that the first excavations were led by researchers who were not archeologists by profession (Malez and Salković in 1984), and that Kaluđerović's excavations (in 1993 and 1995) were conducted hastily (3 m of sediment were excavated in 9 days) and without sifting and that in both cases the cave bottom was not reached it would be favorable to reexamine the archeological potential of this cave (Калуђеровић, 1996: 291).

[1] Personal communication with Aitor Ruiz-Redondo, The Cantabria International Institute for Prehistoric Research.

NOVAKOVCI CAVE

Type of find	Cave	Orientation of entrance	SW
Guide	Saša Stevanović Sokobanja	Entrance width	9.6
Speleological mark	8.1-19	Entrance height	2.7
Altitude	670	Max. width	9.6
Coordinates	N 43°38,842´ E 022°03,846´	Max. length	10.7

Novakovci cave was given its name after the creek Novakovci that springs from its interior. The cave is located on the southern most hillside of Mt. Krstatac along the boundary of the vicinities of the villages Čitluk and Orešac. The area in which the cave is located is very clear and even because its entire vicinity is covered by fields and meadows and therefore access to the object is not a problem since it may be reached by dirt road from the villages of Čitluk and Orešac.

The cave entrance has the shape of slanted and elongated ellipse and is located inside a limestone ridge that protrudes form the southern hillside of Mount Krstatac like a big step. The inside of the cave consists of a cave hall immediately after the entrance and a low, eastern canal which after a few meters mounds into a small hall from where the Novakovci creek springs. The walls of the object are mainly smooth, except for its western wall from which like a high-set step protrudes a rough and uneven rock following the outlines of the entire length of the wall. The bed and canal of the creek are small and shallow thus not exceeding a width of 1 m. In front of the cave there is a vast meadow approximately the size of a football pitch. On the field there are pledged monuments erected by the villagers, so during village festivals this place is respected and revered, but regardless of that the space around the cave entrance is covered by dense shrubs and thus barely visible from the field.

The surface cave sediment consists of loose, dark grey soil mixed with sand and crushed rock. The small canal from which the creek springs shows yellow-red clayish sediment which is set at a very shallow depth. It is difficult to estimate the depth of the cave sediment in the main entrance hall but judging by a larger trench along the northern side of the cave the depth of the sediment is more than one meter.

The cave has an exquisite position because it is the starting point of the area of flattened river terraces which mildly cascade downwards to the eastern rim of the Sokobanja basin. Thus this position makes it easy to cross into the nearby Knjaževac basin. Besides that this area is abundant in quartz which can be found in almost all surrounding fields and not far from the eastern hamlet of the village Čitlut known under the name Klenje there has been found an exceptionally reach deposit of the raw material (site Lipov trap) which according to its physical characteristics makes excellent material for the construction of weapons. Although the cave itself may not represent a location with a high archeological potential (taking into consideration that a creek springs from the cave and runs through it) attention should certainly be directed to the

vast plateau in front of the cave which due to the above mentioned might present an interesting archeological object.

SESALAČKA CAVE

Type of find	Cave	Orientation of entrance	SE
Guide	/	Entrance width	20
Speleological mark	/	Entrance height	10
Altitude	586	Max. width	20
Coordinates	N 43°41,916´ E 021°59,294´	Max. length	516

The Sesalačka cave is situated in the north-eastern part of the Sokobanja basin along the hillsides of Mt. Slemen. From the village Sesalac, after which it was named, the cave is at a distance of 2 km immediately along the village road heading towards the village Rujište. The Sesalačka cave is a dominantly tunnel cave – an overgrowth of Zarvina river which is a tributary of Sesalačka river that mounds into the Moravica river at the coal mine in Čitluk as its right-hand tributary. Zarvina river springs at the southern side of the oblong part (812 m) out of Andesite rock. After a shorter flow it comes to Cretacean limestone through which it flows until it mounds into the Sesalačka river. In the area of Sesalačka cave the limestone stretches in the shape of a transverse rafter into which Zarvina river first cuts a small, shallow and narrow cul-de-sac basin (about 300 m long) at which end it then sinks into the ground cutting the limestone rafter like an overgrowth.

The cave was surveyed at multiple occasions. The first data on the Sesalačka cave were provided by Jovan Cvijić as early as in 1895 where he mentioned just the basic data on the cave (Цвијић, 1895: 31). In a paper published 30 years later, Jovan Cvijić mentions that the dry Sesalačka cave has two siphons close to its exit and that the cave ceiling above them is penetrated by three pits (Цвијић, 1926: 10). However, we were unable to verify these data in the Sesalačka cave.

Jovan Petrović deems that the Sesalačka cave is tectonically predisposed on two levels and that here the river penetrated through the limestone barrier building inside of it a vast subterranean corridor of 70 m in length. On the left side of the cave there are three lateral canals, thus its total length is 280 m. The sinking flow in the cave receives from the right hand side a large tributary which later descended into the depths and presently spurts out as a powerful spring 500 m westwards of the cave (Петровић, 1976: 158–159).

In his paper dealing with the relief of Sokobanjska Moravica Đ. J. Marković provides certain information about the morphology of the Sesalačka cave: the main canal of the Zarvina river is 5-8 km long, some 30 meters wide and 8-12 m high. Three small lateral canals separate from the right side of the main canal and join it again. Due to ceiling collapsing the cave is shortened down to the size of a longer overgrowth. Due to intensive limestone decay inside the thin ceiling the cave shall further and gradually

shorten and the overgrowth is going to be destroyed. Zarvina river used to previously flow above the cave ceiling which is confirmed by a small terrace stretching downstream from the cave opening. Because of the karstification of the bottom of the fossil basin the river changed its flow to the underground and started flowing underneath the terrace. Its former subterranean flow from the abyss (at the entrance of the limestone zone) to the exit from the recess shaped like an amphitheatre (once part of the cave) used to be over 300 m long (Марковић, 1977: 62–63).

Sesalačka cave is a short overgrowth joined by a complex network of lateral canals and corridors that resemble a maze. The main canal of Sesalačka cave is an imposing semi-circular overgrowth that is 70 m long, 10-12 m wide and up to 15 m high, whereas the total length of the cave canals is 516 m (Петровић, 1997: 177).

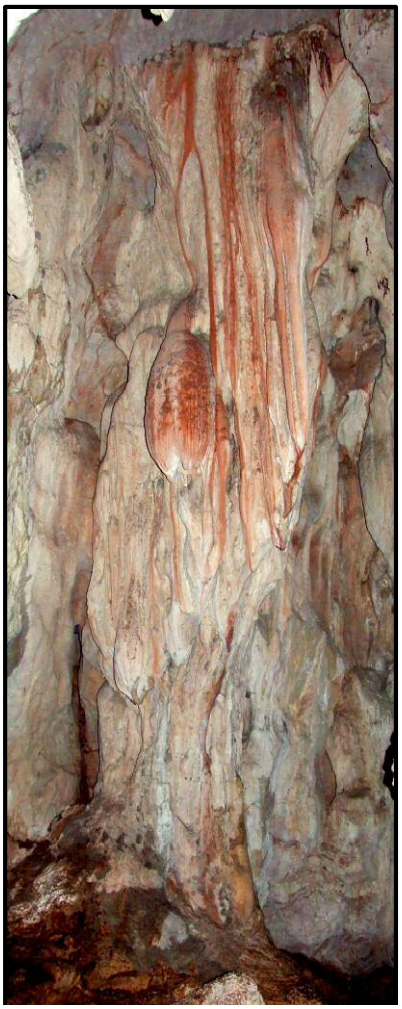
The entrance of the overgrowth is at the location where Zarvina River enters the cave opening by cutting into the right wall of the cave. The entrance part of the canal is cluttered by a mass of crushed limestone and large blocks that are almost camouflaging the entrance. The large limestone blocks in front of the entrance were created by the collapse of the cave canal due to which the original length of the overgrowth was significantly shortened (Петровић, 1997: 180). In 1895 Cvijić noticed four rockshelters in front of the entrance, one of which was 10 m long. Today they are no longer existent but the entrance part is almost covered with large blocks creating a barrier in front of the cave entrance (Цвијић, 1895: 31).

The exit of Sesalačka cave is on a level 3 m below the level of the entrance. It has a triangular shape predisposed by a diaclase with a width and height of 8.5 m, respectively. On its south-western side there are two small openings, one on top of the other. The lower opening is 4 m long and its bottom is 5 m above the riverbed. On the north-eastern side there are two rockshelters. Some 20 meters away from them there is a saddle – the former riverbed of Zarvina River. The saddle is 13.5 m above the current riverbed and only 5 m above the upper edge of the cave entrance. This fossil river bed is cut in 10 m in relation to the ceiling of the overgrowth. It is some 10 m wide and a paved village road runs through it (Петровић, 1997: 181).

Among the numerous canals, the northern canal is the longest one with a total length of 135 m. It is inclined towards the main canal with a drop of 5 m. This canal is joined by 13 smaller canals and corridors that are from 6 to 25 m long. The bottom of the north canal is flat and covered with muddy deposit. Along its canal and its branches visible are different shapes of cave decorations: stalactites, stalagmites, cave columns, draperies, cloaks and sinter pools.

The phases of the morphological evolution of Sesalačka cave and the basin of Zarvina River were dated according to the analyses performed by Dragutin Petrović. The dating was conducted exclusively on the basis of the average amount of the cutting-in of the lowest river terraces in the river basins of eastern Serbia, i.e. the basin of the Crni Timok, where their age is known. The accumulative terrace downstream from the cave, the former basin bottom of Zarvina reka (at the time of the cutting of the higher lateral canals) is undoubtedly of a Holocene age because it was cut in to the alluvial deposits.

In the basin of the Crni Timok, which is the direct neighbor of the basin of the Sokobanjska Moravica, all the accumulative terraces below 10 m of relative height are of Holocene age. The maximal height of the bottom of the fossil valley in the area of the saddle is 13.5 m (10.5 m from the upstream side). According to this it may be assumed that the karstification of the little fossil valley in the area of the present day saddle happened at the end of the Pleistocene and the beginning of the Holocene. Since the valley fossilization and the inception of the intensive formation of the main canal of Sesalačka cave were simultaneous occurrences, it may be presumed that the formation of the cave started at the transition from the Pleistocene to the Holocene. Therefore, the Sesalačka cave represents a very young form of subterranean karst relief of the Sokobanja basin (Петровић, 1997: 182–183). Nowadays the space around the cave is landscaped and used as a resort, while a larger portion of the cave interior is illuminated and accessible to visitors.



Flowstone in Seselačka cave

In 1965 a few fragments of ceramic pottery and urns were discovered near the cave entrance. According to their shape and decoration they belong to the period of the Middle Bronze Age i.e. the Vatin cultural group (Стојић, Јоцић, 2006: 218). Today they are kept in the National Museum in Niš.

Stalactites and stalagmites in Seselačka cave (photo. Nebojša Milutinović)

MILUŠINAČKA CAVE 1

Type of find	Cave	Orientation of entrance	SW
Guide	/	Entrance width	4.1
Speleological mark	/	Entrance height	2.6
Altitude	707	Max. width	12
Coordinates	N 43°40,505´ E 022°02,651´	Max. length	71

The Milušinačka cave is situated in the upper basin of Urdeška river, the right-hand tributary of Sokobanjska Moravica, approximately 3 km upstream of the village Milušinac. The canyon of Urdeška river near Milušinac is wide in its upper part and at the bottom it is narrow and with smooth sides. The river spring is formed in the Senonian marls, sandstone and conglomerates,

and the canyon part is cut into Kampan-Maastricht limestones. It appears that the river has firstly cut its canyon and then, on the level where it transverses from the wider upper into the narrower lower part, it had sunken into the underground due to submersion. Thus it carved a cave with smooth sides and a few large cavities. When later the thin cave ceiling collapsed the subterranean flow had again become a surface flow. The saddles which once formed the cave ceiling are completely gone (Марковић, 1977: 25–26). The cave is located in a part where the river has cut a canyon between Golo brdo in the north and Kratovac in the south. Both caves are carved into a cliff which the locals call Pećurinski kamen in the part of the cliff where limestone lies above wavy sandstone the layers of which stretch in the direction east-west and descend towards the north.

The first cave the locals call Pećura is located directly at the opening called Bogova vrata and has two narrow openings of which the south-eastern one is larger (4x3 m), whereas the other is located on a completely other side of the cave canal and is significantly lower and narrow. The larger entrance is located not far from the opening Bogova vrata and has an almost regular semi-circular opening. It provides direct access to a more spacious hall located in the direction E-W which in its eastern part communicates with its outer part through a crack (5.5 m long and 0.3-0.8 m wide) resembling a window. From this hall northwards leads a shorter corridor to the next hall from which it connects to the other entrance canal stretching in the direction E-W. The profiles of this corridor (E-W) are switching more and more thus their accessibility in their ending parts it is almost impossible and requires moving by crawling. The base of the cave is parallel with the vertical cliff, and the openings connected to the corridor most likely represent the severed part of a larger, more branched cave.

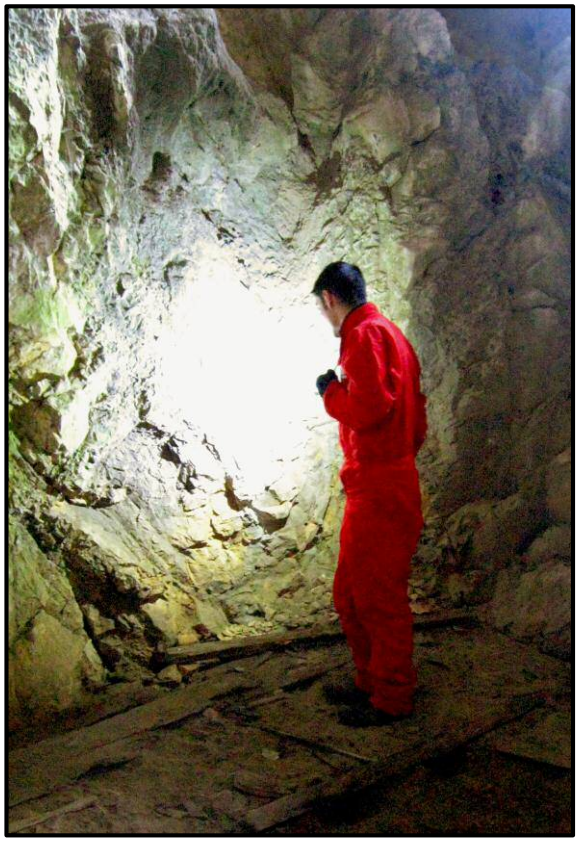
Inside the spacious hall, behind the large entrance the surface cave sediments consist of dark, powdery layer parts of which are mixed with the remains of ash and sooth. Only a few centimeters below that layer there is a layer of yellow-red clay which

in the deeper parts of the cave can be observed on the surface. The entire surface of the cave is mainly covered with smaller pieces of crushed rock from the cave.

The archeological research of the cave started in 2011 when a Levallois artifact (Mihailović, 2014 (b): 52) was discovered during the survey of the surface ground. During probing archeological excavations that followed in 2012 two trenches were excavated of a total surface of 6 m² and the excavation reached down to a depth of 2.5 m during which the rocky bottom of the cave has not been reached. Artifacts are rarely present; only 12 specimens of lithics were discovered and almost all of them originate from the upper layers close to the surface. Among the few artifacts the most prominent ones are two toothed tools one of which is a larger scraper made on a chip of the type *éclat débordant*. Almost all lithic specimens bear the features of Middle Paleolithic industry[1], except for a small micro blade found in the surface layer, which could indicate that there have been explorations during the Upper Paleolithic (Kuhn et al. 2014: 100–101).

In all excavated layers noticeable was the dominant presence of cave bear (Ursus spaelaeus) bones among the osteological remains of which all ages of individual animals were found. Besides the bear found were also the remains of wolves (Canis lupus), foxes (Vulpes vulpes), cave hyena (Crocuta spelaea), horses (Equus ferus), deer (Cervus elaphus), ibex (Capra ibex) and cattle/bison (Bos/Bison), while a few dental remains indicate the presence of rhinoceros. Judging by the above the cave used to be the frequent habitat of cave bears, whereas the human activities were probably reduced to sporadic and short occupations (Kuhn et al, 2014: 101).

Following these archeological excavations, in 2012 the Milušinačka cave was investigated by Aitor Ruiz-Redondo from the University of Cantabria, Spain, an expert for Paleolithic cave paintings and engravings. During the one-day research the surface of the cave walls was thoroughly investigated. Established was the presence of natural ocher but except for traces of soot from torches and a sequence of five red dots above the calcified layer, nothing else was discovered that could indicate the existence of Paleolithic art (Ruiz-Redondo, 2014: 132–133).



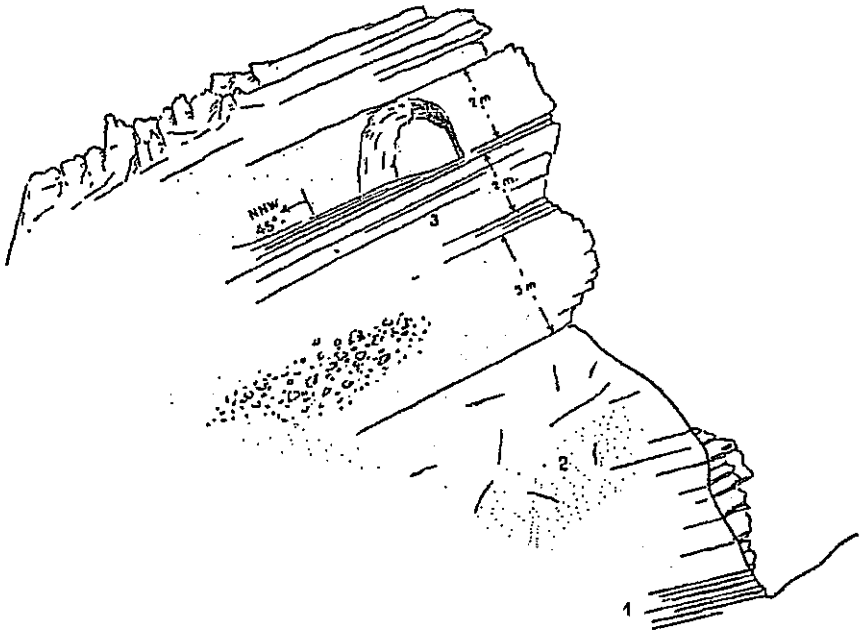
A. Ruiz Redondo exploring cave walls in search for cave art using specialized lamps (2012.)

[1] Kuhn, S., Mihailović, D., Dimitrijević, V. (2014), 100-101, Fig.3.

MILUŠINAČKA CAVE 2

Type of find	Cave	Orientation of entrance	S-SE
Guide	/	Entrance width	5.4
Speleological mark	/	Entrance height	6
Altitude	711	Max. width	9
Coordinates	N 43°40,449´ E 022°02,691´	Max. length	97

The second Milušinačka cave called Pećurina is located some 50 meters to the east from the Pećura (Milušinačka cave 1) on the same side of the valley and on the same vertical cliff. The cave has a spacious entrance opening of triangular shape with rounded sides. In its initial part, the corridor is inclined towards the entrance and thus stretches towards the north during its first 30 meters of length. Then, without any inclination, the corridor turns in the direction east-west following the parallel of the valley. Two lateral canals branch out from the main corridor. The right canal is wide and even and 14 m long, while the left one ascends sharply and ends with a crack. The main canal continues in twists slowly becoming narrow and ends with a cascade mound.



Geological profile of Bogova vrata stone formation
1. – marl limestone; 2. – unstratified limestone;
3. – conglomerates (bottom) with fossil limestone

The hydrological activity of the Milušinačka caves, not including the periodical dripping waters, ended a long time ago because all canals are located high in the limestone section whereas the present springs and sources surface at the bottom of the valley, which is 30-35 m below the level of the cave canals. The surface waters entering

the Pećurina are of short presence and disappear immediately after the rain. It is interesting to mention that even the dripping water do not last very long, most likely because of a thin top layer and the steep inclination of the surface. This, as well as the purity of the limestone could explain the absence of chemical sediments, i.e. cave decorations in these relatively old caves (Петровић, 1976: 157).

All sections of the cave bottom are covered with clay material and sand interlayered with gravel and moist sand stones. This material is even today flooded in by creeks seeping in from the dead-end valleys on the surface (Петровић, 1976: 157).

RUJIŠKA CAVE

Type of find	Cave	Orientation of entrance	SW
Guide	/	Entrance width	1.4
Speleological mark	/	Entrance height	0.6
Altitude	548	Max. width	4.8
Coordinates	N 43°43,359´ E 021°59,231´	Max. length	280

Rujiška cave is located in the very center of the village Rujište. It is situated at the location where the river Trska cuts a small but steep canyon on the rims of which stretch almost straight limestone cliffs up to 50 m high. The canyon is only 500 m long while its width does not exceed 100 m. Large limestone blocks are scattered all over the river banks and most likely they are the result of collapsing cliffs.

On the right riverbank across the old water mill some 30 m above the water level there is a visible rockshelter arch at the bottom of the cliff. The rockshelter is hemispherically cut into the parent limestone and the entrance width is 7 m whereas the height is 6 m and the depth covered by the arch of this object is about 4 m. The base is filled with light-brown soil containing lots of fine and coarse crushed limestone rock. The entrance to Rujiška cave is located approximately ten meters west of the rockshelter.

The entrance into Rujiška cave is very tight and requires crawling for about 7-8 m in order to reach a smaller hall which enables upright standing. Actually, the entire cave is a longer, mostly narrow cave canal the height of which varies between 1 m to 2 m at most. The entire length of the canal contains various cave decorations: stalactites, stalagmites, columns, draperies, but the most impressive decorations are the sinter pools with various lengths from 3-4 m. The cave is very damp with lots of dripping water and little sediment the larger portion of which has been washed out from the cave due to its mildly inclined canal towards the cave entrance.

Judging by it the cave is more interesting for speleological research, especially because of the diversity and beauty of the cave decorations.

BUKOVIČKA CAVE

Type of find	Cave	Orientation of entrance	W
Guide	Igor Lazić Rujevica	Entrance width	4.5
Speleological mark	/	Entrance height	1.5
Altitude	531	Max. width	5.2
Coordinates	N 43°43,021´ E 021°44,288´	Max. length	24

Bukovička cave is located in the vicinity of the village Rujevica on Mt. Bukovik after which it was named since this is one of the most famous caves on this mountain. More specific the cave is located on the western slopes of the hill Sence, somewhat north of the spring called Vrelce and 200 m east of the Crvena reka riverbed, almost directly across Radoslav Milovanović's cabin. The easiest way to access the cave is to start from the village Rujevica and follow the asphalt road leading across the Rujevičko Lake towards the spring Vrelce. From the spring leads a forest path northwards along the western slopes of the hill Sence. After a 300 m walk along this path it is easy to spot the meadow with the mentioned cabin from where the cave entrance is clearly visible.

The speleological object was formed at the boundary between the Paleozoic red sandstone and the Mesozoic limestone and dolomites. Since Bukovic belongs to the Rhodope rock mass and since the surrounding geological formations are at the age limit between the Paleozoic and Mesozoic it is quite possible that this is the oldest cave in the municipality of Sokobanja. Unfortunately, a larger portion of the cave was demolished with explosives organized by treasure hunters some 30 years ago. This caused the complete destruction of the ceiling and portions of the entrance canal walls stretching approximately 15 m in length. As mentioned by the locals, the complete cave once used to have the profile of a halved hour glass while today the only preserved portion is the canal stretching from the central narrowing to the furthermost hall. Therefore, the present entrance leads through a small and rather narrow opening into the cave canal which is up to 2 m high, which then leads to the furthermost smaller hall (4x5.5 m) but with a considerably higher ceiling averaging about 4.5 m in height. The cave is almost completely dry except in the furthest portions of the limestone hall where the dripping water surrounding it has formed another larger flowstone. In front of the cave there is a spacious plateau that is mildly dropping towards the Crvena reka riverbed.

The surface cave sediment consists of dark-brown loose soil mixed with pieces of mostly coarse crushed rock that is especially present in the furthermost hall. It appears that the cave is rather filled since the preserved canal is slightly inclined inwards and towards the furthermost cave wall, whereas the collapsed canal has an opposite inclination. The parent rock has not been noticed anywhere in the base.

The cave is located on a mountain that is considered to be one of the best hunting grounds in the region. There are written documents dating from the 18th century

reporting about the abundance of game and the cave's past. After having returned from Constantinople, the German ambassador, count Damian Hugo von Wirmant, spent some time in Aleksinac and upon hearing the rich game on Mount Bukovik and the surrounding area, he and his entourage went there to test the hunting ground (Протић, 1889: 32). Besides that, the position of the object offers an excellent view and access to the basin of Crvena reka exactly on the spot where the river has made a flattened widening on which today there are numerous meadows and cabins of the locals. This valley also facilitates communication with the other river valleys (Mratinja, Bela reka, Goveđa reka) which are also rich in game. Furthermore, the mountain Bukovik is also famous for its deposits of quartz and other sorts of minerals (Урошевић, 1925: 124). Bearing in mind that this is the only known speleological object on the mountain abounding in resources that were important for the Paleolithic economy and also that, perhaps during prehistoric times, the route across Bukovik was the easiest possible communication with the Morava basin there are assumptions concerning the potential of this cave as well as the entire mountain.

The view of Sokobanja basin from the eastern slopes of Bukovik mountain near Bukovička cave

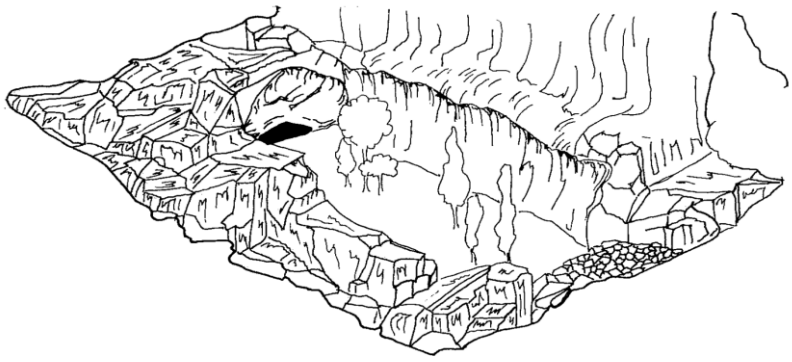
REGISTRY OF COLLAPSED CAVES

STOŽER KAMEN

Type of find	Collapsed cave	Orientation of entrance	E-SE
Guide	Saša Stevanović Sokobanja	Entrance width	8
Speleological mark	/	Entrance height	?
Altitude	841	Max. width	10-12
Coordinates	N43°37,214' E021°52,916'	Max. length	45

Stožer kamen most likely represents the remains of a former cave or spacious rockshelter the ceiling of which is completely collapsed, so presently it has the shape of a little cul-de-sac valley with massive limestone walls (eastern and western wall) with a small funnel-like recess in the northern wall which probably represents the furthermost part of a once big cave canal. The eastern wall still supports part of what once used to be the cave arch and therefore nowadays looks like a spacious rockshelter.

The former cave is located on Mt. Ozren and was named after the nearby „Stožer kamen“, a massive rock with vertical edges that protrudes like a high vantage point from the surrounding landscape. The entire formation lies on a massive limestone section on the southern side of the summit Orlovac (887 m), on the western rim of the Ozren amphitheatre basin. The easiest way to access this speleological object is via the asphalt road Sokobanja-Jezero. Somewhere along the fifth kilometer of the road there is a turn heading eastwards onto a dirt road that leads to the foothill of the mentioned Stožer stena. At the foothill there is a mountain path that in a broad semi-circular arch circumvents the rock from its southern side towards its northern side from where the cave is visible. Since the „Stožer stena“ is visible and easy to recognize from the road it is not difficult the find the cave itself.



Ideal view of Stožer kamen collapsed cave

The collapsed cave is located in the limestone of the lower part of the Urgonian phase (Cretaceous). The large quantity of talus at the western ridge of the hill may be yet one more indicator of the porosity of limestone in this region. The inside of the former cave is cluttered with very large limestone blocks around which a layer of humus with forest vegetation has been formed (dominantly beech and hornbeam). The closest water body is located on the western slope of Orlovac and is some 200-300 m away from Stožer kamen.

The location has a favorable geographic position because it has a good visibility over the Ozren amphitheatre basin (Ozren meadows) which is a popular hunting ground even today. From the western side via the basin of the Golemopadinski creek it maintains a quick communication with the Moravica River and Sokobanja basin. Thus, if this cave ever functioned during one period of the human past it could have been a formidable hunting station.

KOSINJA PADINA

Type of find	**Collapsed cave**	**Orientation of entrance**	**SE**
Guide	**Zoran Stojadinović Vrmdža**	**Entrance width**	**5.3**
Speleological mark	**/**	**Entrance height**	**6 ?**
Altitude	**832**	**Max. width**	**9.3**
Coordinates	**N 43°45,316´ E 021°52,025´**	**Max. length**	**17.1**

Kosinja padina is a collapsed cave located on the southern slopes of Mt. Rtanj, specifically, on its hill called Bučina (937 m). The cave is at a distance of approximately 7.5 km northeast from the village Vrmdža and accessible via a cobble stone road leading from the village Vrmdža to the foothill of Mt. Rtanj. Although it is close to the mentioned road, it is difficult to spot the cave since it is located in a thick beech forest. The object was formed on a slightly inclined slope inside an isolated limestone ridge that had sunken into the earthen sediment of the foothill. These southern slopes of the hill Bučina might represent one of the highest river terraces on Mt. Rtanj. Except for dispersed rocks there are no other visible limestone formations near the object, and the entire landscape is covered with forest black soil on which a dense forest has grown.

Nowadays Kosinja padina resembles a straight canyon with a dead end since the ceiling of the former cave is completely collapsed. The only preserved parts are the walls 6 to 11 m high slightly inclined towards the central line of the object. In the entrance part, the walls are slightly lower (6 m) and gradually rising towards the interior reaching their maximal height at the end of the object (11 m). All the walls are coarse and uneven which is the result of frequent collapses. Some larger stones were found in the former entrance of the object and these stones were used as an enclosure for cattle.

The base of the object is even and of straight lines with a spacious plateau stretching in front of it.

The surface sediment in the object's base consists of forest black soil with protruding large limestone blocks. The sediment is probably rather deep bearing in mind the fact that large beech trees have grown out of the base. Next to the object's wall, not far from the entrance, there is a low cave canal on the same level with the collapsed cave and cave clay can be found inside this canal.

The cave does not appear suitable for a more permanent inhabitation bearing in mind the fact that it is located at a higher altitude and that there are no permanent water bodies in its vicinity. The nearest water body is Pakleška River which is almost two kilometers away from Kosinja padina. However, the cave is situated in a region known to be one of the best hunting grounds on Rtanj and this is due to a wide variety of field plants, some of which are used in human nutrition and medicine (Posa canina, Vaccinium myrtillus, Satureja montana etc.).

KRUŠJANSKA CAVE

Type of find	Collapsed cave	Orientation of entrance	S
Guide	Zoran Stojadinović Vrmdža	Entrance width	6.4
Speleological mark	/	Entrance height	?
Altitude	609	Max. width	13
Coordinates	N 43°43,138´ E 021°50,402´	Max. length	14

Krušjanska cave is located 1.5 km northeast of the village Vrmdža on top of a river terrace that is cut through by the valley of the river Keštica. The cave has a circular base and a larger portion of its ceiling is collapsed. The only preserved element of the cave is a smaller rockshelter located in its northern part inside a wall opposite to the entrance. The arch of the rockshelter stretches at a length of 4-5 m and somewhere in the middle it has a circular perforation (ø=1 m) with extremely smooth walls. The walls are 3-6 m high and mostly smooth and even. The surface sediment consists of dark brown sandy sediment that is the same as on the surface around the object. The entire base of the former cave is covered with thick thorns which make it difficult to move inside its interior. Otherwise, the object was once used as part of a military training ground thus the base of the cave was adjusted to suit the needs of artillery units.

RUJIŠKA ŽLEBINA

Type of find	Collapsed cave	Orientation of entrance	SW
Guide	/	Entrance width	6
Speleological mark	/	Entrance height	?
Altitude	664	Max. width	6
Coordinates	N 43°42,379´ E 021°58,959´	Max. length	300

The root word 'žleb' (groove) in Serbian has created three geographical terms: žlebnik, žlebina and žlebura, the last two of them being synonyms (Цвијић, 1895: 43). Žlebnik is a deep slope cut into a mountainside from the range or ridge down to the foothill and these are filled with flowing water only during heavy rains. Žlebina or žlebura are similar to valleys but their bottom is uneven, there are no continuous inclinations and they have almost no running water (Цвијић, 1895: 43). They give the impression of furrowed, deformed valleys or dry caves without ceilings.

One of such žlebina mentioned in cave morphology is located on the plateau called Mali Obli del in the vicinity of the village Rujište. This plateau has a deep cut ditch intersected by three ditches and thus divided into four parts. On the locations of the ditches there are steep sections around which lie scattered big limestone blocks. Its sides are mostly completely vertical 10 to 15 m high, and the width between them, measured at the bottom, is between 5 and 10 m. Along the walls of the žlebina there are a few smaller and shallow rockshelters. Cvijić mentioned a cave which was not very passable because of collapsed rocks. The canals comprising the žlebina are mostly straight, except the one beneath Skokovo, which makes a circle around the limestone island. Water never flows through these canals, not even during heavy rains. Based on the configuration f the žlebina and the shapes of its walls, Cvijić concluded that there has never been running water there. According to the described features of the žlebina, he considers that this was a dry cave which lost its ceiling due to denudation and was transformed into this interesting shape which he has met there for the first time (Цвијић, 1895: 44).

Rujiška žlebina plan (according to drawing: Cvijić, 1895) 1:2000

THE REGISTRY OF LOCALITIES – OPEN-AIR SOURCES OF RAW MATERIALS

KREMENAC – ČITLUK

The locality Kremenac is located on the hill with the same name (Kremenac 503 m) in the vicinity of the village Čitluk, 700-800 m west of the Coal Mine „Soko“. This is the first hill visible from the north-east after the turn to the village Sesalac from the main road Sokobanja-Knjaževac. This is actually a high river terrace and rivers intersect three of its sides. From the west it is intersected by Sesalačka river, from the south by the Izgare River, whereas the eastern terrace is intersected by Čitlučka river. The entire hill is nowadays covered with arable agricultural land and somewhere at the foothill there is a cell phone repeater. The soil covering this river terrace and used for growing different agricultural crops is eroded vertisol (Nikodijević, 1970b). The entire hill Kremenac encompasses the surface of 1 km². This locality was visited several times during 2012-2014. In 2014 it was visited by Eric Heffter, a PhD student from the University of Tucson who is an expert for open air Paleolithic localities (Heffter, 2014: 52).

Almost the entire surface of the hill contains large quantities of flint material and also significant quantities of quartz. The flint stone is present in various colors such as white, grey and reddish but the most dominant color is the color of honey or a shade ranging from dark grey to black. Archeologically speaking, the most interesting of all sides is the south-western side where flint artifacts with chipping traces were found. The surface in which these artifacts were found stretches over a few hectares. Concerning other findings there were recorded only a few fragments of modern age vessels.

The view of south slopes of Kremenac hill near the village of Čitluk

KREMENAC – VRELO – GORNJI KRUPAC

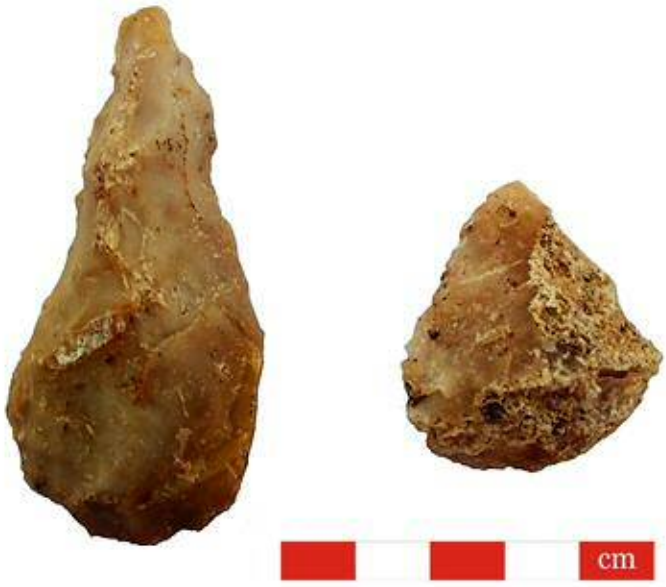
The locality is situated within the vast hill of the same name that is part of the mountain region – Golak. The hill is divided between the vicinities of two villages; Vrelo and Gornji Krupac. A significant part of the hill consists of arable land which in some places is intersected by smaller forests. The pedological cover is comprised of vertisol (Nikodijević, 1970). According to the information provided by Gojko Milovanović, a local inhabitant and author of the monograph „Vrelo“ in the western part of the vicinity of the village Vrelo towards Gornji Krupac there has allegedly been registered a find of flint raw material with artifacts dating from the Middle Paleolithic (Миловановић, 2005: 35). There are few mentions of the data that in 1934 the then Museum Society from Niš organized a survey on the property of the Stojanović brothers located on the western hillsides of Kremenac, and that multiple objects made of flint were found (Костић, 1969: 454; Гарашанин, Гарашанин, 1951: 45–48; Спирић, 1995: 29; Миловановић, 2005: 35).

These data need to be verified bearing in mind that during the survey in 2013, besides quartz, very little flint material has been observed and thus this does not seem to be an actual deposit. However, during this survey the eastern part of the hill was avoided to a larger extent. The following year this locality was visited a few times together with Eric Heffter (Heffter, 2014: 52), but due to the dense vegetation and large surface of the hill was not possible to obtain any concrete results. However, a few pieces of flint raw material were found, as well as one „artifact“ with possible traces of the Levallois technique.

The view of eastern slopes of Kremenac hill near the village of Vrelo

It is possible that the mentioned data on the flint finds from this locality have been mixed up with the surveys of the Museum Society of Niš from 1933 concerning the record about the visit to the locality Kremenac in Rujnik (Archive of the National

Museum in Niš; from Jocić, 2004; 38)[1]. Unfortunately, Gojko Milovanović, the only author mentioning Mousterian artifacts has passed away a few years ago and therefore the source of his information shall remain a mystery. The only thing that gives hope concerning a certain accuracy of the data is the large quantity of flint artifacts that can be found on the surface of the nearby Neolithic locality Panađur near Velepoljska river. The large presence of lithic material in Velepolje, most made from the same or similar raw material indicates that in the nearby vicinity there must have been a deposit of flint raw material.



Lithic artefacts from the neolithic site of Panađur near the village of Velepolje

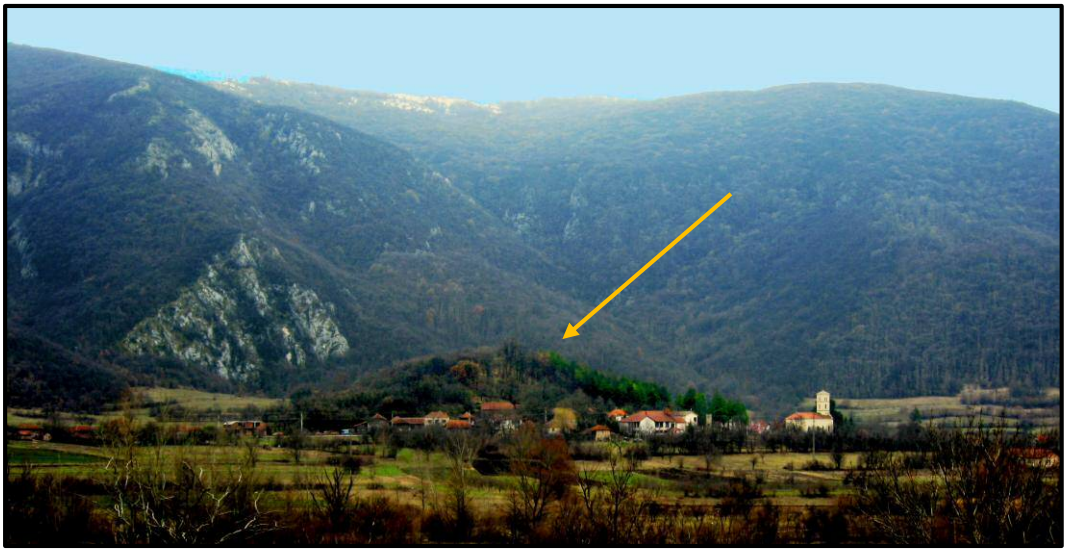
VRELSKA ČUKA

Vrelska čuka is a smaller hill of a conical shape that stands completely alone in the landscape of an alluvial plain. More specific, the hill is located directly near the Moravica spring – Istoci in the hamlet of Vrelo near Čitluk, 200 meters north of the village church. The hill was formed on limestone of Neogenic age (Крстић и др., 1974) on top of which fine vertisol was deposited (Nikodijević, 1970). The hill is covered with sparse forests of hornbeam and firs that are intersected by smaller meadows on multiple locations. The top of the hill provides an excellent view of the Moravica alluvial plain as well as of a larger eastern portion of the basin.

On the entire hill and surrounding fields below it present are lots of fragmented ceramic objects and flint artifacts. The western part of the hill has the largest concentration of material. Besides fragments of antique ceramics also found were fragments of pottery made without the pottery wheel. Their texture is mostly rough and among them there are also pieces with shallow channeling and barbitone decorations

[1] The Museum in Niš sustained heavy damage during the bombing by the Allies in April 1944, thus the archive of information from pre-war researches is incomplete.

thus these finds could be dated to the late Vinca phase and early Bubanj phase[1]. The flint material consists of small knives, arrowheads, cores and chips and a smaller knife made of quartz was also found. The locality itself is located opposite the Čitlučka cave and is only half a kilometer away from the flint raw material deposit in Kremenac near Čitluk. Considering the fact that this is obviously multi-layered archeological deposit with a very favorable strategic position near a cave, river and a flint material deposit it is to be expected that this could have been a temporary habitat during the Paleolithic.



North view of Vrelska Čuka hill

LIPOV TRAP – ČITLUK

The locality Lipov trap is also the name of a hill (594 m) above Suvi potok near the hamlet Klenje in the village Čitluk. The largest part of the hill is covered by fields, orchards and vineyards and the soil substrate is made of vertisol (Nikodijević, 1970). During the survey conducted in 2014 a deposit of flint raw material was found in this locality. In view of this, the spread of the flint raw material is mostly concentrated in the northwestern part of the hill while the most intensive concentration was recorded in the field owned by Milutinović Miodrag from Milušinac (the surface of almost one hectare). The discovered flint raw material is exclusively ranging in colors of honey to a light grey shade. Due to the size of the agricultural crops it was not possible to perform a more detailed prospecting and except for the flint raw material no finds of chipped artifacts were made.

[1] *Dragan Milanović*, Archeological Institute Belgrade, personal communication on his interpretation.

Tabular review of speleological objects in the Sokobanja region

Pit	Entr. width	Depth	Orient.	Altitude	Surround. landscape
Orlovačka	1	5.5	15	757	Hilltop
Oštra Čuka	1.3	2.7	9.5	964	High slopes
Rupa Prozorka	1.4	7.7	21	1123	Hilltop
Veliki ledenik	8	22.5	51	1123	Hilltop
Rtanjska led.	15	45	63	924	High hillside
Porica	8	10	66	672	Hillside

Rockshelter	Entr. width	Length	Orient.	Altitude	Surr. landscape
Mečja	11	4.1	SW	530	Hillside
Tatumirova	15.2	4	NE	519	Canyon
Gradašnjička	28.5	6.5	E	460	Canyon
Poljanski kamen	17.8	5	E	558	Canyon
Golemopadinska	11.5	5	E	422	Canyon
Hajduk Veljkova	14.5	4	NW	321	Canyon
Sokogradska	72	8	NW	381	Canyon
Crkvište	11	9.5	W	520	Canyon
Vrelska	6.2	6.5	N	539	Hillside
Ravan	28	8.5	NE	857	High hillside

Cave	Entr. width	Length	Orient.	Altitude	Surr. landscape
Ozrenska	3.2	420	W	538	Basin
Crvena rupa	?	35	SE	908	Hillside
Mečja rupa	10.1	10,2	SW	624	Top of hillside
Ledenik	8	19,4	SW	1124	Top of hillside
Jelenska	12	16,5	NE	1159	Top of hillside
Čitlučka	1.6	107	N	410	Basin
P. strelište	3.8	14.8	N	337	Canyon
Golemopadinska 1	12.8	12	W	469	Canyon
Golemopadinska 2	3.2	10	W	592	Canyon
Lepterijska	11	19.1	N	419	Canyon
Markova	14	20.5	NW	441	Canyon
Popovička	15.6	26.7	E	359	Canyon
Vlaška	3.4	19.8	E	800	Hillside
Jezerska	4.5	8.5	NW	910	Hillside
Vlasina pećina	0.5	10.9	NW	857	Hillside
Radenkovski kamen	5.5	8.6	SE	629	Canyon
Goveđa peštara	3.9	10.3	N	580	Canyon
Bukovička	4.5	24	W	531	Canyon
Sesalačka	20	516	SE	586	Canyon
Milušinačka 1	4.1	71	SW	707	Canyon
Milušinačka 2	5.4	97	S	711	Canyon
Peć u Strunjaku	9.2	34.4	SW	480	Canyon
Pećurski kamen	12.5	64.1	NW	559	Canyon
Rujiška	1.4	280	SW	548	Canyon
Tamnica	1.6	52	SW	980	High hillside
Dugopoljska	8.1	19.5	SW	597	Canyon
Novakovci	9.6	10.7	SW	670	River terrace

Collapse caves	Entr. width	Length	Orient.	Altitude	Surr. landscape
Kosinja padina	5.3	17.1	SE	832	River terrace
Krušjanska	6.4	14	S	609	River terrace
Rujiška žleb.	6	300	SW	664	Hillside
Stožer kamen	8	45	E	841	Slope

Charts with basic characteristics of speleological objects in Sokobanja

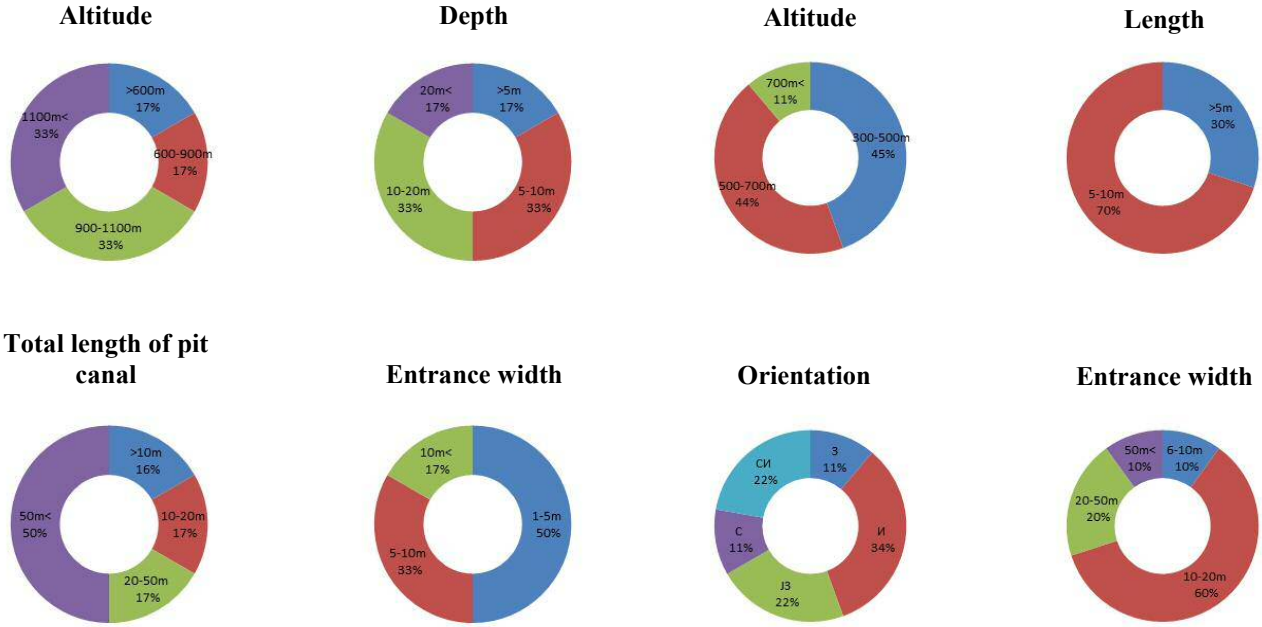


Chart 1. PITS, *Percentages overview according to given parameters*

Chart 2. ROCKSHELTERS, *Percentages overview according to given parameters*

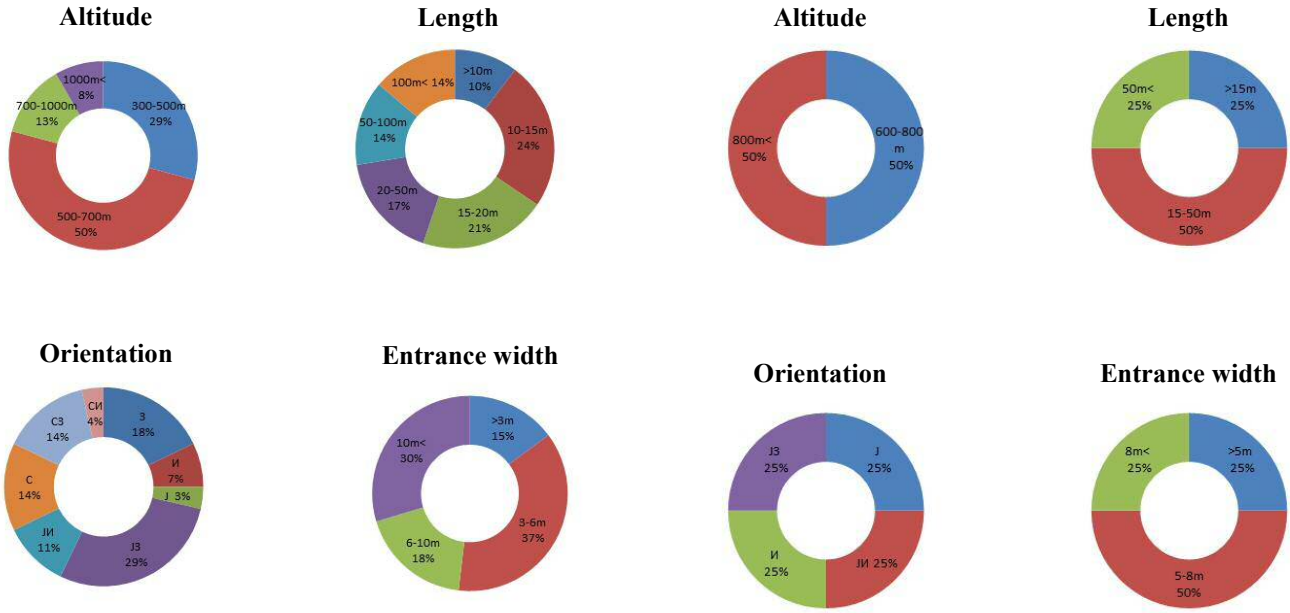


Chart 3. CAVES, *Percentages overview according to given parameters*

Chart 4. COLLAPSED CAVES, *Percentages overview according to given parameters*

NATURAL AND GEOGRAPHIC FEATURES OF CAVE SITES IN THE REGION OF THE WARM-TEMPERATE CLIMATIC BELT

The usual association at the mentioning of Paleolithic habitats is certainly caves but this does not imply that Paleolithic populations inhabited only caves and rockshelters. On the contrary it is considered that these primitive hunters have more frequently used open-air locations. One of the first housing structures in the open air created by man's ancestor appeared as early as 1.8 million years ago in Olduvai – this was a simple construction of a circular base with a floor covered with rocks (Leakey, 1971: 124–128). One example of a larger group of open-air sites is the area of northern Bosnia which is in the shape of a belt (approximately 100 km wide) covering the southern rim of the Pannonian basin. This is an area of high hills and mountains with more than 200 registered Paleolithic open-air localities (Панџић, 2014: 45–48). In Serbia the open-air sites were registered in the vicinity of Vršac (Mihailović, Srejović 1992), on Kremenac near Niš (Šarić, 2013), Samaila near Kraljevo (Михаиловић, Богосављевић-Петровић, 2010: 21–43) and the Petrovaradin fortress in Novi Sad (Михаиловић, 2009). However, the problem with the majority of Paleolithic open-air sites is their intensive exposure to the erosive effects of the soil which quite frequently cause disturbance of the stratigraphy while the enhanced acidity of the soil causes the destruction of organic material.

If we take a look at the archeological chart of South-Eastern Europe we shall notice that the highest concentration of Paleolithic sites is in caves. The reason for such a presence is, above all, due to the fact that the Quaternary deposits are „pickled" i.e. well preserved and usually undisturbed which is seldom the case with open-air deposits. The caves were mostly used as natural shelters by men and certain animals to protect them from atmospheric conditions, and some of them were even inhabited during a longer period of time. Due to the reasons mentioned above the cave layers often contain fossilized remains of humans, the animals they used to eat, remains of fire places, as well as various tools made of stone and bones in different sequences during the development of material cultures. Furthermore, traces of Paleolithic paintings, engravings and burial rituals were mostly discovered in caves.

Most of the presented caves from the Sokobanja basin have not been archeologically excavated. Thus it is difficult to presume which among them could have been used by our ancestors if we do not have a basic insight into the adaptive practices of Paleolithic communities. Now, by presenting the basic morphological and topographical characteristics of speleological objects we are going to review the most famous archeological deposits from the Paleolithic Era situated in the zone of similar natural and climatic conditions in relation to the Sokobanja region. The type and number of archeological finds usually provides us insight into the cultural industry and

size of the group that used that object, the period of settling, frequency of visitation and scope of activities performed on that site. The geographical review of sites in which the existence of Paleolithic and Mesolithic layers has already been established, as well as the presentation of cultural groups that stayed in the cave during longer or shorter periods, shall provide us additional information about the perspectives of Paleolithic hunters during their choosing and using of these speleological objects.

ARCHEOLOGICAL SITES IN SOUTHEAST EUROPE[1]

Archeological sites in Slovenia

Potočka Zijalka is located on the southern slope of the western summit of Olševa in the eastern Karavanka Mountains. The cave was named after one of its former owners, a certain man named Potočnik. The entrance into the 115 m long and 40-20 m long cave is located above the forest zone at an altitude of 1700 m. The inside of the cave contains a tufa tub that has a continuous water supply by dripping water all year long, which to a certain extent compensates for the lack of nearby sources of drinking water (Odar, 2012: 9–34). The cave is known for being an eponymous deposit of olchevian (high-altitude aurignacian) (Brodar, Osole, 1979: 150–152), and was also interpreted to have been a hunting station for hunting cave bears since many thousands of bones of this Pleistocene animal were discovered inside of it. The Ice Age hunters visited the cave only sporadically so as to hunt cave bears, which used this cave as their den (Осоле, 1976: 11).

Mokriška jama is located in the Kamnik Alps on the southern slope of Mokrica (1853 m), at an altitude of 1500 m and approximately 1000 meters above the Kamniška Bistrica riverbed. The cave canal is 45 m long, whereas its width stretches from 5 to 20 m. During excavations conducted in the periods of 1954-56 and 1960 (M. Brodar) finds belonging to the olchevian were discovered in two archeological layers and are similar to the ones from Potočka Zijalka (Brodar, 1955: 204–226).

Betalov spodmol is a simple cave located on the northern rim of the Pivka basin at the foothill of the mountain Polhovica (670 m) not far away from the estuary of the river Nanoščica into the Pivka. The cave canal is 174 m long and is located at an altitude of 537 m. The entrance is 4 m wide and 5 m high and oriented towards the south providing an excellent view of the plain of the Pivka basin. Inside the cave the cultural stratigraphy from the Würm I to the Würm III stages has been established, and the flint artifacts were dated to the Mousterian, Aurignacian, and industry of the final phases of the Upper Paleolithic (Anelli, 1933: 231–237; Osole, 1990: 7–41; Osole, 1991: 7–129; Toškan, 2014: 141–155).

[1] The speleological objects represented in the specimen are archeological sites in the moderately warm climatic belt of South-Eastern Europe with different morphological and topographic features reviewed through the archeological concept of cultural representation and timeframe.

Divje Babe is the name of two smaller caves (Divje Babe I and II) on the most south-eastern slopes of the Alps. This complex is situated at an altitude of 450 m on the northern side along the vertical limestone ridge of Šerbeljski plateau (altitude of 600-700 m). The cave Divje Babe I is of exceptional archeological importance. Its 7 m wide and 5 m high entrance has a northward orientation and from a vantage point 230 m higher it has a good view of the Idrijica valley. In this site the river Idrijica creates a larger widening of the valley at which the surrounding mountain creeks (Sevnica, Žibernik, Bukovska grana and Jesenica) leave their canyons and mound into the mentioned river. Therefore this area of high hills riddled with canyon and with the spacious valley most likely had an exceptional hunting potential. The site Divje Babe I is famous for the finding of the oldest wind music instrument made of a cave bear femur, also known under the name the „Neanderthal flute“ (Turk, 1997; Tuniz et al, 2012: 581–590). Mousterian and Aurignacian flint stone industry was found inside the cave and based on ESR dating it was established that the layers deposited starting from the early Würm glacial to the last maximal glacial (from MIS-5d to MIS-2) i.e. in the period between 116,000 and 25,000 B.C. (Turk, 2007, 2014).

Archeological sites in Croatia

The rockshelter in Krapina is located in the western part of the place called Krapina along the right bank of the creek Krapinica on the hill called Hušnjakovo. On the north-eastern side of the hill there is a somewhat large rockshelter which prior to its surveying was filled with a large layer of sediment. The object is situated 23 m above the current level of the creek at an absolute height of 120 m. The entire Hušjansko hill is built out of Miocene sand stone and conglomerates packed in thick layers with a slight inclination towards the south-east. It is likely that the creek Krapinica may have been on a higher elevation and thus closer to the Krapinska rockshelter. Due to a gradual narrowing of the erosive base, the creek cut its bed deeper and deeper occasionally flooding the rockshelter (Malez, 1970: 15–16). The site is famous for the finding of the largest number of anthropological remains of Neanderthals in the world. Findings of Mousterian industry (Malez, 1970) were found in all the layers except in the deepest one, while the age of the human skeletal remains was established by radiometric analysis to be some 130 000 years old (OIS5e) (Rink et al, 1995). The raw material is mainly of local origin and it can be found in the nearby creek Krapinica (Karavanić, Janković, 2008: 28; Zupanič, 1970: 131–140).

Velika cave or Mačkova cave is situated between Krapina and Vindija, near the village Goranac on Ravna gora. The cave entrance is at an altitude of 428 m, and prior to the excavation of the sediment it was 3 m high with a semi-circular arch 12 m long. This cave consists of two smaller halls with a total length of 25 m. Malez (1979) has determined the archeological industry to be Mousterian, which was later confirmed by repeated research (Karavanić, Smith, 1998: 223–248). All the tools are small in size,

like at the so-called Micro-Mousterian while a small number of finds along the layers indicates multiple short-term habitations in the cave (Karavanić, Janković, 2008: 28).

Cave Vindija is situated in the canyon Velika Sutinska near the village Donja Voća in the Croatian Zagorje region. Not far from the cave runs the small stream Šokot which somewhat downstream joins into the river Voća. The cave entrance which is at an altitude of 275 m is located on the south-western slope of Križnjakov vrh. The entrance is formed by Neogene limestones and facing the west. Before the archeological and paleontological survey the entrance was 3 to 3.5 m high and 15 to 18 m wide. The morphology of the cave cavity reveals a 52 m long and up to 25 m wide, elongated oval room with an arched ceiling. Along with numerous finds of fauna (dominated by the cave bear), finds from Vindija also include many handcrafted items from the Middle (Mousterian) and Upper Paleolithic (Aurignacian, Epigravettian and perhaps Olchevian) (Karavanić, Janković, 2008: 33–34; Karavanić, 1993: 57–58). The Vindian Neanderthals were dated to an age of 33,000-32,000 and for now represent the youngest finds of Neanderthals in Middle and Eastern Europe (Higham et al, 2006: 553–557).

Veternica is a large cave located on the south-western slope of Medvednica, near the western outskirts of the city of Zagreb. The cave entrance is at an altitude of 320 m of absolute height and is approximately 8 m wide and 4 m high whereas the entrance hall stretches 15 m in length and approximately 7 m in width. The entire cave is 7128 m long. It consists of main canals (2622 m) and a complicated maze of horizontal halls, corridors and canals. In the ending portion of the cave runs a stream which sinks on Ponikve. A total of 15 water bodies were registered flowing in the cave canals. Excavations in Veternica were initiated by M. Malez in 1951, and they lasted with interruptions until 1971 (Malez, 1979a). Malez has ascribed the lithic finds from the lower Pleistocene layer (MIS5c-5a) to the primitive Mousterian, whereas in the younger layers he recognized the typical Mousterian (Karavanić, Janković, 2008: 35). The primitive aspect on the material is most likely due to the types of raw materials used (volcanic tufa, basalt, quartzite) that was probably collected on the river terraces and other sources of raw materials in the cave's vicinity (Miracle, Brajković: 1992: 1–14).

Mujina cave is located north of Kaštela at an approximate altitude of 260 m not far away from the road heading to Labinština. Interior of the cave is completely illuminated. It is some 20 meters long and 8 m wide, and has a hidden right niche and a small plateau which makes it suitable for leaving. The cave plateau provides an excellent view of Kaštelanski bay and the surrounding territory that can be successfully controlled. The type of tools found indicates a Mousterian industry, whereas some finds of specific chips and cores show an application of the Levallois technique (Rink et al, 2002: 943–953). Locally found raw materials (hornstone) was used for the making of tools and this material could mostly be found in close proximity to the cave, although

a number of finds indicate that they may have been brought from more distant places (Karavanić, 2003).

Šandalja is an archeological site east of Pula, and includes cracks in Cretaceous limestone, so called fossil caves filled with sediments and located on the eastern slope of the hill Sveti Danijel. During the blasting for a new stone quarry (1961) the cave called Šandalja I was opened, and in 1962 Šandalja II was opened. The basal part of Šandalja I consists of Low Pleistocene bone breccia and represents a separate unit in chronological and paleontological sense, whereas the caves Šandalja I and II most likely belonged to the same subterranean complex (Malez, 1979 a: 221–227). The stratum "f" of Šandalja I that was dated based on the fauna remains to the Middle and Upper Villafranchian revealed an upper incisor from a homo erectus and a chopper that is considered one of the earliest proof of the material culture of the early Hominids in Europe (approximate age between 950 000 and 900 000 years) (Malez, 1979 b: 83–102). More than 15 thousand lithic finds from the Upper Paleolithic (Aurignacian, Gravettian, Epigravettian) and human remains from the Late Epigravettian were found in the Upper Paleolithic locality of Šandalja II (Karavanić, Janković, 2008: 40–41).

Archeological sites in Bosnia and Herzegovina

Badanj is a Paleolithic site situated in the rockshelter near the village of Borojević some 6 km westwards of Stolac. The rockshelter is located inside a rock, 45 m above the water level of the river Bregava. In this part, the Bregava canyon is 18 km long and approximately 100 m deep (Basler, 1974: 5–18) The rockshelter contains an Epigravettian flint industry represented by two phases one of them being older and this was carbon dated to 13 200 and 12 300 B.C.. A big stone block with a schematically engraved picture of a horse (?) was discovered on the surface of the find inside the central portion of the rockshelter (Whallon, 2007: 22–24).

Cave Rastuša is a natural monument and at the same time it is the only cave site in northern Bosnia located 12 km north-west from Teslić and Banja Vrućica, at an altitude of 370 m. It consists of a spacious canal and a few smaller subsidiary canals of a total length of 440 m. Generally speaking, the Rastuša cave is a branched, almost completely even cave with attractive cave decorations: draperies, cave hieroglyphics, stalactites and sinter pools (Malez et al, 1974: 80–82). The repeated archeological surveys in the period 2010-2013 have, according to the type and manner of processing, confirmed the Mousterian and Aurignacian industry, while the dating analysis of the site have shown that this cave used to be inhabited by men even 40,000 years ago (Панџић, 2014: 72–80).

Archeological sites in Serbia

Hadži-Prodanova cave is a natural monument located in the valley of Raščićka reka near Ivanjica. The cave entrance is at an altitude of 630 m, some 25 meters above the bottom of the valley. The cave has a narrow but high entrance facing the south,

which connects into a more than 40 m long corridor that is followed by two larger halls. Protective excavations have started in 2003 and were conducted at the very beginning of the cave corridor, as well as on the plateau in front of the cave (Михаиловић, Михаиловић, 2006: 13). The older layers revealed artifacts made of quartzite that definitively indicate a Mid-Paleolithic character of the collection, whereas in the younger layer multiple findings of an Upper-Paleolithic type were made, most likely from the Gravettian or Epigravettian industry (Михаиловић, Михаиловић, 2006: 15).

Šalitrena cave, also known in scientific literature as the Big Ribička cave is located in the canyon of the river Ribnica in the village Brežđe, some 6 km away from Mionica. The object is located at an altitude of 227 m i.e. at a relative altitude of 12 m. The cave has two almost identical entrance canals which deeper inside the cave join to create a unique large room whereby the total length of the cave is 135 m (Ђуровић, 1998: 270–271). The cave entrance is facing the northwest. This extremely dry and not too deep cave owes its name to large deposits of guano. Guano is a natural raw material (saltpeter, sodium-nitrate) and as reported by Ljuba Pavlović the Serb rebels of the beginning of the 19th century have actively exploited these deposits for the purpose of producing gunpowder. The AMS analysis of the bone material delivered dates that confirm that the archeological finds from layers 3 and 4 undoubtedly belong to the Gravettian, and the finds from layer 5 to the Aurignacian. The Gravettian layer was dated to 24,000-25,000 years B.C., and the Aurignacian layer to 31,000 years B.C.. The finds from the Mid-Paleolithic layer 6 were dated to an age of 38,000 years B.C. (Михаиловић, 2013: 7–13).

Smolućka cave is located some 15 meters above the small river with the same name, at an altitude of 945 m near the village of Crkvine along the road Novi Pazar-Tutin. The cave entrance is facing north and has the dimensions of approximately 4.0 m x 4.5 m. The entrance leads to the first hall which is at a slightly lower level than the second one and they are separated by a 1 m high stone cascade. The total length of the cave is 25 m. In front of the entrance there is a small platform from which a path leads to the bottom of the canyon formed by the Smolućka River. According to its geographic position Smolućka cave is so far the most southern point with Mousterian finds in the territory of Serbia (Калуђеровић, 1986: 225–226). The finds taken from the stratified layers of Smolućka cave and their undoubted dating to the period of the Middle Paleolithic (38,000 years) give this locality a special place among the Mousterian sites in the territory of Serbia (Šarić, 2002: 9–27).

Risovača is a cave in the vicinity of Aranđelovac in mid-Šumadija. The cave is situated on the north-western side of the hill Risovača at an altitude of 230 m and 16 m above the Kubišnica riverbed. The stone quarry that has been opened in the vicinity of the cave caused partial damage to the entrance of the object so that the present width is now 8 m whereas the length of the cave canals is 187 m. Warm mineral water of a calcium-magnetite type used to sprout from within the cave. Following the disturbances

caused to the mentioned water flow the water type of the mineral water has changed to a sodium-hydro-carbonate type. After the cessation of this type of water flow the cave was penetrated by superficial waters, which have deposited sediments (Ђуровић, 1998: 266–267). Remains of Middle and Upper Paleolithic industry were found inside the cave Гавела, 1988).

Balanica cave complex consists of two caves, Velika and Mala Balanica located next to each other. The complex is located 15 km east of Niš, on the eastern rim of the Niš basin. Its more precise location is on the hill Brljavski kamen on the southern slopes of the Svrljig Mountains. The caves were formed of limestone from the Jurassic and Cretaceous in the zone where young mountain ranges collide with the Rhodope masses. Balanica is located a few hundred meters above the right riverbank of the Nišava River, at an altitude of 338 m, at the very exit of the Sićevačka gorge. Both caves are relatively spacious and are facing south. Systematic researches of the cave complex are still ongoing and are being conducted continuously since 2004 under the management of Dušan Mihailović (Mihailović, 2014a: 107–121).

Velika Balanica consists of two parts: the frontal part looks like a rockshelter with the dimensions 8 x 7 m, whereas the rear part is almost 40 m deep and approximately 15 m wide. The industry found in the upper layers of Velika Balanica (2a–2c) probably belongs to the typical Mousterian, whereas the industry from the lower layers (3a–3c) could be dated to the Charentian. The exceptional quantity and diversity of chipped artifact, as well as the high degree of finely crushed animal bones indicate that in certain phases the cave was most likely intensively inhabited and was used as a base camp (Михаиловић 2008: 6-8, 13).

Mala Balanica is almost completely filled with sediment. On the surface level its dimensions used to be 25 x 8 m, and the entrance height was 1,20 m (Михаиловић 2008: 5-6). Unlike Velika Balanica, this cave most likely used to be a temporary habitat that was visited many times during a relatively short period. Taking into consideration the higher degree of preservation of the remains, the thickness of the geological layer and the small distance between both caves it is supposed that Mala Balanica had a special purpose that was in connection with the activities in Velika Balanica (Михаиловић 2008: 10). Mala Balanica is famous because of a find that consisted of a human mandible with very archaic features that cannot be related to the classic European Neanderthals. The first results concerning the age of the find were established by means of radiometric dating whereby the minimal age of the mandible was established to be before 113 + 72 - 43 kya (Roksandić et al, 2011: 186–196), whereas the latest dating results obtained by means of analyzing the electronic spin resonance (ESR) in combination with the analysis of a sequence of Uranium isotopes have moved the aged limit to before 397–525 thousand years according to which the mandible was classified into the group of oldest hominin finds in Europe (Sima de los Huesos, Mauer, Arago, Ceprano and Visogliano) (Rink et al, 2013: 1–7).

Pešturina is located north-west of the village Jelašnica, at the foothill of a mound that belongs to the northern slopes of the mountain Suva Planina. The cave is located at an altitude of 330 m above the riverbed of a seasonal creek that has cut a small gorge. The cave entrance is facing west, 15 m wide, 3,5 m high, and the cave is 22 m long (Михаиловић, Милошевић, 2012: 90). The surface layer of the cave revealed object from the early prehistory, layer number 2 revealed artifacts from the Upper Paleolithic, and layers 3 and 4 contain finds from the Middle Paleolithic (Михаиловић, Милошевић, 2012: 91). A large portion of the Mid-Paleolithic layer was dated by means of the ESR method to a period between MIS 5d and 5a, the lower portion of layer 3 was dated by means of OSL to the period MIS 4, and the method of ultra-filtration of layers 3 and 2 was used to date them to the period MIS 3, all of them belonging to the relatively warm climatic phase during which southern Serbia did not have a lot of snowfall (Blackwell et al, 2014: 28; Mihailović, 2014b: 49–50). According to C14 dates, there is evidence for human occupations at least between 16,300- 16,100 calBP, between 33,100- 29,700 calBP, and between 44,600- 43,500 calBP. Considering these dates in conjuncture with the lithics at Pešturina it is most likely that around 30 kcalBP Pešturina was occupied by modern humans producing Gravettian or Early Epigravettian industries; around 45 kcalBP the cave was most likely used by late Middle Paleolithic Neanderthals (Alex, Boaretto, 2014).

Baranica is a cave on a hill with the same name located at the very exit of the Trgoviški Timok canyon, approximately 5 km south-east from Knjaževac. The hill Baranica has the morphology of a limestone peninsula because it is situated at a location where the Trgoviški Timok makes a sharp bend thus the hill is surrounded by the river from all sides but east. The cave is located at an altitude of 260 m on the right riverbank of the river Timok, some ten meters above the water level (Ђуровић, 1998: 268–269). It consists of an entrance part and three smaller interior rooms. The front part is spacious (dimensions 6.8x4.0 m), and has two entrances, one of which is facing south and the other facing east. The cave contains material from the early Upper Paleolithic (35,000) and the Late Glacial period (13,000) (Михаиловић и др., 1997: 38–39).

Mirilovska cave is located approximately 3 km upstream from Senje at an altitude of approximately 370 m and approximately 70 m above the riverbed. The cave entrance is 6 m wide and 3 m high, facing west. The cave has the shape of a sub-horizontal canal with a total length of 70 m, which some 20 m from the entrance turns in a south-eastern direction and at its end makes a fork into two smaller channels (Ђуричић, 1996: 173–177). The Epigravettian features of the artifacts and the find of the species Lepus timidus in the same layer are climatic and chronological indicative markers for a period of maximal freeze by the end of the last Glacial (Димитријевић, Јовановић, 2002: 122).

Archeological sites in Romania

Peştera cu Oase in its literal translation from Romanian means „Cave with bones". It is located in the south-western Carpathians near the city of Anin in Banat, some 30 km east of the Romanian-Serbian border. This is an area of robust terrains, complex geology with numerous rivers that have cut their riverbeds deep and steep. The cave belongs to the karst system of the creek Ponor which through Minis and Nera joins the Danube only 36 km to the south. Peştera cu Oase is actually a branchy cave system more than 1000 m long consisting of a few canals and 12 galleries formed on at least two levels. The creek Ponor runs through the lower level of the cave in the direction NW-SE for about 750 m, whereas the upper level (40 m higher) is exposed to the process of extensive collapse whereby the accumulation of sediment has interrupted the contact with the creek level. The collapsing process has also closed three former cave entrances that used to be on the upper level thus nowadays the cave is accessible only through the water siphon of the Ponor creek (Milota et al, 2014: 5–15). The upper cave level has revealed the oldest anthropological remains of modern people the approximate age of which is estimated to be between 38,4 and 42,5 thousand years (Trinkaus et al, 2003: 245–253; Trinkaus, 2013: 229–233), while genetic researches have revealed that the DNA material contains from 6% to 9% of autosome Neanderthal chromosomes (Fu et al, 2015: 216–219). Based on the research done so far it can be concluded that the cave was not used for human habitation and it is still unknown how anthropological remains managed to find their way into the cave. Thanks to its features the cave represents one of the best-preserved deposit of cave bear remains in Europe and some of these bone deposits arranged on the rocks indicate that humans have arranged them there (Quilès et al, 2006: 927–934). Although there is a lack of direct archeological context concerning the cultural industry of these early people and bearing in mind the dating of the remains, the most acceptable classification places them in the Protoaurignacian lithic complex known from Selište I, an open-air site some 100 km away (Zilhao et al, 2007: 249–262).

Peştera Murierii or Female cave is located on the southern most slopes of the Transylvanian Alps (southern Carpathians) in Gorge County in Oltenia. The cave entrance is 8 m wide and 2.5 m high, facing north and located in front of a spacious plateau (approximate altitude 650 m) dominating above the small valley of Yellow river which enters its rocky canyon at just that location. The complex cave system hides a real labyrinth of canals and galleries scattered on four levels of a total length of 7000 m. During the 1950s the first three most spacious galleries were excavated (Gherorghiu et al, 1951: 73–86) (*Principala, Secundara, Musteriana*, that are interconnected in a circle) which have revealed Middle Paleolithic layers and female skulls dated (AMS, ^{14}C) to an age of approximately 30,000 years (Soficaru et al, 2006: 17196–17201).

Coliboaia is a cave through which runs a river and it is located in the canyon of the river Sigitel on the western rim of the Apuseni Mountains (altitude of 1849 m) in

the county of Bihor, Autonomous Region of Krišana. The Sigitel River joins some 5 km downstream the river Black Kereš from where it easily communicated with the Pannonia plain. The small cave entrance (4 m wide and 3 m high) is located at an altitude of 560 m, facing south, and in front of it stretches a large plateau with an E-W orientation. After the entrance the floor steeply descends to a large gallery from where a 750 m long main flow canal stretches which is joined by a few dead-end corridors. After more than 500 m the water canal mounds to a gallery with cave paintings that is located in a dead-end corridor on a level that is slightly higher than the level of the cave creek. The paintings were drawn with black charcoal showing: a bison, horses, a mammoth, bear heads and the head of a rhinoceros (Ghemis et al, 2011: 73–86). The cave has not revealed any Paleolithic artefacts but cave paintings have been directly dated with C14 method to the Aurignacian (between 27 870 ± 250 and 35 120/36 780BP) (Clottes et al., 2012: 525).

Archeological sites in Bulgaria

Kozarnika is a single-canal cave located 6 km north-west of the city of Belogradčik (area of Vidin), some 30 kilometers from the Bulgarian-Serbian border. It is located on the northern hillsides of the Balkan mountain at an altitude of 250 m, close to the lower Danube plain. The cave entrance faces the south and is located 85 m above the valley. With a length of 218 m, the Kozarnika cave belongs to the group of smaller caves in comparison with the other speleological objects in the karst region of Belogradčik (Beron et al, 2006: 340–341). In the layers that are between 1.4-1.6 million years old (dated according to the paleomagentism of the Earth's magnetic field and the fauna analysis) a human tooth was found as well as artifacts from the Early Acheulean industry which most likely belonged to *the Homo erectus* or *Homo ergaster* (Sirakov et al, 2010: 94–106). The finds form the Middle Palaeolithic layers belong to the Mousterian flint industry with high presence of Levallois cores dated to the period between 300,000-50,000 B.C. The Upper Paleolithic layers correspond to the earliest complexes of Gravettian industry dated to an age between 43,000-39,000 years (Guadelli et al, 2013: 155–157).

Temnata dupka is located in the canyon of the river Isker on its right riverbank in the vicinity of the village Karlukovo (Lovečka area). The cave is located in a limestone ridge near the estuary of the village creek, some 50 meters away from the cave Prohodna – a national natural monument. The cave consists of two large canals and a few lateral corridors with a total length of approximately 215 m. The inside of the cave contains a group of stalactites the position of which has the role of a dam thus the dripping water has created a small pond. The cave entrance is 55 m wide, 18 m long and is located at an altitude of approximately 220 m, while the cave is at a height of 100 m from the level of the Isker (Beron et al, 2006: 347–348). Temnata dupka is the first archeological site in Bulgaria (1924) in which the Aurignacian industry was discovered (Попов, 1931, 1936). Year-long researches have established that the cave

was used by Palaeolithic hunters that used the Mousterian, Aurignacian, Gravettian and Tardigravettian flint industry (Kozłowski et al, 1994b).

Bačo Kiro is a cave located on the northern hillsides of the Balkan mountain in the rocky canyon of Drjanovska river – Gabrovaska area in central Bulgaria. More precisely, Bačo Kiro is a cave system with a real maze of canals spreading over four levels with a total length of 3,600 m. It was formed in the Cretaceous limestone on a steep cliff at an altitude of 335 m. Behind a relatively small entrance (7x2 m) stretches a large gallery (30x80 m) rich in speleothem (Beron et al, 2006: 149–150). Following archeological researches (Попов, 1921: 46–55; Радевъ, 1926: 168–169; Popov, 1939: 85–126; Kozlowski, 1982) that have lasted many decades it was established that the cave Bačo Kiro contains 20 litho-stratigraphic units that have revealed lithic materials dating from the Middle to the Late Upper Palaeolithic, and that almost every layer also contained anthropological material (Ivanova, Sirakova, 1995: 12–24).

Arkata cave complex is located in the north-east Rhodope Mountains, on the cliffs above the right river bank of the river Marica near the village of Orešari in the Krdžalija area. The word Arkata in Bulgarian means literally „arch“, and the rockshelter mentioned here fully justifies its name because its arch is 360 m wide. Beneath the arch of this spacious rockshelter there are 8 smaller caves not longer than 30 m. The entire complex is located at an altitude of 440 m, faces the south and offers an exceptional view onto the spacious Marica river valley. During 2008 and 2009 Stefanka Ivanova led excavations in the three caves. The discovered lithic material from the Pleistocene layers indicates a Gravettian industry, while the finds of macro and micro fauna witness a warmer climatic period during the human occupation of this cave complex (Ivanova et al, 2012: 1–24).

Archeological sites in Montenegro

Mališina stijena is a rockshelter on the left riverbank in the difficult to access part of the Ćehotina canyon (village Ljutići near Pljevlja), at an altitude slightly less than 800 m and approximately 8 m above the river level. It is 35 m wide, 15 m deep and 10 m high, facing the north-east. Its lower layers, that were carbon dated to an age of 38 000 years contain a mixed Middle and Upper Paleolithic industry (Hedges et al, 1990: 211–237). The upper layers contain industry from the Gravettian or Epigravettian period, while the youngest layer was dated to an age of 13 800 years ago i.e. the Early Mesolithic.

Medena stijena is located approximately 1 km upstream the Ćehotina canyon from Mališina stijena and is easier to access than it. By type, this object is a rockshelter with its opening facing the south located 10 m above the river level, 30 m wide, 8 m deep and 10 m high. Artifacts made of chipped stone from the upper layers were dated

to the Epigravettian (Tardigravettian), and the artifacts from the upper layers were dated to the Late Mesolithic (Srejović, Marković, 1986: 37–38).

Trebački krš is a rockshelter situated in the vicinity of the village Trepča near Berane, at the left riverbank of the river Lim, in the area where the Trebačka River exits its small valley and joins the valley of the Lim. This is a shallow rockshelter facing southwards, 30 m wide, only 6.5 m deep, whereas the height of the object is not clearly defined. The lower layers are of Pleistocene age containing Epigravettian artifacts made of chipped stone, while the upper layers have deposited during the Holocene and contain material of younger prehistory (Đuričić, 1996: 75–102; Радовановић, 1986: 75).

Vruća pećina is a relatively small speleological object located in the village of Bioče, 12 km north of Podgorica on the left riverbank of Mala Rijeka, not far from Bulin most, at the very top of the hill that is named after it. The entrance is facing south, and is 11 m long, 4 m wide and 3.5 m high. In front of the entrance there is a plateau covering approximately 8 m2. The researched layers have revealed finds from the Mesolithic and Early Neolithic (Ђуричић, 1997: 195–199).

Bioče rockshelter is located on the spot where the Mala Riijeka River joins the river Morača, in a small basin. The rockshelter is situated on the rim of a valley, on the left side of the Morača River, some 30 m above its riverbed, on the foothill of a high limestone section. The rockshelter faces the south-west. The maximal length of the rockshelter is 9 m (from the drop-line), and it is 11 m wide. In front of it there is a spacious plateau (50 x 30 m), which also contains archeological layers and is covered with numerous surface deposits of stone artifacts (Đuričić, 2006: 179). The Bioče rockshelter is known for its large number of flint artifacts where approximately 200 stone finds were found over a surface of 1 m² excavated from a depth of 5 cm (Đuričić, 2006: 181). Dominant are artifacts of the Mousterian industry, but artifacts with traces of Upper Paleolithic chipping techniques can also be found. The main raw materials are river pebbles that are abundant in the Morača River. Besides hornstone, varieties of carbonate rocks and fine-grained sandstone were also used (Đuričić, 2006: 182–183).

Odmut is a shallow cave located at the estuary of the Vrbnica River into the Piva River, at the foothill of the limestone hill Kulina at the spot where the Piva leaves its narrow canyon and mounds into the valley that stretches along the Vrbnica River all the way to Plužine. The object is located at an altitude of 558 m, faces the south-east and its entrance is 20 m wide and 14 m high and about 11 m deep from where it narrows into a tight canal. Odmut is known because it belongs to the rare speleological objects that contain intensive traces of human settlement almost exclusively from the Holocene Era: Mesolithic, Upper and Lower Neolithic, turn from the Eneolithic into the Neolithic, Early and Late Eneolithic into Bronze Age (Srejović, 1974: 3–6; Kozlovski et al, 1994a).

Crvena stijena is located above the left riverbank of the Trebišnica River, today's Bilećko Lake, in the close vicinity of the village Petović, at the very border between Montenegro and Herzegovina. It was named after the steep cliffs towering above it that are covered with red patina that was most likely generated due to the dry patination of limestone. This is a large rockshelter located 50 m above the level of the river, at an altitude of approximately 700 m. With its opening facing south, the rockshelter is 24 m wide, 25 m high and its depth along the base is 15 m. In its Paleolithic layers we can observe elements of numerous industries: Pre-Mousterian, Proto-Mousterian, Tayacian, Pontinian, Micro-Mousterian, denticulated Mousterian, Late Mousterian, Gravettian, Tardigravettian and Final Epigravettian (Basler, 1975; Mihailović, 2009a: 19–20). All this indicates that Paleolithic hunters visited Crvena Stijena almost continuously starting from the isotopic phase 6 until the end of the Pleistocene, as well as later during the Mesolithic and Neolithic (Mihailović, 2014b: 57–64).

Archeological sites in Albania

Blazi is a cave in the area of Mati, northern Albania, facing the south-east. It is located above a river canyon at an altitude of 300 m and was formed in the eroded limestone the surface of which is covered with cracks of crushed rock and is therefore difficult to access. Its entrance height is 5 m, and 12 m wide stretching like a tunnel that slowly narrows and ends at the distance of 60 m. The layer in which the flint Gravettian/Epigravettian artifacts were found was carbon-dated to a period of 18 000 years ago (Richter et al, 2013: 65–82).

Konispol is a cave in the form of a tunnel with a lateral opening making its entrance, and with smaller vertical openings. The cave faces the west. The Saraqint limestone massif in which the cave is located belongs to Mt. Pindus that is located near the place named Konispol in the most southern part of Albania. The cave is 50 m long, 6 m deep, 6 m high and located at an altitude of 400 m. The cave is accessible and offers a view over the short valley of the Pavel River that stretches from the mountain to the coastal part of the Ionic Sea. The cave contains traces of habitats dating from the Mesolithic, Neolithic and Bronze Age (Korkuti, 2003:212–225).

Archeological sites in Greece

Asprochaliko is a shallow rockshelter in Epirus located in the narrow canyon of the Louros River, 20 m above its riverbed. The rockshelter is only 3-4 m deep and 20 m wide. The lower layers, which were dated by means of thermal luminescence to a period 100 000 ago (isotopic phase 5), contain traces of Mousterian Levallois technology, while the upper layers were carbon-dated to a period 39 000 years ago and contain Micro-Mousterian artifacts (Darlas, 2007: 346–366).

Theopetra is a cave located in Thessaly on the very western end of the Thessaly valley facing the famous geo-morphological formation of Meteora, 100 m above the valley on the limestone hill Kalambaka at an altitude of 280 m. The entrance width is 17, the height is 3 m, and the object further expands into a spacious hall with a surface of approximately 500 m^2. Research has revealed traces of life from the Middle and Upper Paleolithic, Mesolithic, Neolithic and the Metal Ages (Kyparissi-Apostolika, 2000). The lower layers contain Mousterian of the Quina type and Levallois Mousterian, whereas the upper layers contain Mousterian with a significant share of Upper-Palaeolithic types and were carbon dated to a period of 46 000 years ago based on which they belong to its upper limit, but may also be even older. Four human footprints of four different persons of child age represent a unique discovery from one of the horizons of the upper layers that is at par with all the speleological objects of South-Eastern Europe (Manolis et al, 2000: 81–94).

CAVE SITES IN SOUTHEASTERN EUROPE

1.Divje babe
2.Betalov spodmol
3.Mokriska jama
4.Potočka zijalka
5.Šandalja
6.Krapina
7.Veternica
8.Velika cave
9.Vindija
10.Mujina cave
11.Rastuša
12.Badanj
13.Šalitrina cave
14.Hadži-Prodanova cave
15.Smolućka cave
16.Risovača
17.Mirilovska cave
18.Pešturina
19.Velika i Mala Balanica
20.Baranica
21.Peštera ku Oaše
22.Kolibaja
23.Peštera Mujeri
24.Kozarnika
25.Temnata dupka
26.Bačo Kiro
27.Arkata
28.Crvena stijena
29.Odmut
30.Vruća cave
31.Bioče
32.Medena stijena
33.Mališina stijena
34.Trebački krš
35.Blazi
36.Konsipol
37.Asprohaliko
38.Teopetra

Tabular review of basic features of cave findings in the region of SE Europe

Cave name	Alt.	Height from river	Cave depth	Entr. width	Orient.	Surround. landscape	Industries	Literature
Potočka Zijalka	1700	/	115	20	S	Mountain above vegetation line	Olchevian, Aurignacian	*Brodar M. , Olse F. (1979)*
Mokriška pit	1500	1000	40	/	S	Mountain on vegetation line	Olchevian, Aurignacian	*Brodar M. , Olse F. (1979)*
Betalov spodmol	537		174	4	S	Valley	Mouster., Aurig. Epipalaeolithic.	*Osole, F., (1990)*
Divje babe I	450	230	70	7	N	Valley with 4 river joints	Mousterian, Aurignacian	*Turk, I.,(2007)*
Krapina	120	23	/	/	SE	Valley with low hillsides	Charentian, Mousterian	*Malez M., (1970); Karavanić I. (2007)*
Velika peć	428	/	25	12	W	Low hillsides	Micro-Mousterian	*Malez M., (1979); Karavanić I. (2007)*
Vindija	275	32	52	25	W	River gorge	Mouster., Aurig., Epigravettian	*Malez M., (1979); Karavanić I. (2007)*
Veternica	320	/	7128	15	SW	Hilltop above canyon	Mousterian	*Malez M., (1979); Karavanić I. (2007)*
Mujina cave	260	/	20	8	S	Low hillsides near sea	Mousterian, Levallois	*Karavanić I . (2008)*
Badanj	/	45	6	11	SW	River canyon	Epigravettian	*Basler Đ. (1974); Whallon, R.(2007)*
Rastuša	370	/	440	7	NE	Low hillsides	Mousterian	*Панџић И. (2014)*
Mala Balanica	338	100	25	4	S	River canyon	Charentien, Mousterian	*Михаиловић Д. (2008;2009)*
Velika Balanica	334	100	48	8	S	River canyon	Charentien, Mousterian	*Михаиловић Д. (2008;2009)*
Pešturina	330	30	22	15	W	Creek joint	Charentien, Mouster., Gravett.	*Михаиловић Д Милошевић С. (2012)*
Baranica	260	10	45	/	W	River canyon	Early Upper Paleolithic	*Михајловић Д. и др.(1997)*
Mirilovska cave	370	70	70	6	W	River canyon	Epigravettian	*Туричић Љ. (1996)*
Risovača	230	16	187	8	N	Low hillsides	Mouster., Early Upper Paleo.	*Гавела Б. (1988)*
Hadži Prodanova	630	25	420	2,5	NW	River canyon	Mousterian, Gravettian	*Михаиловић Д.; Михаиловић Б.,(2006)*
Šalitrena cave	227	12	135	18	NW	River canyon	Mousterian, Aurignacian, Gravettian	*Михаиловић Б.,(2013)*
Smolućka cave	945	15	25	4	N	River canyon	Mousterian	*Калуђеровић З. (1986). Михаиловић Д (1998)*
Kozarinka	250	85	210	12	S	Hillsides above plain	Early Acheulean Mouster. Kozarnikien Gravettian	*Sirakov, N. at al. (2010)*
Temnata Dupka	220	100	215	55	/	Canyon	Mouster, Aurig. Gravett. Tardigravettian	*Kozlowski, J.K.*, at al. (1994)
Bačo Kiro	335	40	3600	7	SE	River canyon	Mousterian, Bachokir., Aurig., Tardigrav.	*Ivanova S., Sirakova S., (1995)*
Arkata	440	/	/	360		Valley	Gravettian	Ivanova, S. at al. (2012)
Crvena stijena	700	50	15	24	S	High hillsides above valley	Tayacian, Mouster., Tardigravettian	*Mihailović D.,(2009);*
Mališina	800	8	15	35	NE	River canyon	Mousterian, Tardigravettian	*Радовановић И., (1986); Mihailović D.,(1999).*
Bioče	/	30	9	11	SW	Basin	Mousterian	*Радовановић И., (1986)*
Medena s.	/	10	8	30	S	River canyon	Epigravettian	*Срејовић, Д. at al, (1986)*
Trebački krš	800	/	30	6.5	S	River valley	Epigravettian	*Туричић, Љ. (1996)*
Vruća cave	400	/	11	4	S	Hillsides above smaller basin	Mesolithic	*Туричић, Љ. (1997)*
Odmut	558	/	11	20	SE	Valley	Mesolithic	*Srejović, D. (1974)*
Blazi	300	/	60	12	SE	Canyon	Epipalaeolithic	*Richter, J. at al. (2014)*
Konispol	400	/	50	6	/	Valley	Mesolithic	*Korkuti, M. (2003)*
Asprohaliko	/	20	4	20	/	Canyon	Mousterian, Upper Paleolithic	*Darlas, A. (2007)*
Teopetra	280	100	/	17	SE	Limestone ridge above valley	Mousterian	*Kyparissi-Apostolika, (2000)*
Peštera ku Oaše	700	0	1000	/	/	Subterranean flow, canyon	Early Upper Paleolithic	*Trinkaus, E. at al. (2013)*
Peštera Mujeri	650	/	7000	8	N	Basin-canyon	Mousterian, Upper Paleolithic	*Soficaru A. at al. (2006)*
Kolibaja	560	/	1000	4	S	Canyon, subterranean flow	Aurignacian, Gravettian	Ghemis, C. *at al. (2011)*

CONCLUSION

The archeological relevance of pits

From the archeological point of view, pits may be an exceptional depot of osteological remains since by their configuration they are natural and often hopeless traps for animals as well as for humans. In Serbia pits have barely been subject of archeological excavations, whereas in France and Spain such researches have delivered exceptional results.

The mountain range Atapuerca in Burgos – Spain consists of a karst system that includes a large number of sites in an area of only a few kilometers. One of such sites is the so-called „Bones pit" (Sima de los Huesos). The bottom of a small pit, hardly 25 m deep, a few hundred meters away from the entrance into the Great Cave in Atapuerca has during the past few years been witness to the discovery of numerous human remains (Arsuaga, 1997: 109–127). The remains consist of thousands of bones that belonged to the skeletons of approximately thirty different people. The remains were uranium-dated based on the content of uranium in the layers covering the remains, and calculations have shown that the human bones are close to 500,000 years old (Bischoff et al, 2003: 275–280).

This site is very important for documenting the anatomy of the Heidelberg man the osteological remains of whom have until lately consisted exclusively of skulls and mandibles, parts that are preserved best (Arsuaga et al, 1991: 191). However, except the anthropological remains themselves important is also the context in which they appear, as well as of the material found next to them. As concerns the Bone pit in Atapuerca, this context is fairly unusual. Besides human remains there are also remains of other animals, above all remains of cave bears, the quantity of the bones of which indicates at least 167 individuals of that species (García et al, 1997: 155–174). Although small in number, remains of other carnivores were also discovered among the remains of bears, and these include lions, ocelots, foxes, and some types of dogs and marten (Cuenca-Bescós et al, 1997: 175–190). However, there are no remains of herbivores, animals the humans used to eat most frequently. Their remains are among the most numerous in most of the sites, while concerning the lithic material the only find so far was a quartz handaxe (Carbonell et al, 1995: 826–830).

The features of a pit – tight, dark and without easy access – lead us to conclude that such objects were never used as living space, which is also confirmed by the context of finds that could have never been the standard inventory of a habitat but more likely to be remains that were for some reason dragged to the pit or thrown onto its bottom. The animal bones show neither traces of mutilation with stone tools nor any tooth marks from carnivores or vultures (Arsuaga et al, 1997: 119–121). The possibility that the heap was made by a bird of prey was discarded at the very beginning. The only

acceptable cause that could clarify the forming of this heap would be the consequence of some disaster or a funeral practice conducted by primitive human communities. The current stage of research is more in favor of human action, which implies that the remains of these 33 people were deliberately left at the bottom of the pit together with carnivore animals (Arsuaga et al, 1997: 124–125). However, this interpretation is being questioned because it leads us to the conclusion that the Heidelberg man has reached the level of a symbolically developed conscience while having left behind sparse evidence of his existence. Nevertheless, further research shall help the resolving of this dilemma but for now the situation is such that the quartz handaxe found in the Bone pit in Atapuerca is considered the oldest funeral tribute (Carbonell et al, 1995: 829–830).

The archeological importance of caves and rockshelters

One of the primary human needs was the need for the search of natural shelter as protection from bad weather, animals or other groups of people. In the Paleolithic, living space also included the use of various natural or artificial objects, ranging from caves, rockshelters to simple huts, tents and arched constructions made from mammoth bones. Caves are the most characteristic and, in an archeological sense the best-preserved Paleolithic habitats. The organization and choice of living space represent a unity of natural conditions and cultural development within which man secured his existence and continuity of life. In human history, the development of habitats demonstrates their variable role in the regional system of settlement which is evident also with the modern communities of hunter-gatherers. The natural factors that influenced the settlement and establishment of temporary or permanent settlements are manifested through the geo-morphologic features of the soil, the type of water bodies, the climate and vegetation. The human factor should certainly be added to this because it is this factor that caused changes in the environment since man has always changed himself along with his environment.

During the Paleolithic and Mesolithic, man had a high degree of mobility and thus managed to find his first habitats in natural shelters, rockshelters and caves. Caves are specific phenomena in space that man started using very early due to their availability, size, internal climatic conditions, sheltering from winds, safety reasons as well as the possibility and diversity of utilizing his environment. Concerning the time and mode of usage, caves may represent main and specialized settlements, as well as short-term or primary residences. Short-term residences were used as a place of stay during migrations, scouting of an area, observation and surveillance of the environment, as well as a sort of logistics camps. Caves were also places where rituals were performed and funerals held (Straus, 1990: 255-304). Due to their natural conditions caves are often only parts of entire complexes of natural shelters that were used more or less on a permanent or temporary basis.

Collapsed caves are former cave canals whose ceilings have completely or partially collapsed thus they resemble smaller, dead-ended gorges. The collapsing process may be influenced by subterranean as well as superficial erosive factors, and

also by seismic tremors. It often happens that only the entrance corridor of a cave collapses and thus the cave remains preserved from outer influences, which can in return influence the preservation of archeological remains. The Regourdou cave in the Dordogne is a nice example of extraordinary archeological site which was discovered due to the collapse of a cave canal. Actually, the cave entrance had collapsed in the far past, but due to the effects of erosive processes the cave ceiling collapsed in 1954 revealing a pit (cave hall) 23 m long, 11 m wide and 4 m deep where the skeleton of a Neanderthal in some sort of stone casket was discovered (Madelaine et al, 2008: 101–102).

An interesting phenomenon in many Paleolithic sites is the dominant presence of traces originating from the activities of carnivores and their remains. The shifting between carnivores and humans in cave sites is pretty common and it appears that there is a real distinction between the usage patterns of a locality during the Middle and Upper Paleolithic. A precise taphonomic study of the sites (Prolom II, Lazaretska cave) occupied by more than one vulture shows that the usage pattern of a site is considerable stable and continuous during a longer period of time i.e. from approximately 120 to 60 thousand years (Prolom II). The location features of these habitats had also a clear permanent importance for the people and other predators and vultures, and the continued studying of these sites should assist us in understanding some of the actions and decisions the people have made in the process of using and arranging of their living space (Burke, 2000: 282–283).

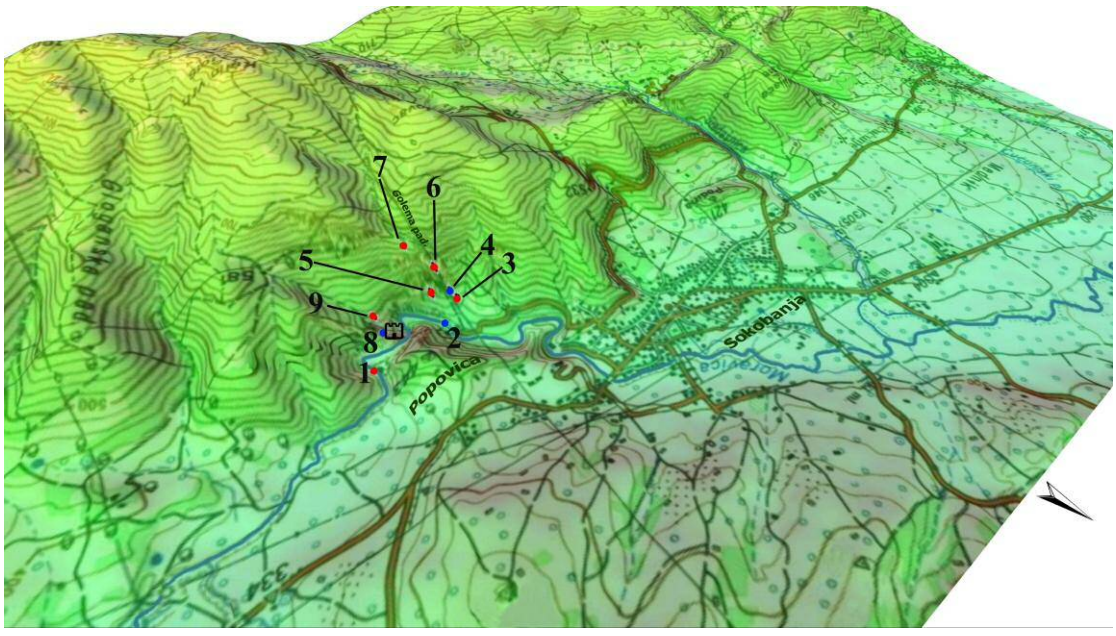
When we refer to the main features of settling during the Paleolithic, they pertain to the settling of caves and rockshelters as well as adequate open-air spaces. Cave sites and rockshelters have provided exceptionally reach information about long periods of human activity. Most of the caves and rockshelters are situated in well-hidden locations, quite often on a position providing a good view at the surrounding habitat, as well as access to rich natural resources and raw materials of good quality. During the Paleolithic, a number of habitats in caves and rockshelters served as some kind of base camp where various technological and economic activities were conducted, whereas the others served as transitional or logistics camps in which one part of the community used to reside only temporarily, in passing, or for the purpose of stocking up with food and raw materials.

The archeological potential of speleological objects in the Sokobanja region

It is noticeable that most of the caves mentioned in the table (sites in which the Paleolithic is confirmed) are located in valleys, gorges and river canyons. The constant hydrographic activity in such areas has caused the more frequent forming of speleological objects, especially caves and rockshelters. Gorges and canyons represent the refuge bases for numerous animal and plant species, especially during cold periods. Besides being areas with a constant supply of drinking water they also offer an exceptional strategic position favorable for hunting from an ambush or by chasing. These are the reasons due to which the Pleistocene people chose their habitats in these natural reservations. The Sokobanja region is a very karst area abounding in such relief

formations thus the highest concentrations of caves and rockshelters can be found in the rocky river-joints.

The Sokograd gorge was formed along the river Moravica, somewhat upstream from the famous thermo-mineral spring „Banjica“ in the eastern part of the Sokobanja settlement. Here the river has cut a deep gorge in the massive limestones, thrusting its way through them in the shape of a loop around the fortress Sokograd. The gorge is approximately 2 km long and stretches first in the direction north-east – south-west and then makes a meandering turn towards the north-west. Its loop created a large basin of moist and fresh air which is especially important during summer months when the temperatures are high and the long summer draught sets in, whereas during winter and bad climatic conditions this area is protected from the penetration of strong winds because it is hidden among steep cliffs. Furthermore, based on its geological, geo-morphological and mesoclimatical features, the Moravica gorge represents an interesting micro-unit, different from the other parts of Sokobanja. The best indicator of the specific mesoclimate is the complex vegetation of a relict character (e.g. Fago-Coryletum colurnae mixtum), which considerably differs from the other vegetation outside the gorge (Mišić, Dinić, 2000: 104–110).



Map 3. The Sokograd gorge and positions of potential Paleolithic sites
1. Popovička cave; 2. Lepterijske rockshelters and Hajduk Veljkova cave 3. Strelište cave; 4. Golemopadinska rockshelter; 5. Lepterijska cave; 6. Golemopadinska cave 1.; 7. Golemopadinska cave 2.; 8. Sokogradska rockshelter; 9. Markova cave

Map 4. Geological map, The Sokograd gorge and positions of potential Paleolithic sites
1. Popovička cave; 2. Lepterijske rockshelters and Hajduk Veljkova cave 3. Strelište cave; 4. Golemopadinska rockshelter; 5. Lepterijska cave; 6. Golemopadinska cave 1.; 7. Golemopadinska cave 2.; 8. Sokogradska rockshelter; 9. Markova cave

Karstic erosive processes are dominant in this gorge, thus it contains some 15 caves and rockshelters. Some of the speleological objects have no archeological potential whatsoever because they are completely washed out and contain no sediment (like Popovička cave), while others are in close proximity to the river and are therefore often exposed to floods and the influences of river erosion (Lepterijske rockshelters). Unlike them, there are objects such as the Sokogradska rockshelter and Markova cave in which the presence of Paleolithic artifacts was confirmed during archeological excavations conducted in 1996 and 2012.

Panorama of the Sokogradska gorge (photo by Siniša Stojanović)

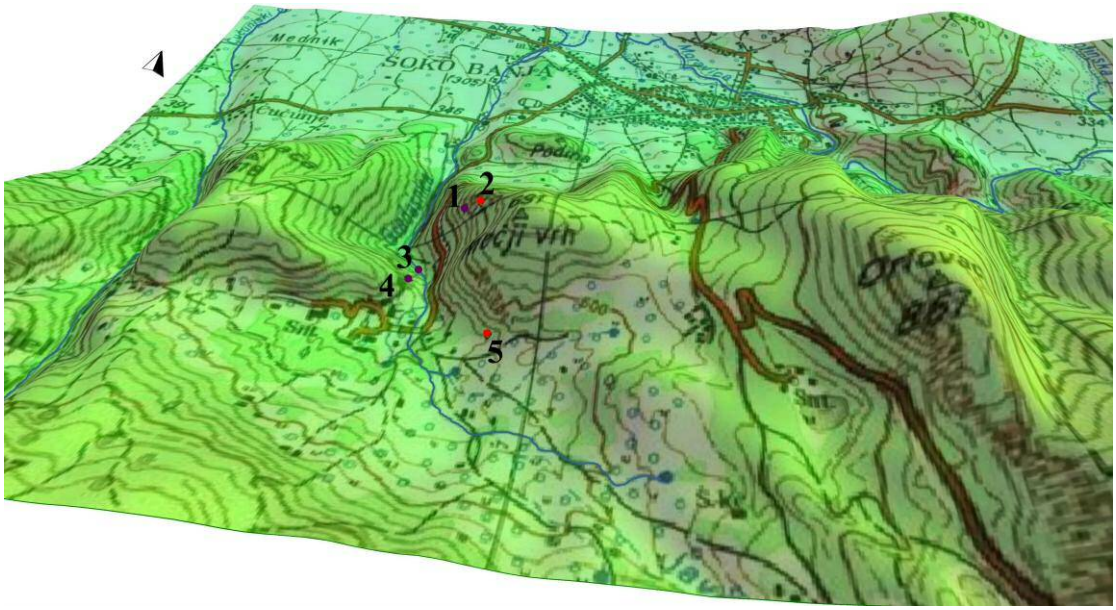
Of all the speleological objects that have not been archeologically surveyed, the greatest attention deserve Lepterijska cave and Golemopadinska cave I. According to their position, both caves meet the requirements for settling during the Paleolithic. They are located in the river gorge some hundred meters above its present-day river bed and provide an excellent view of the surrounding area. Their entrances are spacious and well illuminated, and their interior is comfortable enough to accommodate a smaller

group of hunters. Both caves are well covered with sediment and the illegal ditch in the Golemopadinska cave showed a reddish clay layer which could originate from the Pleistocene.

If we compare the Lepterijska and Golemopadinska cave I with already researched objects from the Sokograd gorge (Sokogradska and Markova caves), we will notice certain similarities. All these objects are located at an altitude between 380 and 480 m, and because they are all located at the left bank of the Moravica River their entrances are facing northwards, which could be an advantage bearing in mind that northern winds seldom blow in Sokobanja (Дакић, 1967: 10). All the caves have such a position that they could easily have been temporary hunting stations providing a good view of the surrounding area and easy and quick access to the river bed from where the game could be chased up to the basalt cliffs of Sokograd and the Sokograd rockshelter. Based on their position, size and altitude, the mentioned caves bear certain similarities with the caves in Sićevačka gorge such as Velika Balanica, Mala Belanica and Pešturina. Among other things, it is important to mention that the Moravica gorge, together with the Sokograd fortress represents a multi-layered archeological site containing traces from the La Tène, Roman and Middle Age Period. Thus this micro-region has a century-long tradition of settling, which confirms its favorable position and optimal possibilities that may have been used and considered favorable even during the Paleolithic.

Gradašnjička gorge was formed by its namesake river which is the most important left tributary of the Moravica River besides the Čučunjska River and Poružnička River. It flows from the limestone surface between the mountains Ozren and Leskovik and at the entrance to the Ozren amphitheatric basin it forms a small gorge characterized by numerous speleological objects. Erosive and accumulative waterfalls appear in many places and there are generated by the selective erosion, i.e. accumulation of tufa. Along the flow of the Gradašnica River there are 11 cascades of a total height of 44 m, the largest of them being the Ripaljka waterfall that is 12 m high. The tufa accumulating along the Gradašnjica River (up to 11 m thick) is a specific form of Quaternary fluvial karst of eastern Serbia (Stevanović et al, 1992: 191). The tufa is deposited around the cold freshwater flows of water rich in carbonates. The plants absorb the CO2 from the water leaving behind CaCO3 as a dry matter depositing on plants. After the decomposition of the plant, a hollow rock is all that remains (Jovanović, Srećković-Batoćanin, 2009: 95). It has been established that the tufa is depositing in summer as in winter but that the depositing intensity is greater during warm temperatures, so it is supposed that larger series of this rock were formed during the Holocene and the warmer periods of the Pleistocene (Gavrilović, 1999: 49–50). The richness of the fossilized flora in the Gradašnica tafa was analyzed in detail by J. Marković (1950) following which the deposits were divided into two horizons: 1. the older horizon in the middle stream near the water collector „Bela voda“ (Pliocene-Lower Pleistocene) 2. the younger horizon in the upper stream around the Ripaljka

waterfall (Middle Pleistocene) (Marković, 1950: 119–130). These „preserved“ plant remains are witness of a once abundant vegetation that used to grow here during the Ice Ages, thus this small gorge had all the conditions to become rich in various species of hunting game and thus also attracted the human species.



Map 5 and 6. Topographic 3-D and geological map, Gradašnjičke gorges with positions of potential Paleolithic sites
1. Mečja rockshelter; 2. Mečja rupa; 3. Gradašnjička rockshelter; 4. Tatumirova rockshelter; 5. Ozrenska cave;

Panoramic view of sloping basin of Ozren mountain and Gradašnjička gorge (photo. P.D. Žeželj)

The area along the Gradašnica River provided good conditions for being settled during the Paleolithic also thanks to the existence of several speleological objects. The largest and most famous object is certainly the Ozrenska cave or Delta cave that was formed at the exit from the Gradašnjička gorge. Although this cave has very long canals, except for a few smaller halls it is not very spacious and due to its narrow entrance it is also weakly illuminated. With such a configuration it resembles the Hadži-Prodanova cave thus there might be a possibility that the cave could have been interesting to Mousterian or Gravettian hunters, like the mentioned cave in the vicinity of Ivanjica. Besides that, a spacious plateau stretches in front of the cave and may have been intensively used for habitation during stable climates. Mečija rupa is another smaller but well illuminated cave located at the top of the hill above Gradašnjička gorge. Due to its dominating position and excellent view over the surrounding terrain it could have served as a convenient hunting station. Although the presence of sediment inside the cave does not appear promising, the situation on the flattened plateau in front of the object is more favorable thus rising expectations about the existence of a Pleistocene layer.

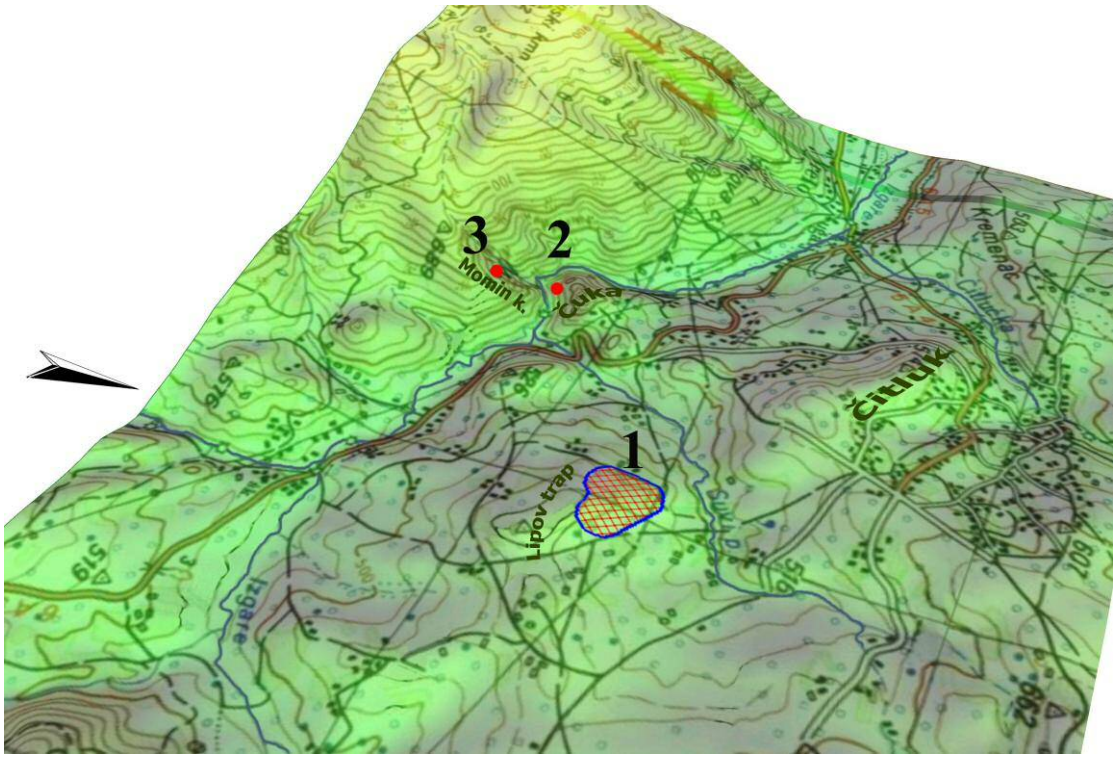
The objects nearest to Gradašnjička river are the Tatumirova and Gradašnjička rockshelters. The Tatumirova rockshelter is located in the cliffs above the river and difficult to access, whereas the Gradašnjička rockshelter is located on a flattened plateau 20 meters above the river. Besides its spaciousness, the Gradašnjička rockshelter draws attention by its rockshelter sediment that, after only a few centimeters of forest chernozem turns into a layer of red sandy sediment with lots of fine crushed rocks. This layer of red soil is most likely of Pleistocene age, based on the finding of a fossilized tibia belonging to the *Canis* genus[1]. By its configuration as well as altitudinal difference from the mother river, the Gradašnjička rockshelter resembles the famous Krapina. The tufa layers that are characteristic for this gorge may be exceptional preservatives of possible osteological remains which is another semblance with the deposit in Hjušnjakovo in the breccia layers of which the largest number of anthropological Neanderthal remains in Eastern Europe was found.

The Izgare river, which actually creates the river Moravica passes through an extremely karsted and narrow gorge located between the villages Čitluk and Levovik. The gorge-like incision which at some locations widens into a canyon reaches a height of more than 100 m. During times of low water levels the riverbed is completely dry because the water sinks into the limestone (Марковић, 1977: 40).

In the area of the Izgare gorge there are two speleological objects, one at each riverbank. On the right river bank there is the cave in Strunjak and on the left Pećurski kamen in which the existence of Mousterian artifacts was confirmed (Malez, Salković, 1988; Калуђеровић, 1996; Михаиловић и др., 1997). Furthermore, at a distance of approximately one kilometer from the gorge and the mentioned caves there is a deposit of flint raw material called Lipov trap. Due to the lack of sediment, the cave in Strunjak

[1] Established according to the analysis of *Stefan Milošević*, Faculty of Philosophy Belgrade.

has to be discarded as a potential archeological site, but the insufficiently explored Pećurski kamen deserves more attention. Taking into consideration that the first excavations were led by explorers who were not archeologists (Malez and Salković, 1984), and that Kaluđerović's excavations (1993, 1995) were conducted with increased speed (3 m of sediment excavated in only 9 days (Калуђеровић, 1996: 291)) and without sifting, as well as that in both cases the cave bottom was not reached, it is considered that the archeological potential of this cave has not been fully explored.



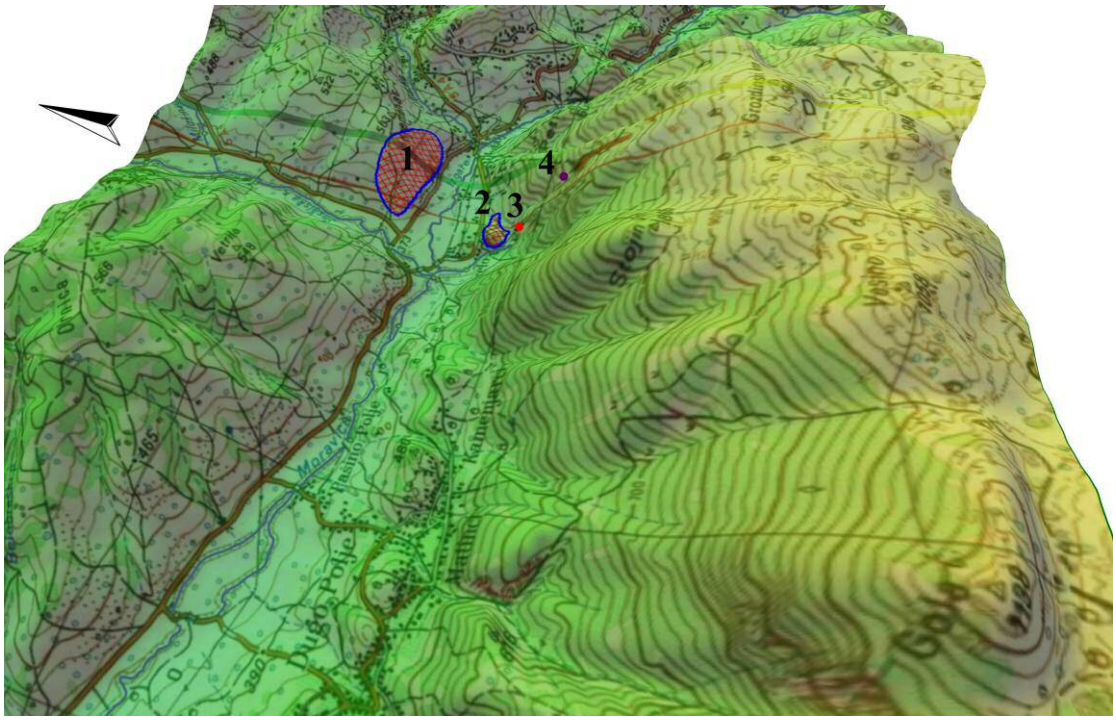
Map 5 and 6. Topographic 3-D and geological map, Izgare river flow with positions of potential Paleolithic sites
1. Lipov trap; 2. Cave in Strunjak; 3. Pećurski kamen;

Panoramic view of landscape around the Izgare river and its gorge, view from Momin kamen cliff

The Vrelska valley is located near the spring of the river Moravica in Istoci. The spring of the Moravica River is a karstic and at the same time the strongest source of the Moravica located in the eastern section of the Sokobanja basin not far from the village Čitluk. This is the area where the three rivers join (Moravica, Izgare and Sesalačka River) and where their streams form an approximately 1 km wide valley stretching between the foothill of Mt. Devica in the south and the high lake terraces in the north. Such valleys, rich in water and composed of fertile alluvial deposits of good quality once used to be exceptional reservations of large hunting game during the Pleistocene (Bertini 2012; Daujeard, Moncel 2010).

Besides the Late Neolithic locality of Vrelska čuka two more speleological objects and one deposit of flint raw material (Kremenac) were registered on the rim of this area. The Vrelska rockshelter does not contain sufficient enough sediment in spite of its spacious dimensions and good position. The Čitlučka cave, on the other hand, contains a large sediment cone but due to its configuration it hardly could have been a habitat of Paleolithic people. The finding of a human bone, as well as the impressive pit hall suggest a certain archeological potential of the cave which, if we let our imagination play, we could compare to the funeral depot from the „Bone pit“ (Sima de los Huesos) in Atapuerca. The findings of flint with chipping traces in Kremenac are not sufficiently indicative to claim the existence of Paleolithic industries. The favorable geographic position of the entire site, as well as the rich deposits of raw material influenced a longer period of human occupation (confirmed by findings of Vinča, Bubanj and Antique pottery in Vrelska čuka), therefore we may suppose that this location was attractive also to Pleistocene people, which is not impossible because at a

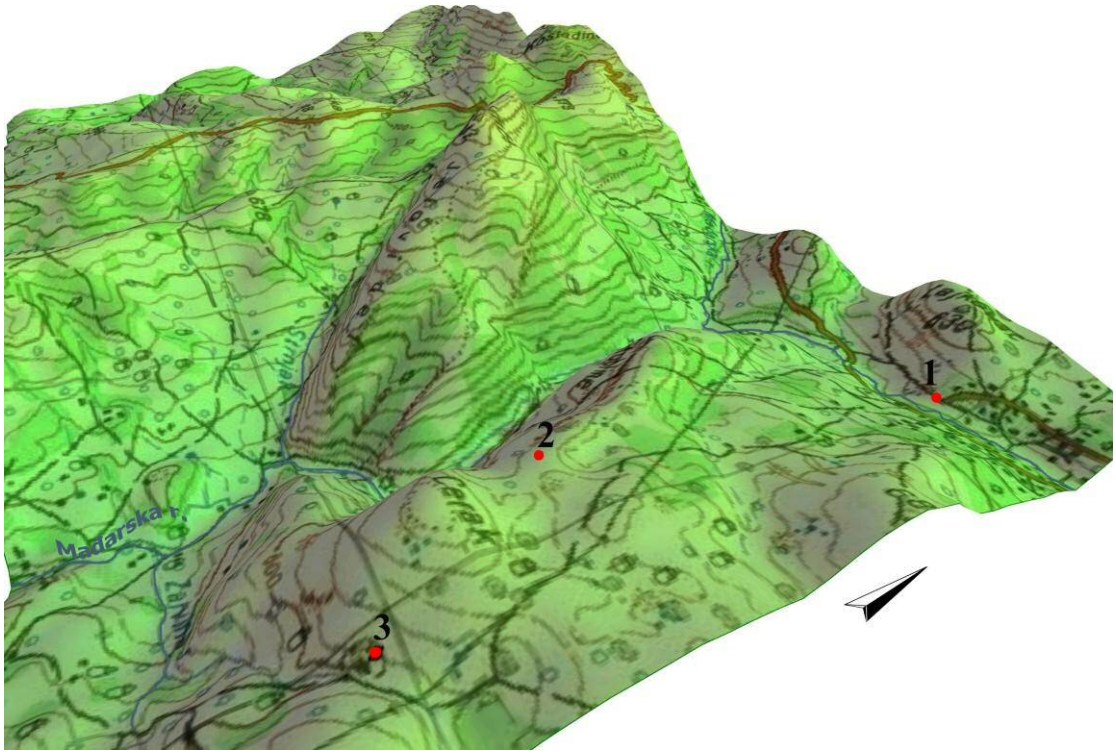
distance of only 3 km to the east there is Pećurski kamen, a cave in which the existence of Mousterian artifacts has already been confirmed.



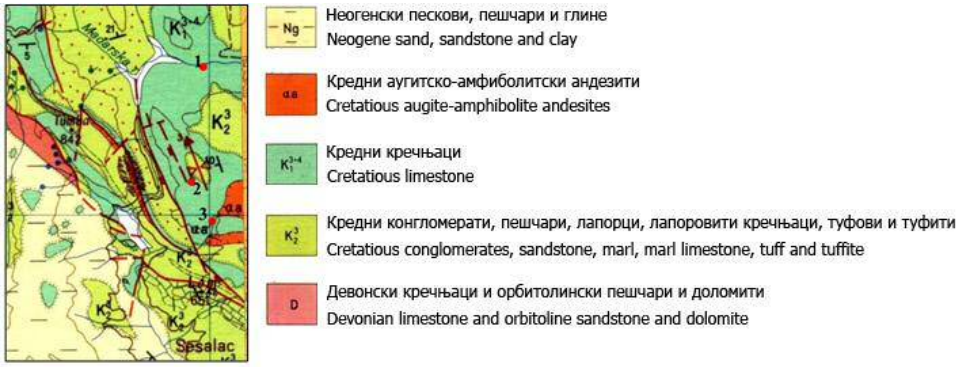
Map 9 and 10. Topographic 3-D and geological map,
Moravica river valley with positions of potential Paleolithic sites
1. Kremenac; 2.Vrelska čuka; 3. Čitlučka cave; 4. Vrelska rockshelter

The Sesalačka River, created by the Javorski creek and the river Trska joining at the foothill of Baba, joins the Moravica near Vrelo. In its upper stream it is called Mađarska River and runs between the branches of Mt. Rtanj in the west and Mt. Slemen in the east. On its way to the estuaries it receives two more tributaries from both sides out of which the left tributaries Milušinačka River and Zarvina River are considerably bigger as opposed to the smaller right creeks – Strnjak and Ciganska River. The entire confluence has cut its valleys into limestone, sandstone and conglomerates containing some eruptive rocks, thus creating several smaller gorges (Дакић, 1967: 13).

Three speleological objects are registered in this area, the most famous of them being the Sesalačka cave. Although the cave is very spacious and branched, the analyses of D. Petrović have established that its present main entrance (i.e. overgrowth) is of an Early Holocene age, which would exclude the existence of a Paleolithic layer. However, the cave has two more entrances on its upper levels which are communicating by their corridors with the branchy interior of the cave. Since it is almost certain that these entrances are older than the Holocene, it is not impossible that this large and branchy cave could be a potential Paleolithic habitat.

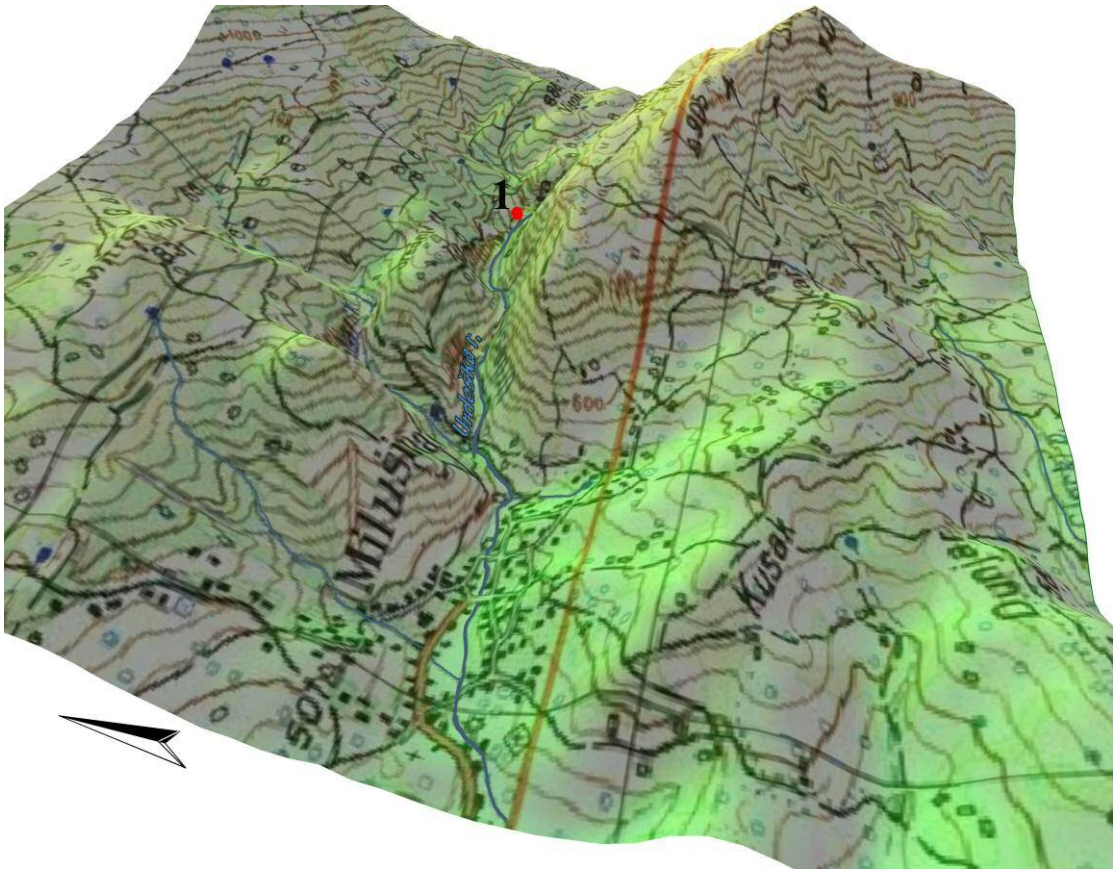


Map 11 and 12. Topographic 3-D and geological map, Seselačka river with positions of potential Paleolithic sites
1. Seselačka cave; 2.Rujiška žlebina; 3. Rujiška cave



The Urdeška gorge is created by the Urdeški creek, the eastern tributary of Milušinačka River. At its bottom the gorge turns into a narrow groove with vertical sides and gigantic pots and waterfalls. The most prominent are the 6 vats the fifth of them is 5 m deep and 3 m in diameter. This gorge has many natural rarities and the most

prominent of them are the 10m high Velika Ripaljka waterfall, the overgrowth known under the name Bogova vrata, the thermo-mineral spring at the foothill of Gradište hill, as well as the 7 m high Veliki buk on the river in close proximity to the village Milušinac.



Map 13 and 14. Topographic 3-D and geological map, Urdeška river gorge with positions of potential Paleolithic sites *1. Milušinačka cave 1 and 2.*

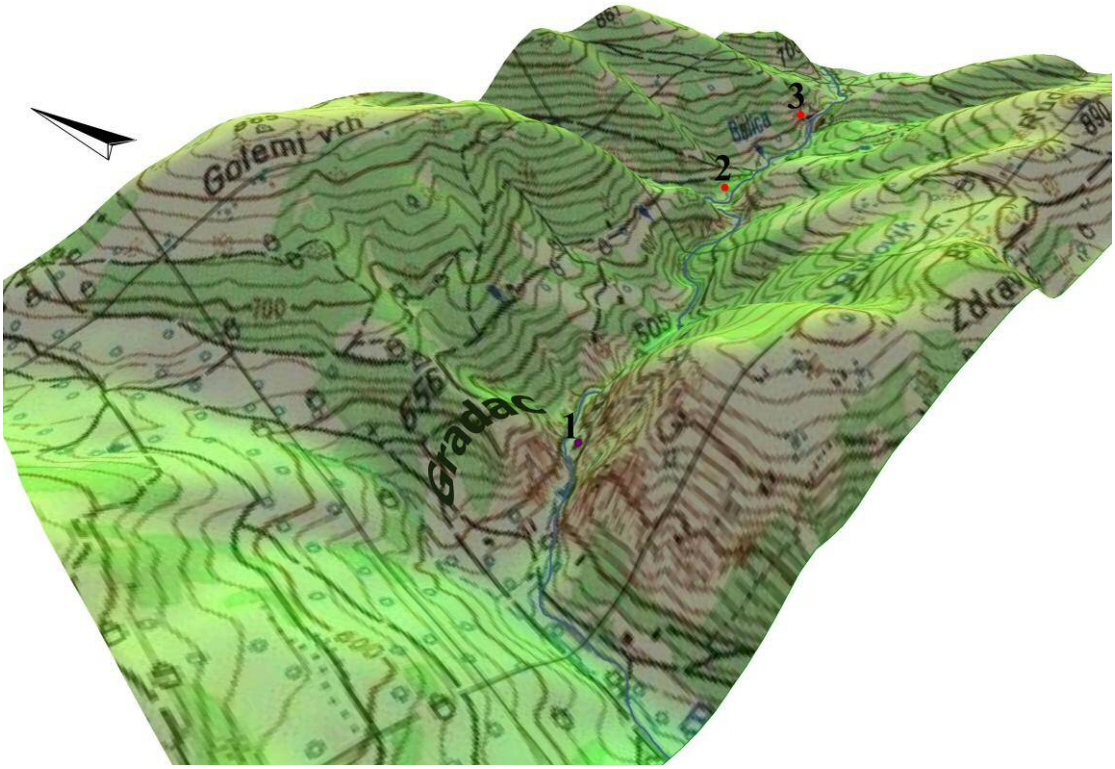
Besides that, several speleological objects have been registered in the river gorge, the most important of them is the Milušinačka cave (1) in which the existence of Paleolithic artifacts has been established during the archeological excavations in 2012 led by D. Mihailović and S. Kuhn (Kuhn et al, 2014: 100–101; Mihailović, 2014: 52). Also attractive is the more spacious Milušinačka cave 2 located only some 50 m away from the previous cave thus there is a great probability that the existence of Paleolithic

artifacts may also be registered there. Paleolithic layers were also registered in two mutually close caves, as is the example of Mala Belanica and Velika Belanica in the Sićevačka canyon where Charentien and Mousterian artifacts were found (Михаиловић 2008: 6-13).

Panoramic view of Urdeška gorge besides Bogova vrata (Gods door) and Milušinačka cave 1 and 2

The Bela reka gorge was formed in the limestones on the southern slopes of Golak and belongs to the confluence of Toponička River. The gorge is approximately 5 km long and passes through massive limestone rocks creating three canyons: Kulište, Tomin kamen and Gradac. Although the surrounding hills are quite bare and dry with only low shrubs and bushes, the inside of the gorge contains considerably livelier and abundant vegetation dominated by large beech trees.

In each of the mentioned canyons of Bela reka a cave was formed. These objects drew the attention of earlier explorers and thus in 1996 Z. Kaluđerović organized and led archeological excavations in the Crkvište rockshelter. The cave sediment was excavated to a depth of 2 m where prehistoric pottery and animal bones were discovered but the Pleistocene layer and rocky bottom of the cave were not reached (Калуђеровић, 1996: 291). The remaining two caves are located upstream from Crkvište and also contain sediment. The existence of Paleolithic layers may not be entirely excluded without further archeological excavations bearing in mind that the altitude of the entire gorge varies from 480 to 580 m, that the slopes of the surrounding



Map 15 and 16. Topographic 3-D and geological map, Bela river gorge with positions of potential Paleolithic sites
1. Crkvište; 2. Goveđi Pešter; 3. Radenkovski kamen

Bela river gorge near the Crkvište rockshelter

Bela river near the Radenkovski kamen

hills are facing south and that remains of Pleistocene game mammals (Ursus spelaeus, Capra ibex, Lepus sp.) (Димитријевић, 1997: 194–195) were registered in the Popšička and Prekonoška caves, as well as Paleolithic artifacts in Golema dupka (Михаиловић и др., 2009: 8). Furthermore, the Bela reka gorge is an important strategic point for the communication of travelling routes heading towards the Svrljiška, Sokobanjska, Niška and Aleksinačka basin. The importance of this route is witnessed by the early Byzantine fortifications in Gradac and Kulište.

Vrmdžanska River sprouts from a strong spring underneath the southern branches of Mt. Rtanj (Cerje). In the upper part of its stream the river has cut a low gorge through the massive limestone at a length of approximately 3 km, whereas only 7.5 km of its lower stream is located in Tertiary deposits. Interesting are also the small valleys of the source branches of Vrmdžanska River – Dupleš, Pakleš and Pesnica, which are dry and karsted with a wide bottom and the appearance of a canyon.

Besides a few collapsed caves (Kosinja padina and Krušjanska cave) no other speleological objects were registered in the stream of the Vrmdžanska River except the more distant Rtanjska ledenica. M. Garašanin has registered in the stream of Vrmdžanska River a few sites from the younger prehistory (Trapovi, Pakleš, Međukamen) (Гарашанин, Гарашанин, 1951: 469–470). The entire area is located in the zone of high and curved river terraces (altitude of 680-940 m) that are intersected by dry valleys and small streams. The high terraces offer an excellent view of the terrain towards the south and the Moravica River valley, and numerous dead-end valleys even today are the refugia of numerous plant and animal species and therefore it would not be surprising to find existing Paleolithic habitats in the open air similar to those in northern Bosnia. As already mentioned, the area of northern Bosnia encompasses a terrain of high hills and mountains offering a broad view of the valley belt of the Sava River where more than 200 Paleolithic open-air sites have been registered (Панџић, 2014: 45).

* * * * *

One of the most important creations of the cultural evolution of mankind were habitats that rendered man the most adapted species able to exist in areas stretching from the equator to the polar circles. Man has adapted his accommodation to various surroundings, temperatures, raw materials, as well as his very diverse requirements depending on taste, habits, economic and social organization.

The adaptive practices of Paleolithic communities on their natural environment and the choice of habitats from various areas of the central Balkan clearly demonstrates that the Sokobanja basin with all its natural and geographic features may have been inhabited during the Paleolithic epoch. During the past million years, cave sites with cultural stratigraphy from the same or similar climatic zones were formed during almost all of the Pleistocene phases, ranging from the first hand choppers to the final phases of Upper Paleolithic industries. In northwestern Bulgaria, at the very border with Serbia,

archeologists have discovered the anthropological remains of the oldest Lower Paleolithic (Kozarnika) and Upper Paleolithic (Bačo Kiro) people in this part of Europe. Anthropological remains from the Lower and Middle Paleolithic have also been registered in the more western areas of the Balkan, such as Mala Balanica, Krapina, Vindija and Šandalja. Thus it is entirely possible to find the physical presence of ancient human communities from all Paleolithic phases, as well as that these remains are preserved.

The area between the river Timok, Stara planina and the river Nišava encompasses all the main communications that in the past used to lead from south-east Europe to central Europe. This part of Serbia, together with the Sokobanja region, is characterized by a developed karst relief containing numerous caves and rockshelters suitable for settlement. In some of them, like the cave complex Balanica, Pešturina, Baranica, Milušinačka cave and Pećurski kamen the flint industry from the Middle and Upper Paleolithic has been confirmed.

In the numerous scientific papers of domestic and foreign authors it is emphasized that during the glacial periods the Balkan Peninsula may have been a refugium not only for many plant and animal species but also for communities of hunter-gatherers. Due to these reasons, even then the question emerged on what may have been the role of the central Balkans in the cultural processes and movements of populations during the Paleolithic in southeastern Europe. Following the latest research the situation has somewhat changed and one of the most important results is that it was shown that this part of the Balkans was intensively populated during the Paleolithic. Thus the entire area that today encompasses the temperate belt (including the Balkans) in the past was not a refugial area in a classical sense (which implies a certain degree of isolation) but rather „a permanently inhabitable area“ with similar ecological features (Михаиловић et al. 2008: 17-18). Unlike the Iberian or Apennine Peninsula, the Balkan Peninsula was during all its Pleistocene phases open towards the south which enabled the populations inhabiting its bordering areas to shift towards the south during the onset of cold periods, and vice versa enabled the communities from the southern (resident) areas to settle territories in the north in warm periods (Михаиловић et al. 2008: 15-16).

In the geographic and paleo-ecological sense, the entire territory of eastern Serbia and the Sokobanja area represent a mountainous and basin region intersected by numerous valleys, gorges and canyons. In the past, the river valleys, as well as many basins used to be migratory zones of large fauna, while the hill and mountainous area, probably like today, was characterized by diverse vegetation and fauna. It was this circumstance that facilitated various modes of providing plant and animal resources for the Paleolithic communities. It facilitated the orientation towards hunting large game, as well as the utilization of a wider spectrum of, climatically and ecologically, more resilient animal species (Михаиловић et al.? 1997: 33).

The presence of sediment is the first and basic factor that has to be met in order to expect any archeological results. The probability of discovering remains of Paleolithic habitats is greater if the objects contain thicker and more stratified deposits that have not been considerably disturbed since the times of their depositing. A vast

majority of caves in the Sokobanja region has a good presence of sediments in some of which even Pleistocene layers are present, thus the first condition concerning archeological research of the Paleolithic is met.

The largest number of archeologically surveyed speleological object in the Balkans is located at altitudes between 250 and 450 meters. The largest number of caves in Sokobanja is located at attitudes ranging from 450 to 650 meters which is not such a high altitude bearing in mind that traces of glaciers have not been registered on either of the high mountains in eastern Serbia, as well as that the altitude of the snow limit at the peak of the last Glacial was at 1200 m (Šegota, 1979: 28–29). Such a situation is confirmed by most Paleolithic findings registered on higher altitudes such as Smolućka (945 m), Mališina stijena (800 m), Crvena stijena (700 m), Hadži-Prodanova cave (630 m), or even at extremes like Potočka Zijalka (1700 m) and Mokriška pit (1500 m).

The size of the entrance, length, as well as the surface of effective space inside the caves obviously do not play a significant role in the selection of Paleolithic habitats. Binford's theory that each member of a hunter-gatherer community needed at least 10 m² of cave space, as a key factor for choosing a cave (Binford, 1968: 316–317) has been rejected long ago in numerous archeological and ethnographical researches (Lim, 1985: 107–108). The Sokobanja caves similar as the specimens from researched caves vary in their entrance size, length and surface. From this it may be concluded that Paleolithic communities have generally avoided unlit caves i.e. caves with small entrances (less than 2 m) but certainly this may not be regarded as a clearly defined rule. The cave length is also not a deciding factor bearing in mind that people almost exclusively used the space around the cave entrance. The surface of the effective space is more important but does not have to be a decisive factor and this was confirmed during ethno-archeological researches of caves that used to be inhabited by modern hunter gatherers who most frequently chose smaller rockshelters or caves the surfaces of which mainly varied between 15 m² to 120 m² (Galanidou, 2000: 243–275).

The entrance orientation of the specimen also varies significantly although there is an assumption that Paleolithic communities preferred to inhabit caves facing the south. This factor does not at all have to be of primary importance, especially concerning caves located in gorges and canyons where the effect of sunlight exposure does not have a significant role due to the configuration of the terrain.

The flint resource, necessary for the normal functioning of Paleolithic communities, was used for the production of adequate hunting weapons and other tools used by almost all the populations of the older Stone Age. This purpose was mainly served by rocks that were very hard but also easy to break (split) into fairly regular shapes. The chipped artifacts were made from many types of rocks and some minerals (quartz, opal, chalcedony), that are very hard (6 – 6.5 degrees of the Moss scale), have a shell-like break suitable for shaping the artifacts, are very brittle and facilitate their breaking into sheets thus resulting in sharp edges and have a high content of silicates. According to these features and the petrographically analyzed artifacts, the following materials were used to produce chipped artifacts: hornstone (also organic hornstone like e.g. radiolarite), quartz (and its varieties like achate, chalcedony, jasper), opal, felsite,

rhyolite (obsidian) and some volcanic rocks, quartzite, magnesite with a high silicate content (Inizan et al, 1999: 13–26). An analysis of raw materials performed in south-western France in Mousterian sites established that 70-98% of flint raw materials located in the sites were brought from a distance less than 5 km, 2-20% from a distance between 5 to 20 km, while less than 5% were brought from a distance more than 30 km (Mellars, 1996: 17). It is interesting that in central Europe these distances sometimes may be significantly greater which could imply that populations used to hold a larger territory or that the sources of these materials used to be rarer (Klein, 1999: 465). Raw materials necessary for the manufacture of Paleolithic tools have also been confirmed in a several locations in the Sokobanja basin and their position is such that they could have supplied a large portion of the area. Above all, these are deposits of flint in the most eastern part of the basin (Kremenac near Čitluk and Lipov trap), Kremenac near Vrelo on the southern slopes of Mt. Ozren (Heffter, 2014: 52), as well as numerous crystal and quartz deposits on the slopes of Bukovik in the most western part of the basin (Урошевић, 1925, 1928).

By comparing the cave habitats from the Balkan area and the registered caves in the Sokobanja basin with the surrounding mountains we may conclude that the life of Paleolithic communities during a significant part of the Pleistocene was possible, if not favorable in the Sokobanja region. By the end of the 1980s and mid 1990s surveying excavations performed in Pećurski kamen (Malez, Salković, 1988; Калуђеровић, 1996) and Markova cave (Калуђеровић, 1996) have confirmed the existence of Paleolithic artifacts in the Sokobanja basin. The latest research conducted in 2012 within the project "Surveys of the transition from the Middle into the Upper Paleolithic in eastern Serbia" conducted by the Faculty of Philosophy from Belgrade in cooperation with the University of Arizona from Tucson (USA) have confirmed the existence of Paleolithic material in the Milušinačka cave and Sokogradska rockshelter.

ZUSAMMENFASSUNG

DIE SPELEOLOGISCHEN OBJEKTE SOKOBANJAS ALS POTENZIELLE PALÄOLITHISCHE FUNDSTÄTTEN

Die monografische Veröffentlichung under dem Titel „Die Speleologischen Objekte Sokobanjas als potenzielle paläolithische Fundstätten“ ist eine Fortsetzung der Forschungsergebnisse die Petar Milojević erstmals in seiner Diplomarbeit vorgestellt hat. Die Forschungen zum Thema der Diplomarbeit wurden in Rahmen der Ausführung des Projekts „Forschung des Übergangs vom Mittleren zum Oberen Paleolit in Ost-Serbien“ in Zusammenarbeit der Philosophischen Fakultät aus Belgrad mit der Arizona University aus Tucson (USA), durchgeführt.

Das Forschungsthema war die Erforschung speleologischer Objekte und Fundorte im Freien, die mögliche Lebensräume paleolitischer Gemeinschaften gewesen sein könnten. Das Ziel der Forschung war, mittels archäologischer Prospektion (lokale Naturumgebung, verfügbare Resourcen, raümliche und morphologische Eigenschaften der unterirdischen karstischen Formationen), anhand der Siedlungsschemas, Wirtschaft und Organisation der paleolitischen Bevölkerungen, die potenziellen örtlichen Fundorte zu Erkunden und deren Potenzial für weitere zukünftliche Forschungen zu ermitteln. Die größte Aufmerksamkeit wurde der Analyse der speleologischen Objekte gewidmet d.h. ihrer geografischen Lage, Größe, dem Auftreten von Sedimenten, als auch ihrer Typologie, Entstehung und Evolution. Der Interressen- und Zeitrahmen unfängt die gesamte Epoche des Pleistozän, und die Hauptproben bestanden aus zahlreichen speleologischen Objekten und Fundorten von Rohstoffen aus Stein im Tal von Sokobanja und den umliegenden Bergen (Rtanj, Slemen, Krstatac, Devica, Ozren, Bukovik und Rožanj).

Die Forschungsmethoden basierten sich auf dem Sammlen von Informationen mittels archäologischer Ausgrabungen und ihrer Entahme aus der wissentschaftlichen Literatur.

Die durch Feldforschung gesammelten Informationen beinhalten: das Finden und Lozieren gewisser speleologischer Objekte und Fundorte im Freien und deren detaillierte Beschreibung, Erforschung und Beschreibung der umliegenden Gegend, kartographische Eintragung der Fundorte mit topographischen Grunddaten (Höhe, Maße des Objektes usw.), das technische Vermessen des Grundrisses und Querschnitts des Objekts, Fotografieren, Sammeln und Illustrieren verschiedener Klassen von Oberflächenfunden, Sammeln von Informationen, Notieren von Beobachtungen und Erfahrungen der einheimischen Bewohner und Spezialisten verschiedener Wissentschaftsgebiete (Geologen, Jäger, Förster, Bergsteiger usw.).

Die weitere Bearbeitung der gesammelten Informationen bestand aus deren Verarbeitung mit Hilfe der GIF Software (Global Mapper).

Zum Zwecke der Forschung wurde nur eine Grundanalyse durchgeführt. Diese bestand aus dem übertragen der Lokationspunkte der Objekte aus einer Datei in die

Software und deren Eingliederung in zuvor geo-differenzierte, thematisierte Karten. Dies sind topographische (1:25000) und geologische (1:100000) Karten. Dieser Prozess ermöglichte das Anzeigen der raümlichen Lage und der gegenseitigen Verhältnisse der Objekte im heutigen Erscheinungsbild des Geländes (mit Hilfe von topographischen Karten). Das Anzeigen mittels geologischer Karten ergänzte bereits vorhandenes Wissen über deren Erstehung und dem Verhältnis zu den umliegenden geo-morphologischen Formationen. Die geographische Lage der erforschten Objekte wurde mit Hilfe eines dreidimensionalen DEM (Digital Elevation Model) Models des Sokobanjschen Tals auf einem Raster-Untergrund (ASTER DEM Worldwide Elevation Data 1.5 arc-second Resolution) ermittelt. In diesem Fall handelt sich es um die Benutzung dieses Models zur Ergänzung der topographischen Karte um das heutige Aussehen des Reliefs zu zeigen, und auch um die Lage der erforschten Objekte im Gegensatz zur Umgebung zu erfassen.

Die Arbeit enthält 165 Textseiten, inclusive eines voluminösen Quellenverzeichnisses, Bilder im Text, Listen von Gruben, Felshöhlen, Höhlen, eingefallenen Höhlen und Ablagerungen von Rohmaterialien im Freien, Tabellen der speleologischen Objekte in der Region Sokobanjas und der Paleolitischen Fundstätten innerhalb der speleologischen Objekte in Südost-Europa, eine Liste der Funde und auch ein Bilderalbum über die speleologischen Objekte.

Diese Studie ist ein Beitrag zum speleologischen und archäologischen Informationsschatz über die Region Sokobanjas und ermöglicht eine Übersicht der potenziellen Fundstätten. Die Liste der speleologischen Objekte beinhaltet 6 Gruben, 10 Felshöhlen, 27 Höhlen und 4 eingefallene Höhlen. Außer der speleologischen Objekte enthält die Liste auch noch 3 potenzielle Fundstätten von Steinartefakten im Freien. Die Daten der speleologischen Objekte sind übersichtig und systematisch dargestellt. Genaue Informationen über die Lage, Morphologie, Ablagerungen wie auch präzise Angaben über bereits durchgeführte Forschungsarbeiten ermöglichen den interresierten Forschern das Lozieren der Fundstätten und bilden eine gute Grundlage zur Vorbereitung der Forschung. Ausser der Liste welche das Hauptmerkmal dieser Publikation bildet, beinhaltet diese Monographie auch verschiedene Aspekte die für die Vorbereitung der Forschung auch wichtig sind. Das Vorwort gibt einen historischen Überblick der Erforschung der speleologischen Objekte und paleolithischen Fundstätten, als auch über die natürlichen und geographischen Merkmale des Sokobanjschen Tals (geographische Lage, Relief, geologische Zusammensetzung, paedologische Deckschicht, Klima, Flora und Fauna). Die Bedeutung des Erforschens von Fundstätten aus der frühesten Zeitalter menschlicher Vergangenheit ergibt sich aus dem Verzeichnis archäologischer Funde in Höhlen in Südost-Europa, wobei die in dem Endwort enthaltenen Ergebnisse und Bemerkungen eine Möglichkeit für zukünftige Forschungen über die paleolithischen Lebensraüme im Sokobanjschen Tal in Aussicht stellen.

LIST OF FINDS

OSTEOLOGICAL MATERIAL

T.1.Pećurski kamen
1.Ursus spelaeus, I2 upper left
2.Ursus spelaeus, D4 lower right juvenile
3.Capra ibex, P4 upper left sub-adult
4.Ursus spelaeus, I2 upper right sub-adult
5.Ursus spelaeus, M2 upper right senile B 21,8 L 28,6
6.Ursus spelaeus, P4 upper right sub-adult B 14,6 L 21,3
7.Ursus spelaeus, I2 lower left sub-adult
8.Ursus spelaeus, M2 upper right, sub-adult B 22
9.Ursus spelaeus, upper right
10.Ursus spelaeus, lower right
11.Ursus spelaeus, magnum right, D 38,8 H 32,5 B 23,8
12.Ursus spelaeus, atlas juvenile
13. Mammalia indet, cranium
T.2. Pećurski kamen
14. Ursus spelaeus, femur indet. trampling striations
15.Ursus spelaeus, humerus right
16. Bos taurus, phalanx I, Dd 26,3
T.3.Pećurski kamen
17.Ursus spelaeus, left rib
18.Ursus spelaeus, femur right, juvenile

T.4. Crkvište
1.Cervus elaphus/Capra ibex, radius
2.Cervus elaphus, metatarsus

T.4.Gradašnjička rockshelter
1.Canis sp. Left tibia, gnawed

T.5. Čitlučka cave
1. Bos sp. mandible left, juvenile, cutmarks M-4 – separation of the mandible from the skull, alveolar measures – P2 L 11,7 P3 L 19,5

T.6.Čitlučka cave
1, Homo sapiens sp. humerus right, Dp 46,3 Bp 50,8

T.7. Foothill of Gradac – Labukovo
1. Homo sapiens sapiens, tibia right, corrosion

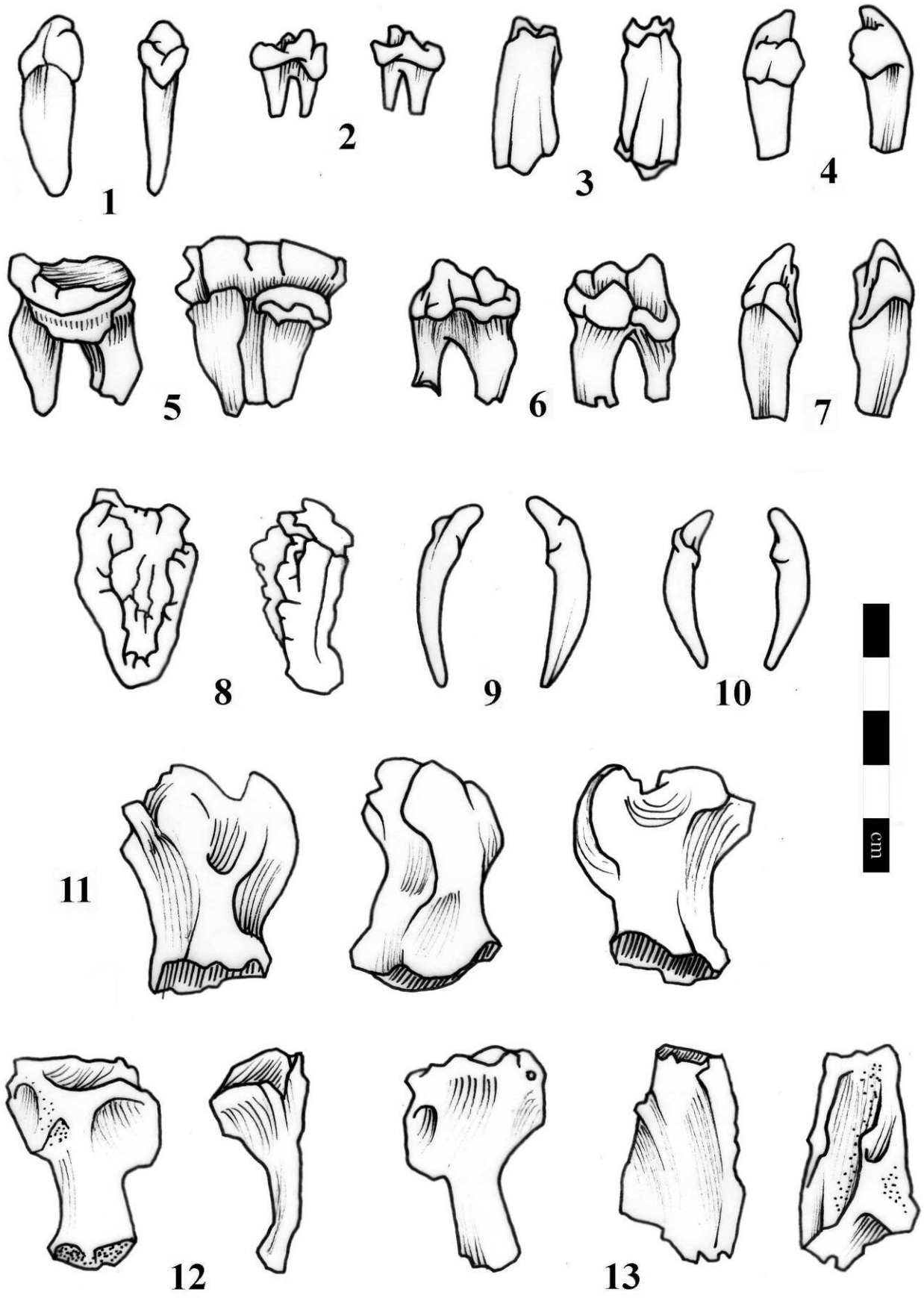
FLINT MATERIAL

T.8. and **T.9.** ***Kremenac near Čitluk***
1. Piece of flint, beige color with chipping marks
2. Piece of flint, black color with chipping marks
3. Flint core, red color with chipping marks
4. Flint core, dark-brown color with chipping marks
5. Fragment of a flint blade, triangular cross-section, grey color
6. Flint chip, beige color.
7. Flint core, dark-brown color with chipping marks
8. Chunk of flint raw material, greyish-white color with chipping marks
9. Chunk of flint raw material, dark-grey color with chipping marks

T.10. and **T.11.** ***Vrelo – fileds***
1. Piece of flint, dark-grey color with chipping marks
2. Flint blade, triangular cross-section, retouched, beige color
3. Small quartz blade, trapezoid cross-section, white color

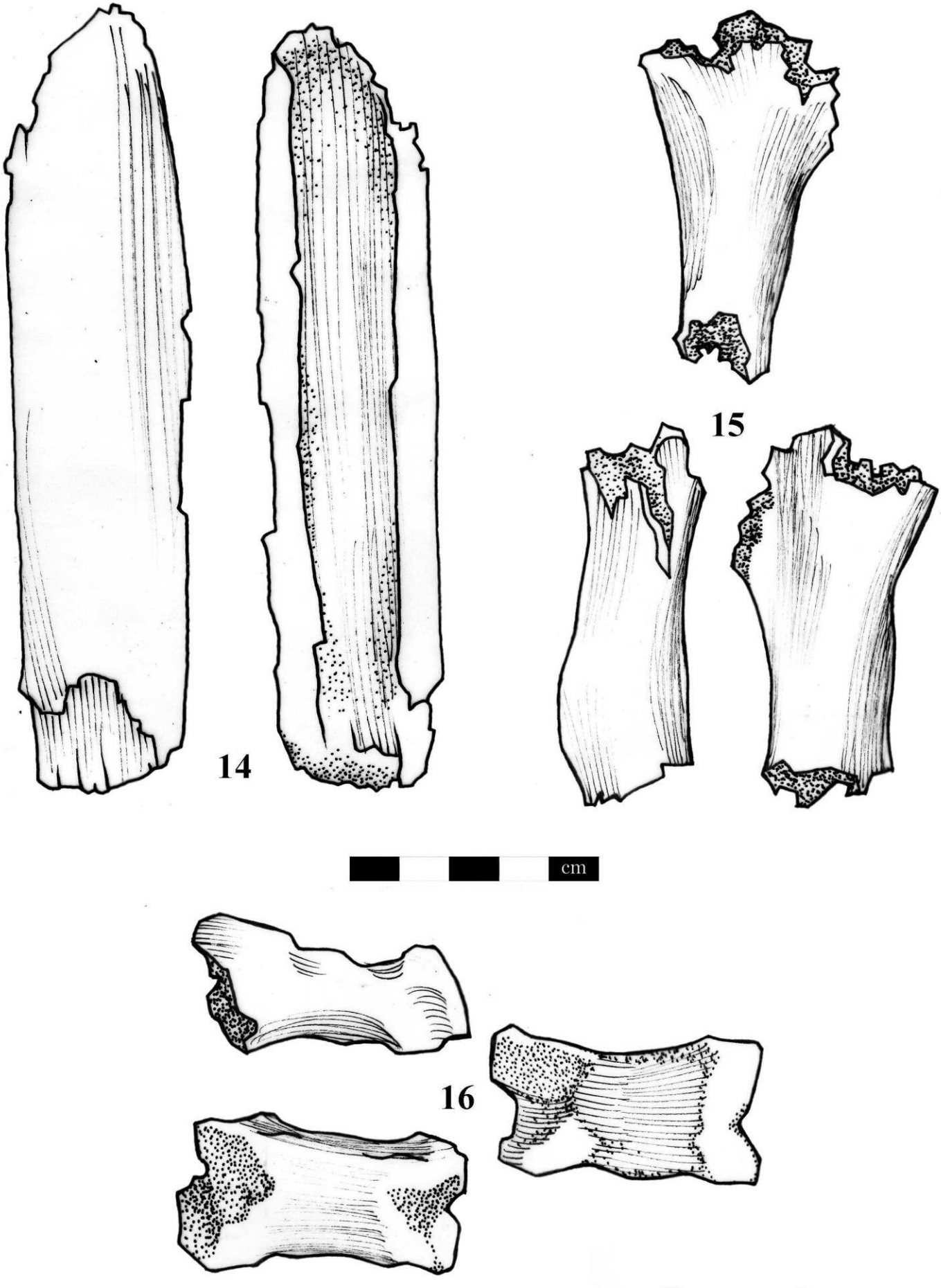
T.10. and **T..11.** ***Vrelska čuka***
4. Flint chip, triangular cross-section, honey color
5. Flint chip, triangular cross-section, dark-brown color
6. Flint point, trapezoid cross-section, dark-brown color
7. Flint blade, trapezoid cross-section, white color
8. Flint point, trapezoid cross-section, white color
9. Flint scraper, retouched, rhomboid cross-section, white color

TABLE 1.



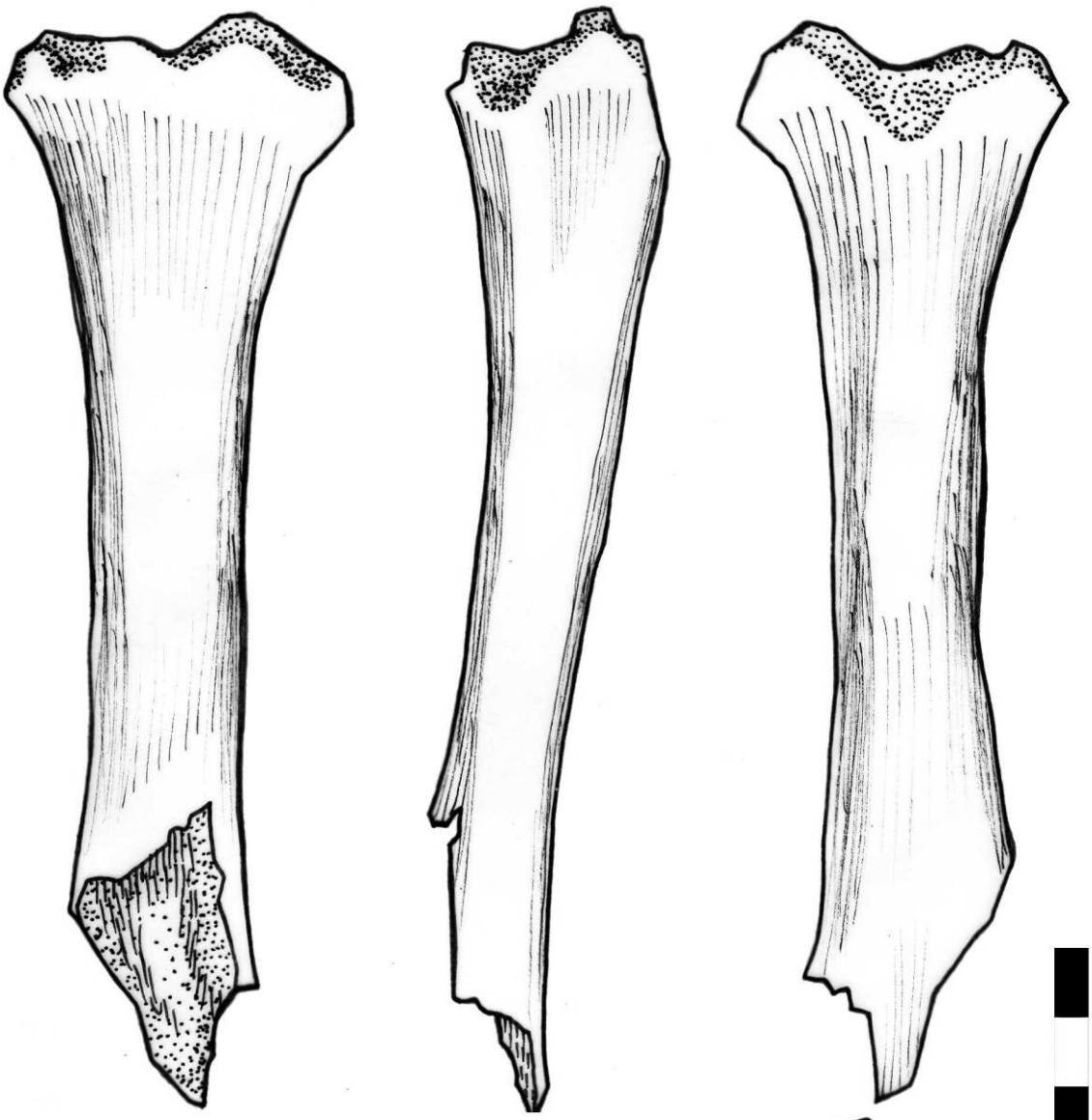
1-13. Pećurski kamen

TABLE 2.

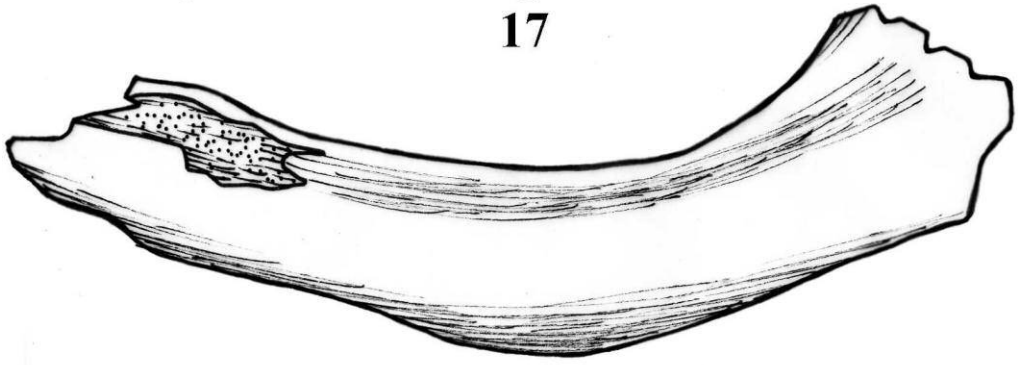


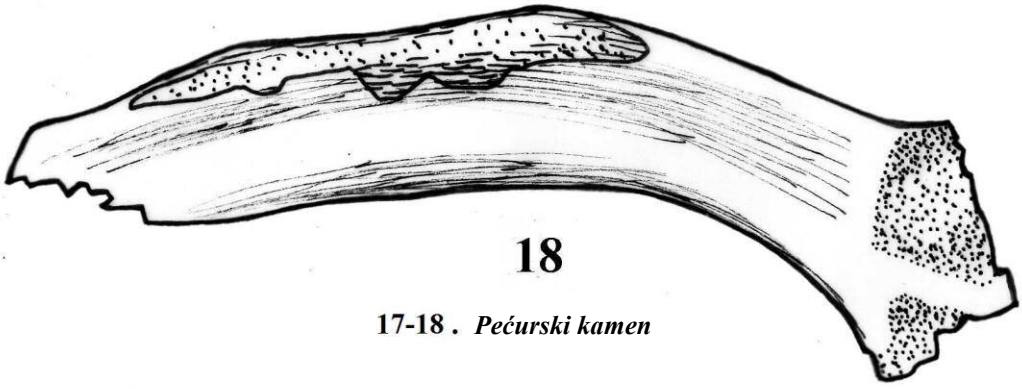
14-16. Pećurski kamen

TABLE 3.



17



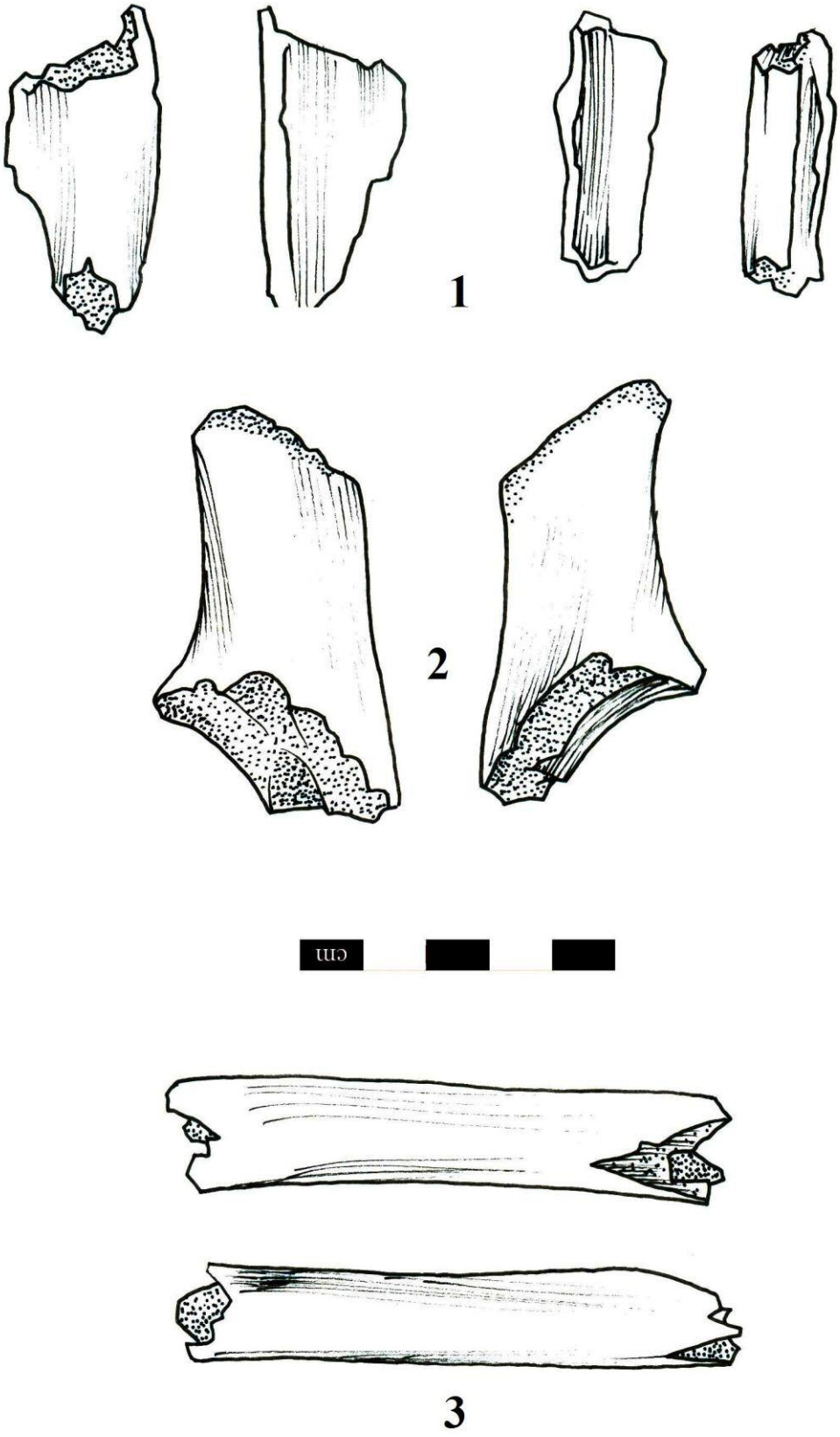


18

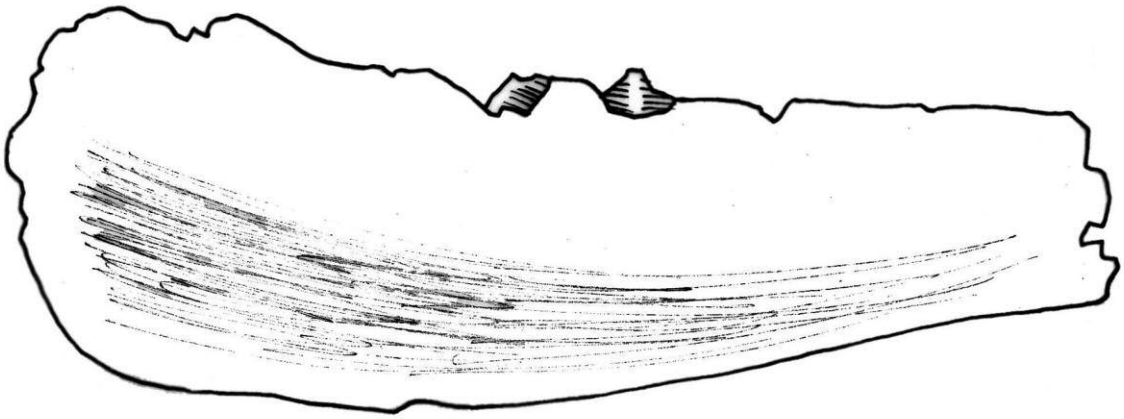
cm

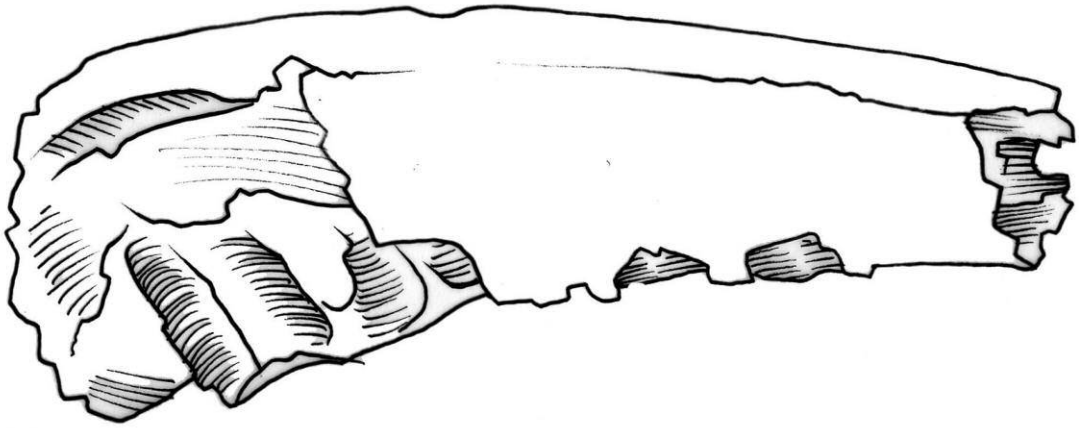
17-18 . ***Pećurski kamen***

TABLE 4.



1-2. ***Crkvište;*** **3.** ***Gradašnjička rockshelter***






cm

TABLE 6.

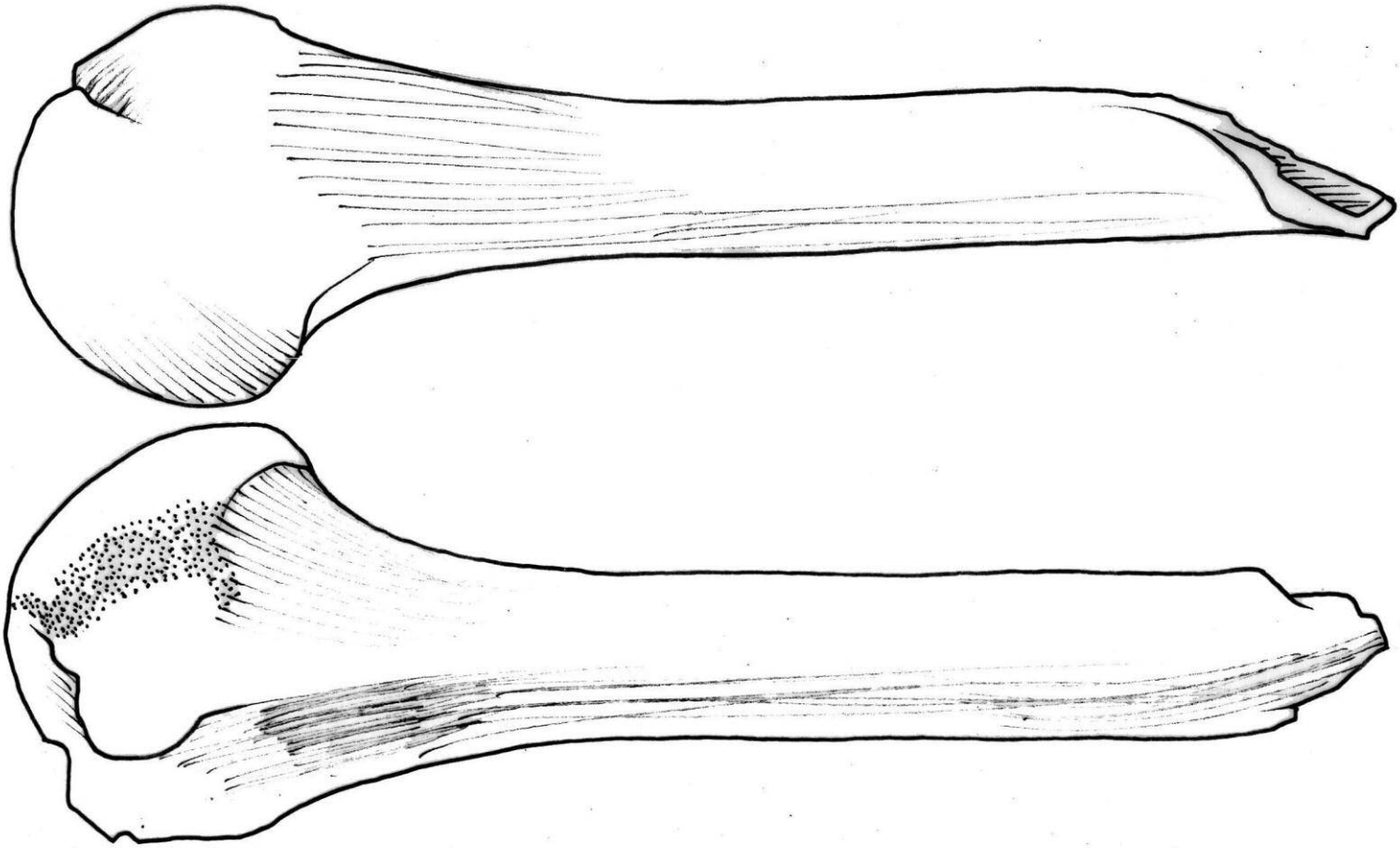


TABLE 7.

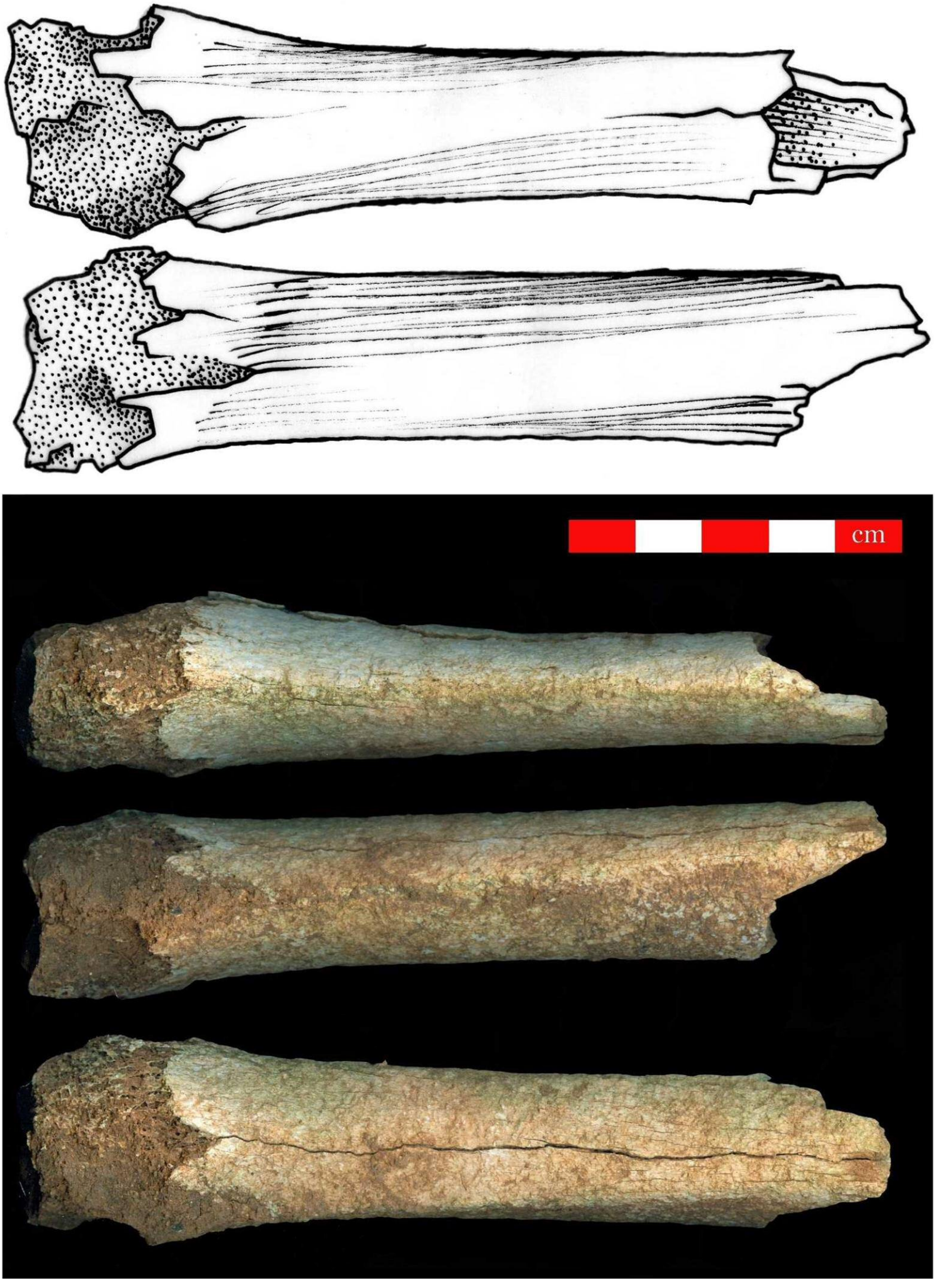
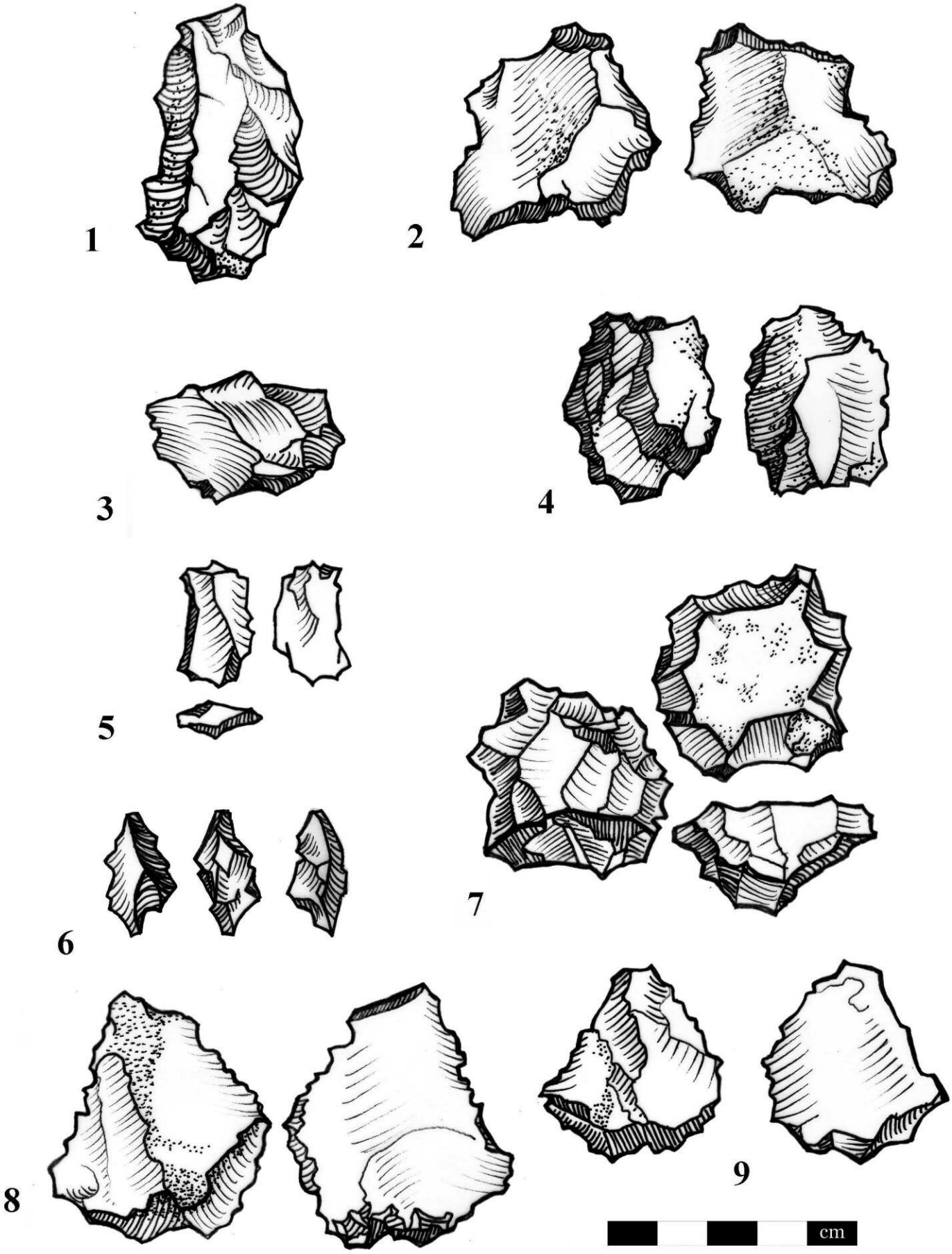
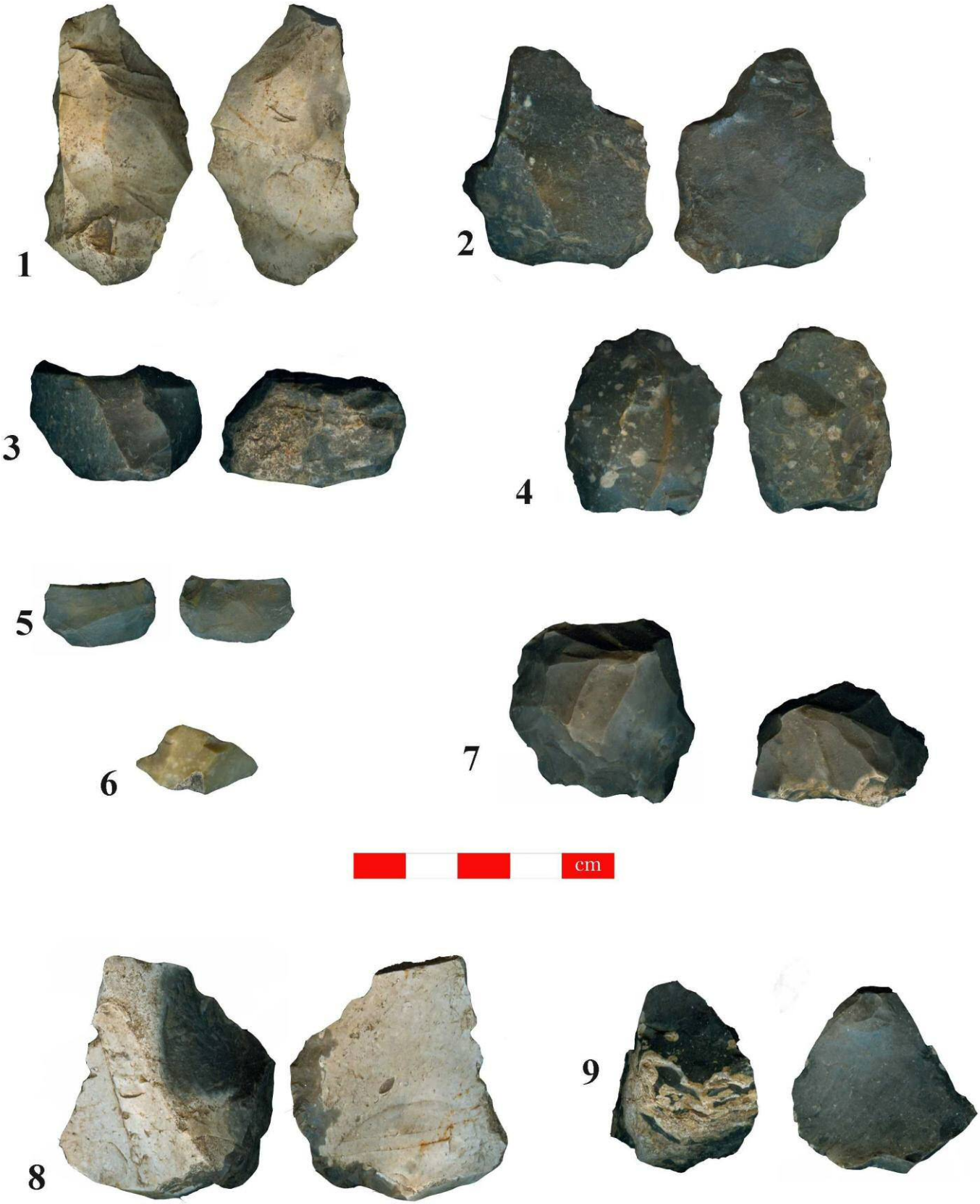


TABLE 8.



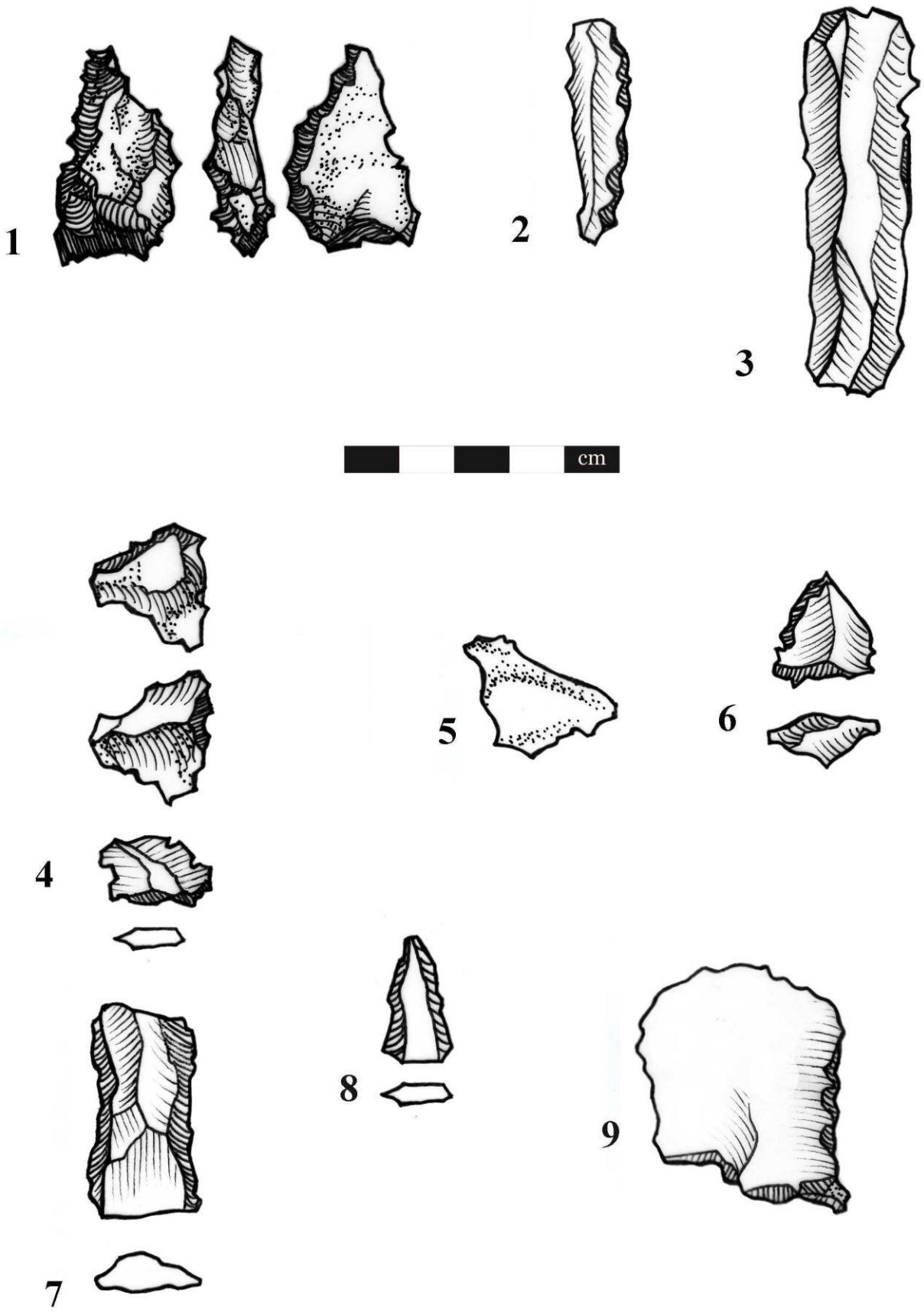
1-9 ***Kremenac - Čitluk***

TABLE 9.



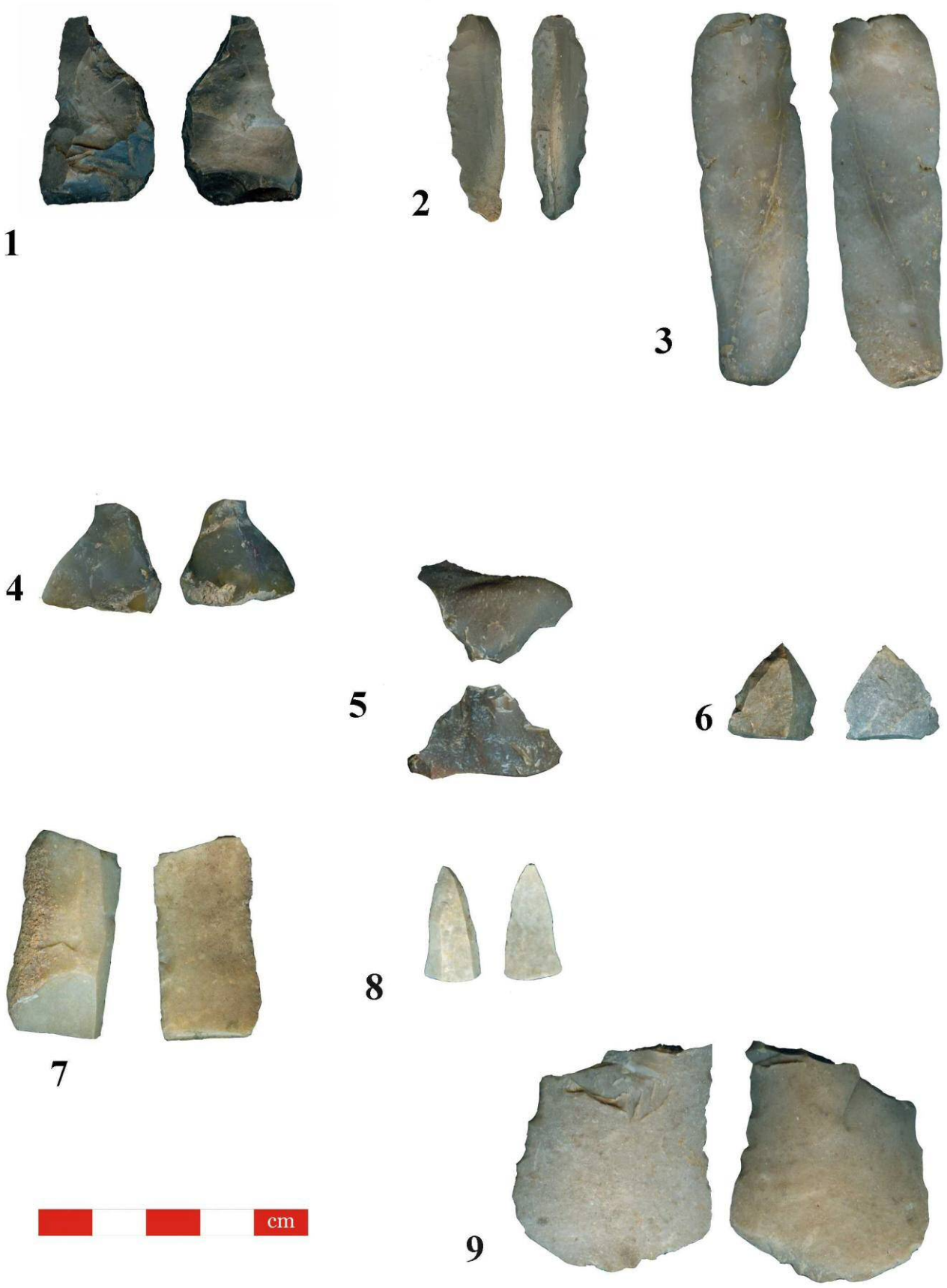
1-9 ***Kremenac - Čitluk***

TABLE 10.

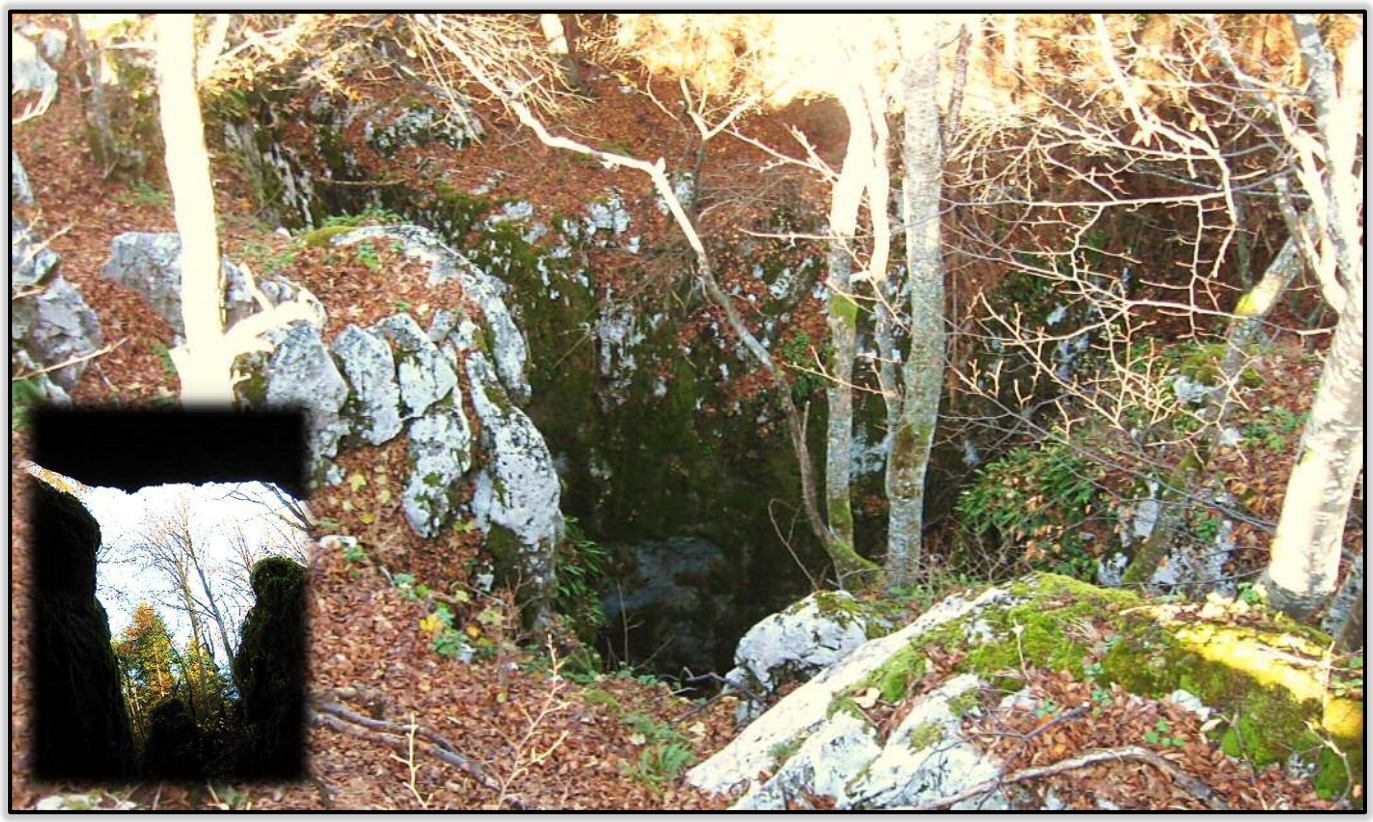


1-3 ***Vrelo fields*****; 4-9** ***Vrelska čuka***

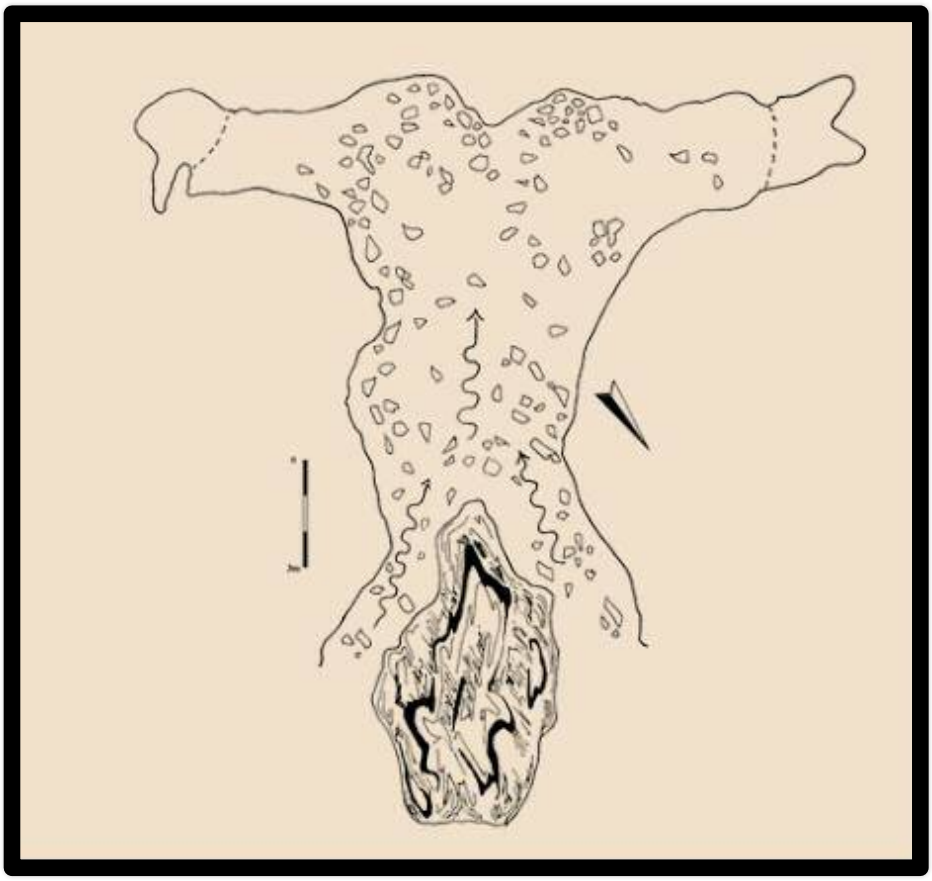
TABLE 11.



1-3 ***Vrelo fields*****; 4-9** ***Vrelska čuka***



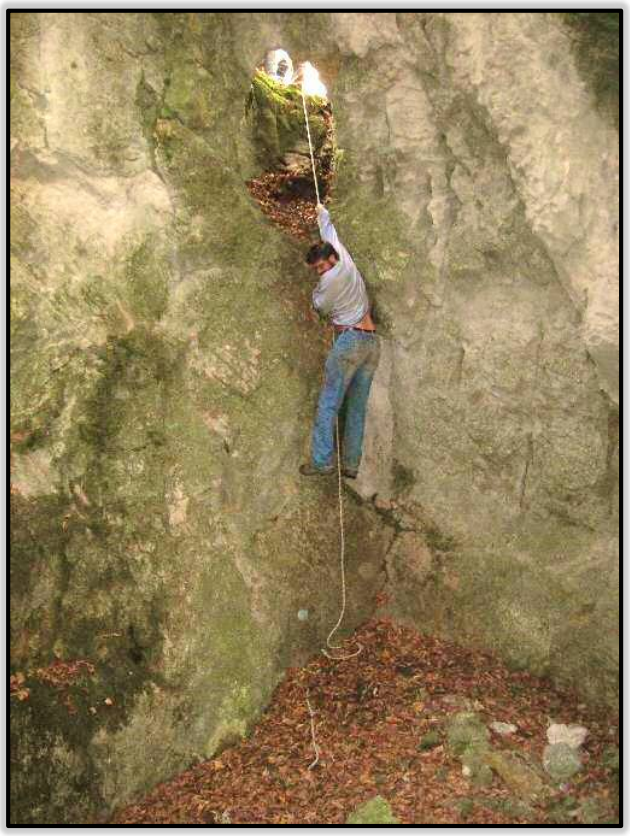
Сл. 1. Јеленска пећура улаз у јаму.
Fig.1. Jelenska pećura, pit entrance.



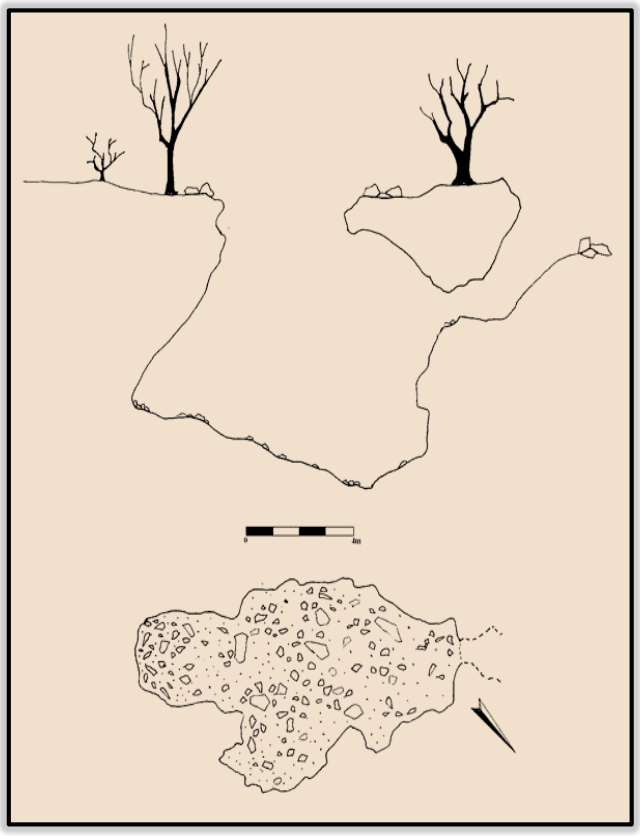
Сл.2. Јеленска пећура, план основе.
Fig. 2. Jelenska pećura, ground plan.

Сл. 3. Рупа Прозорка, велики улаз.
Fig. 3. Rupa Prozorka, big entrance.

Сл. 4. Рупа прозорка, мали улаз.
Fig. 4. Rupa Prozorka, small entrance.

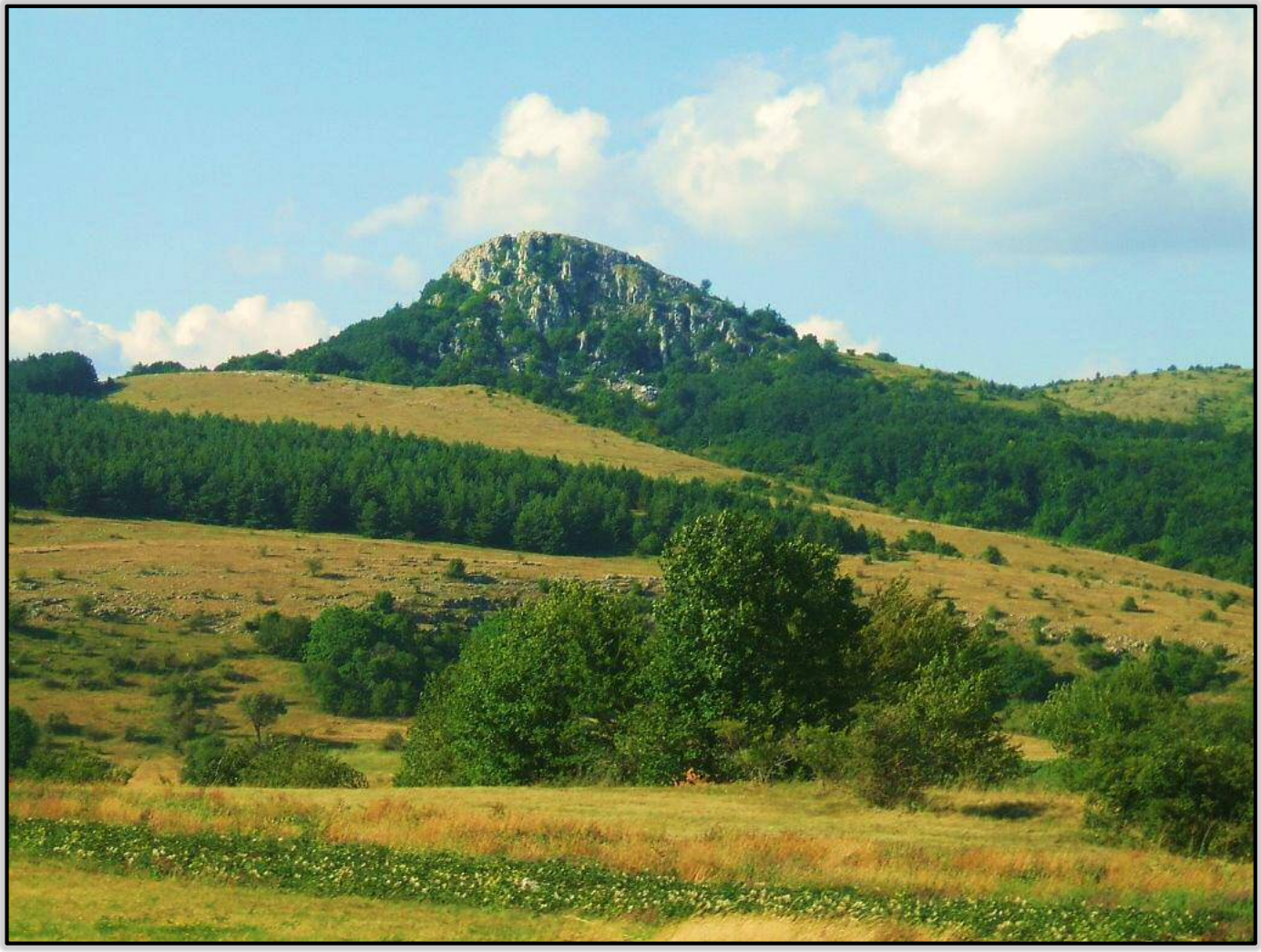


Сл. 5. Рупа Прозорка, поглед на мали улаз из јаме.
Fig. 5. Rupa Prozorka, view on small entrance from the pit.



Сл. 6. Рупа Прозорка, пресек (горе) и план основе (доле).
Fig. 6. Rupa Prozorka, section (above) and ground plan (below).

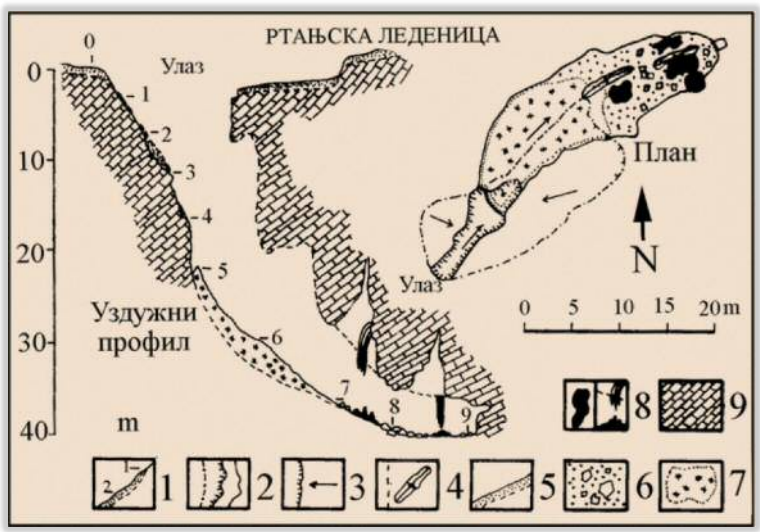
Сл. 7. Орловачка јама, поглед на улаз из унутрашњости јаме и пресек јаме
Fig. 7. Orlovačka jama, view on pit entrance from the pit interior and pit section.



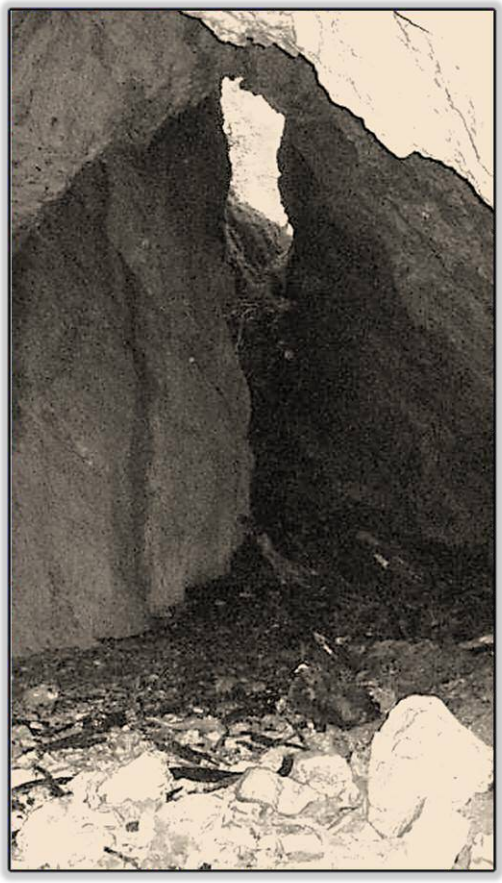
Сл. 8.Оштра чука *(фото. Младен Антић)*
Fig. 8.Oštra čuka *(photo by Mladen Антић)*

Сл. 9.Јама под Оштром чуком, улаз.
Fig. 9. Jama pod Oštrom čukom, pit entrance.

Сл. 10. Ртањска леденица, улазни отвор.
Fig. 10. Rtanjska ledenica, pit entrance.

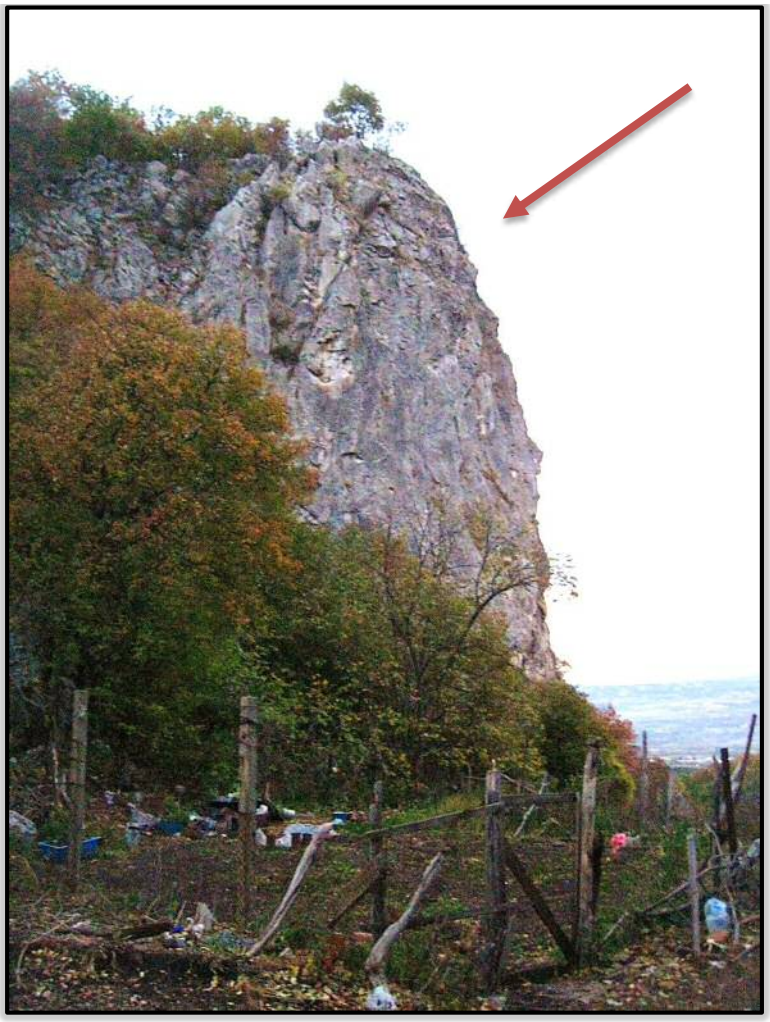


Сл. 11. Ртањска леденица, план основе и пресек јаме: 1. тачке осматрања климатских елемената, 2. ниво улазне депресије, ниво јамског улаза, ниво јамске дворане, 3. одсек, нагиб, 4. приближно оџак-кубе у таваници, 5. педолошки слој, стеља, 6. кречњачки блокови и дробина, 7. наслаге снега, 8. наслаге леда (план, профил), 9. поремећени слојевити кречњак (из: Нешић 2002: Ск. 2).
Fig. 11. Rtanjska ledenica, ground plan and pit section: 1. points of climatological observations, 2. level of entrance depression, level of pit entrance, level of pit hall, 3. intersection, slope, 4. approximate chimney-dome, 5. pedological layer, detritus, 6. limestone boulders and gravel, 7. snow deposit, 8. ice deposit (plan, section), 9. disturbed layered limestone (from: Нешић 2002: Ск. 2).



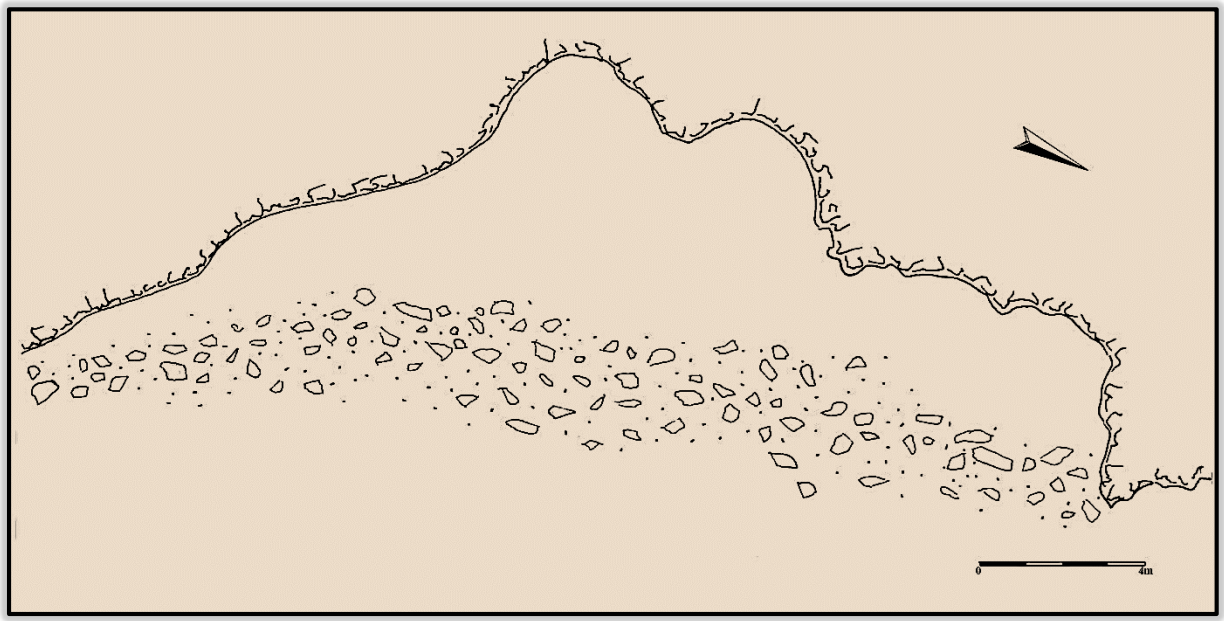
Сл. 12. Ртањска леденица, улазни отвор из унутрашњости јаме.
Fig. 12. Rtanjska ledenica, pit entrance from the pit interior.

Сл. 13. Татумирова поткапина, поглед са југоистока на објекат.
Fig. 13. Tatumirova rockshelter, view from south-east.



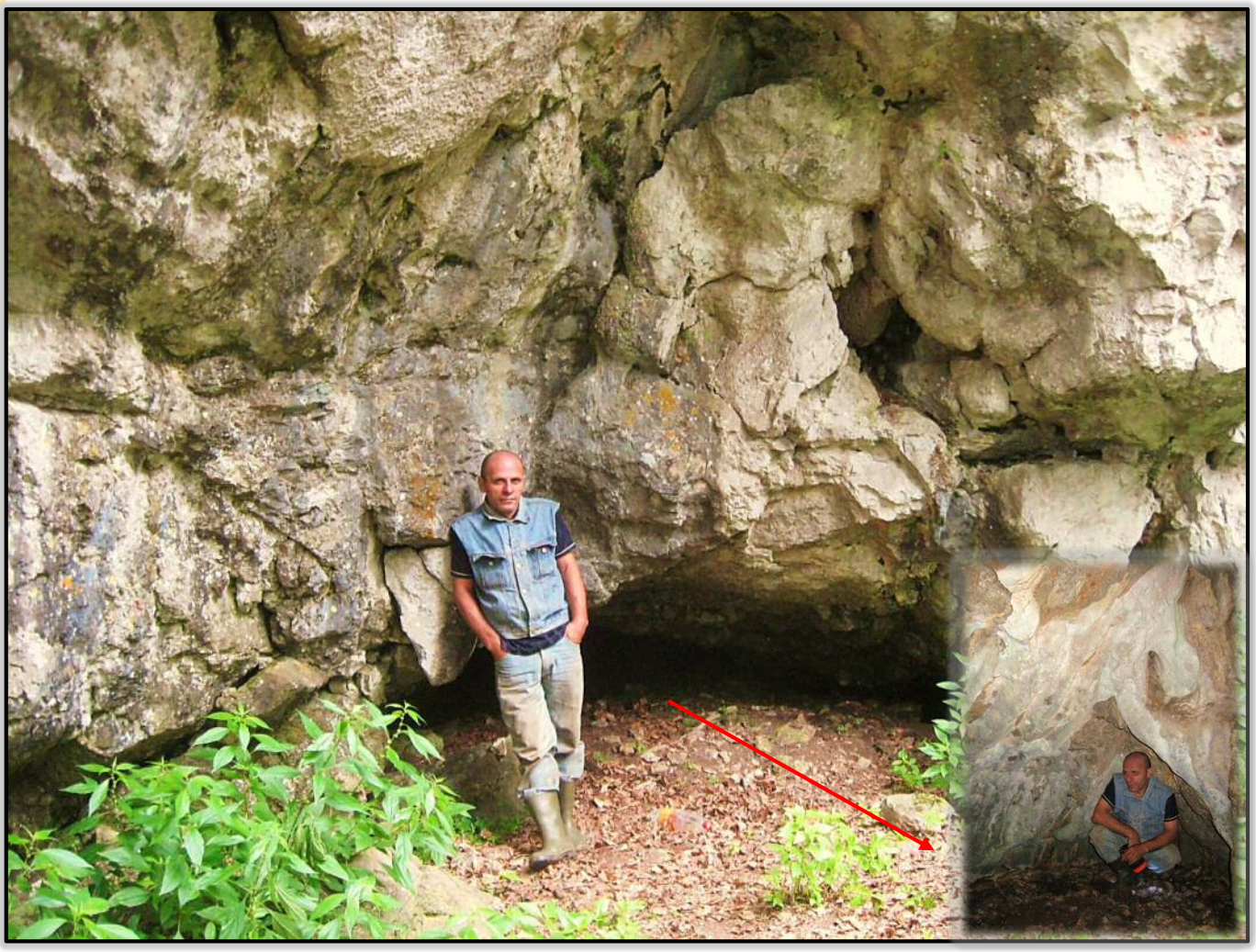
Сл. 14. Татумирова поткапина, поглед на литице са југозапада.
Fig. 14. Tatumirova rockshelter, view on cliffs from south-west.

Сл. 15. Градашњичка поткапина, поглед са југоистока.
Fig. 15. Gradašnjička rockshelter, view from south-east.

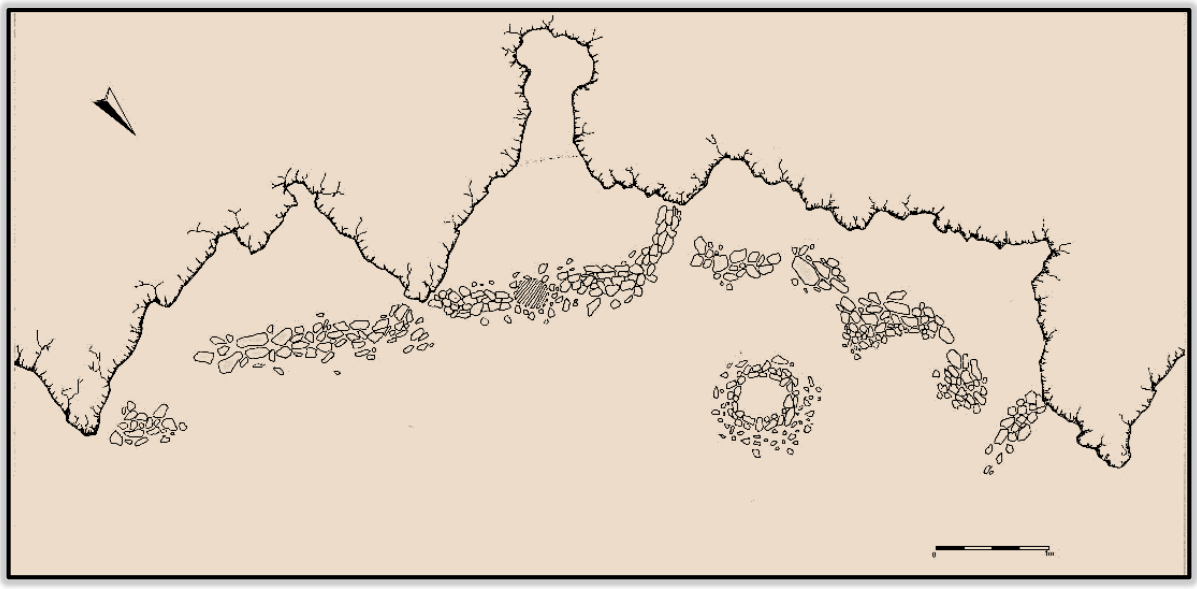


Сл. 16.Градашњичка поткапина, план основе.
Fig. 16. Gradašnjička rockshelter, ground plan.

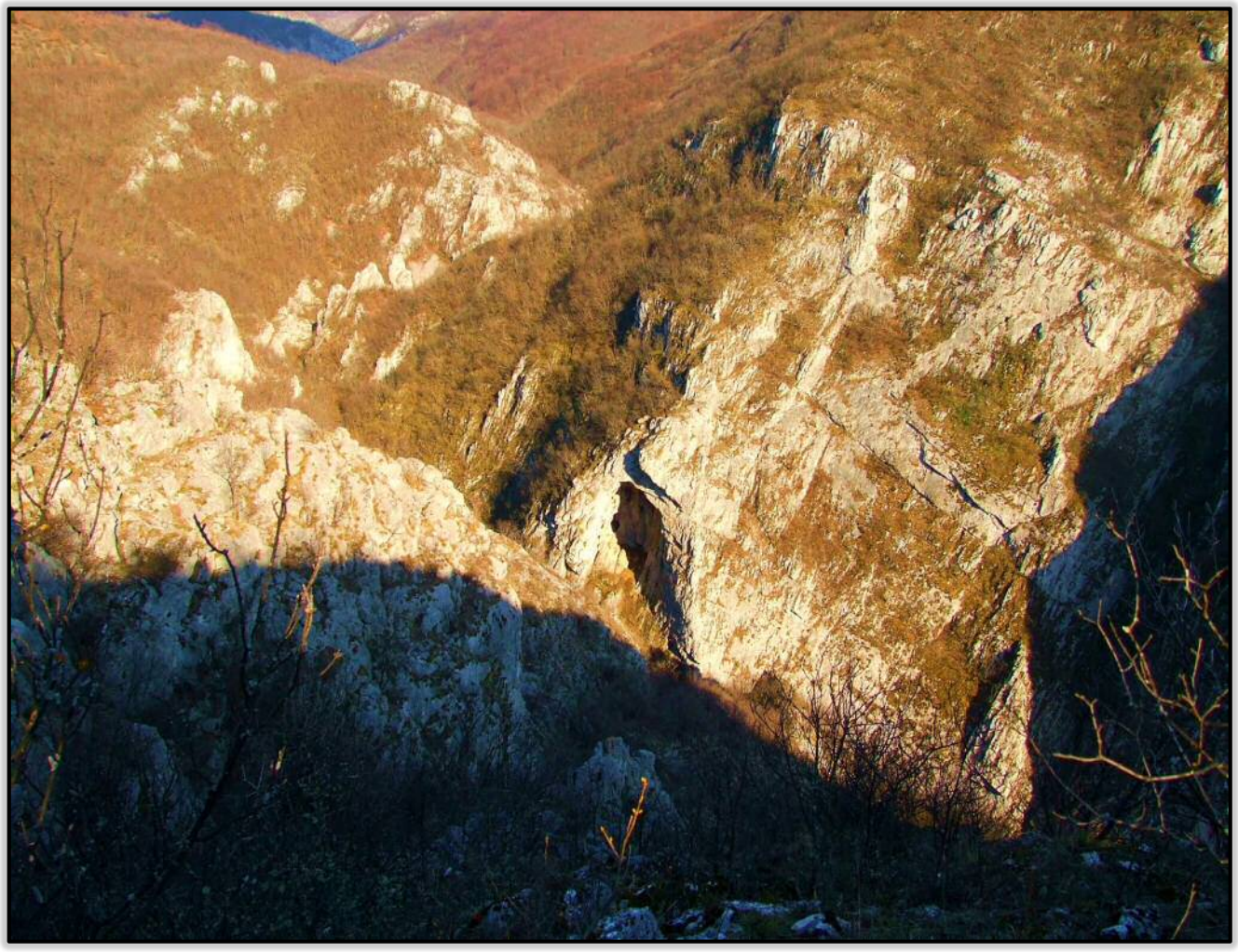
Сл. 17. Мечија поткапина, поглед на објекат са југозапада.
Fig. 17. Mečija rockshelter, view from south-west.



Сл. 18. Поткапина Раван, поглед на централни и унутрашњи део објекта са севера.
Fig. 18. Ravan rockshelter, view of central and inner part of object from north.



Сл. 19. Поткапина Раван, план основе
Fig. 19. Ravan rockshelter, ground plan.

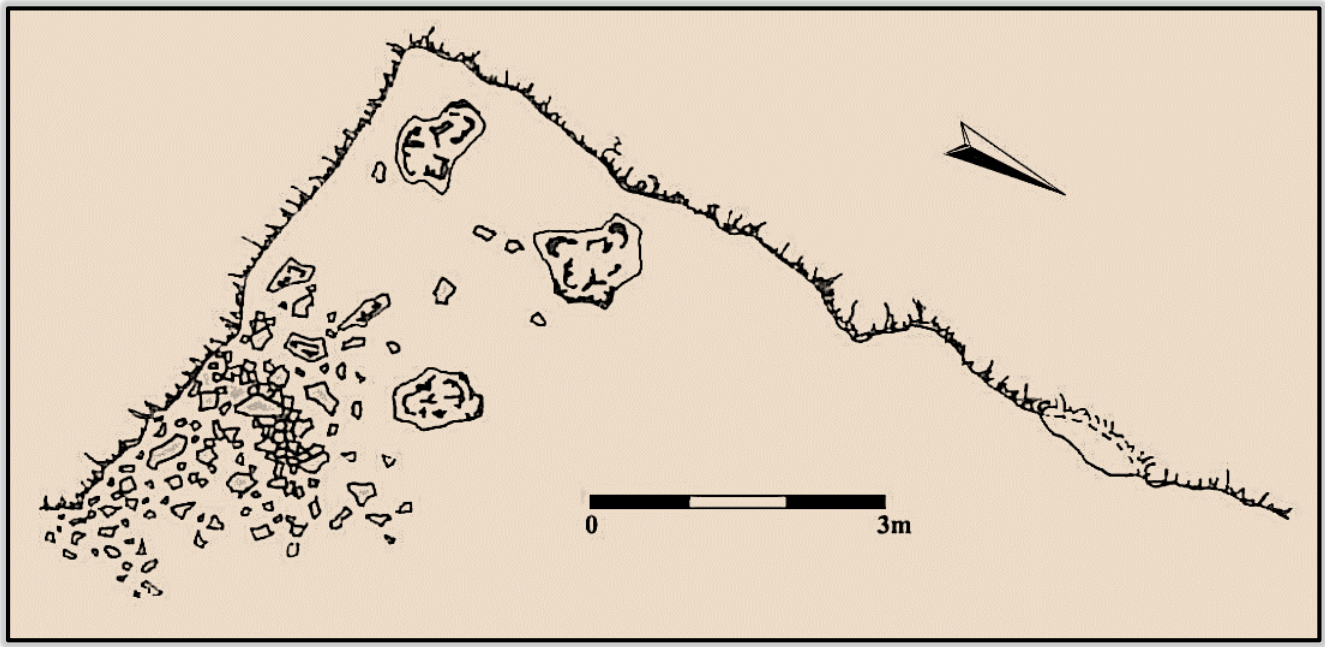


Сл. 21. Поткапина Црквиште, поглед са брда Градац
Fig. 21. Rockshelter Crkvište, view from hill Gradac.

Сл. 22. Поткапина Црквиште, поглед са брда Градац
Fig. 22. Rockshelter Crkvište, view of entrance from south-west

Сл. 22. Поткапина Црквиште, остаци старе арх.сонде уз источни зид
Fig. 22. Rockshelter Crkvište, old arh. trench along east wall

Сл. 23. Големопадинска поткапина, поглед са истока.
Fig. 23. Golemopadinska rockshelter, view from east.

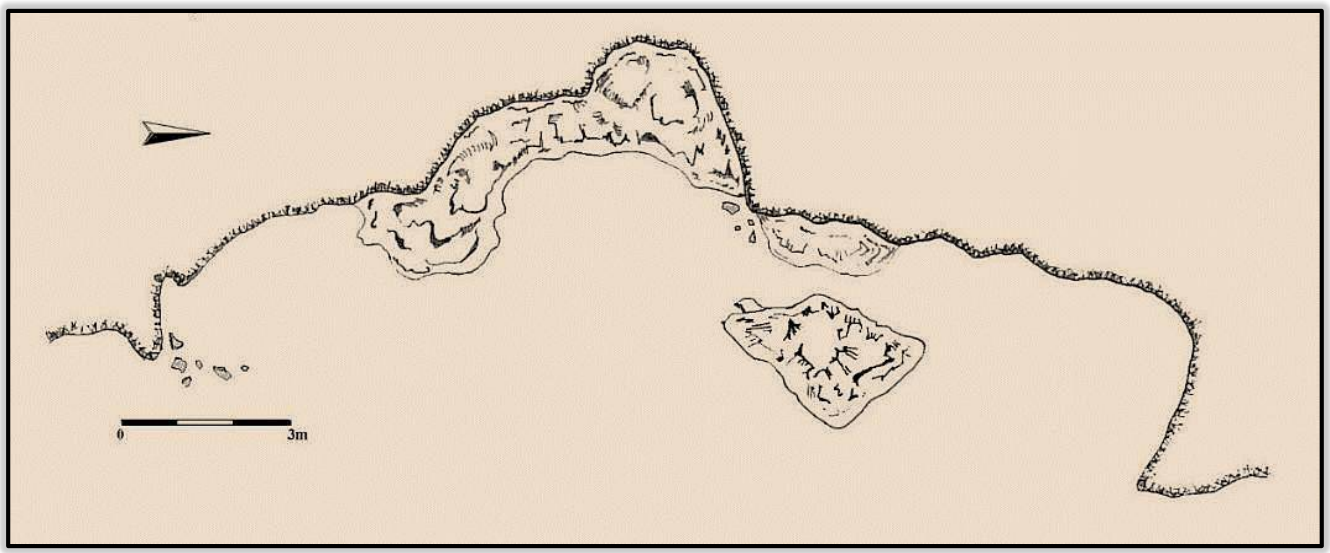


Сл. 24. Големопадинска поткапина, план основе.
Fig. 24. Golemopadinska rockshelter, ground plan.

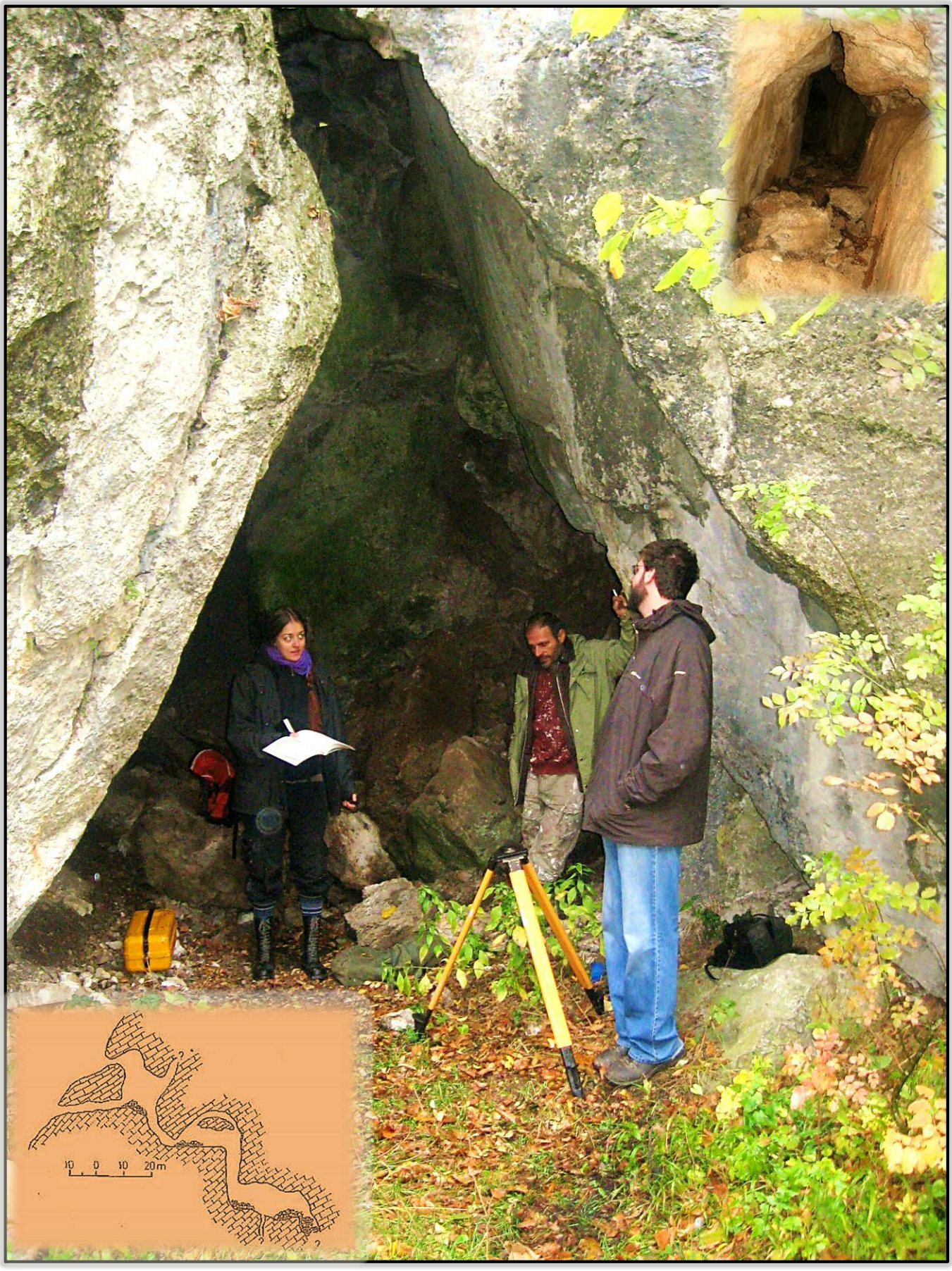
Сл. 25. Сокоградске литице са положајем Сокоградске поткалине.
Fig. 25. Sokograd cliffs and location of Sokograd rockshelter.

Сл. 26. Врелска поткапина, поглед са Врелске чуке.
Fig. 26. Vrelska čuka rockshelter, view from Vrelska čuka.

Сл.27. Пољански камен, поглед са истока.
Fig. 27. Poljanski kamen, view from east.

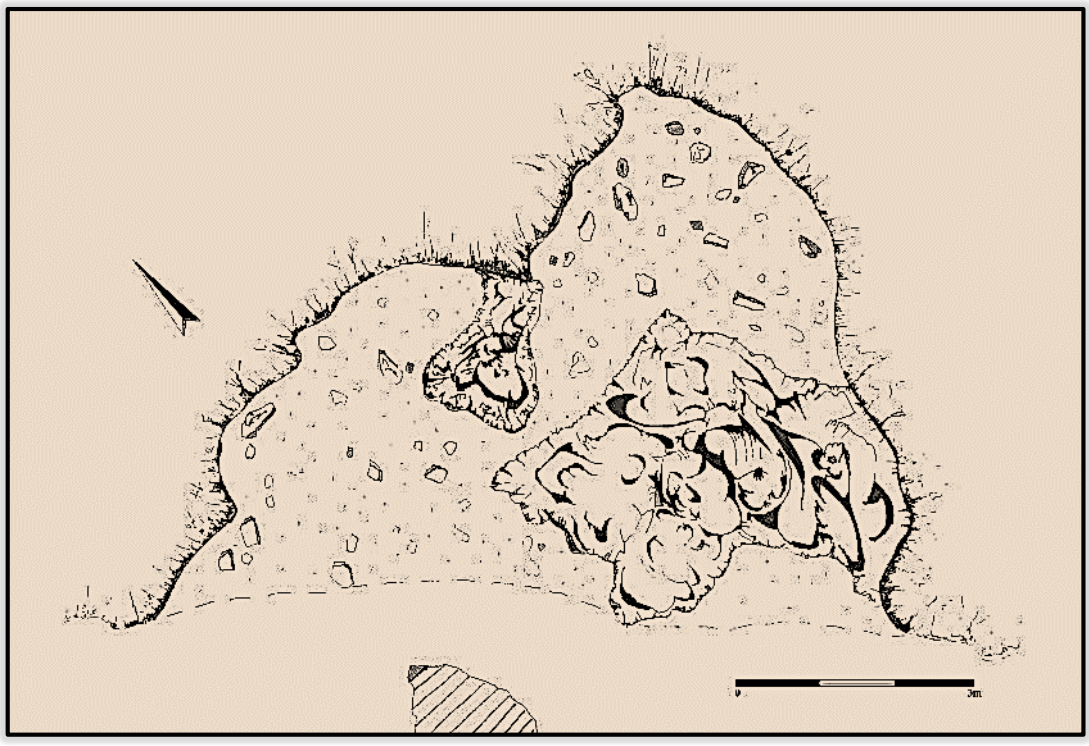


Сл. 28. Пољански камен, план основе.
Fig. 28. Poljanski kamen, ground plan.



Сл. 29. Озренска пећина, улаз у пећину, пећински ходник и уздужни пресек (цртеж из Petrović 1974).
Fig. 29. Ozrenska cave, cave entrance, cave hallway, longitudinal section (drawing from Petrović 1974).

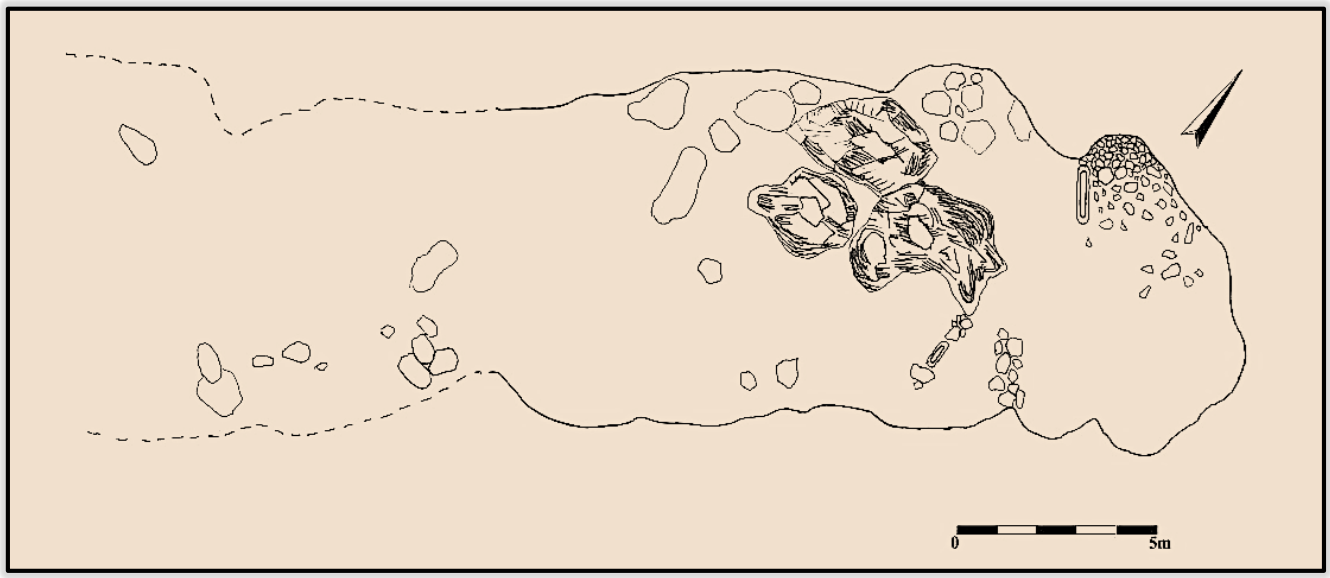
Сл. 37. Мечја рупа, улазни отвор и поглед на положај пећине из дворишта специјане болнице „Озрен“.
Fig. 37. Mečija rupa, cave entrance and view on cave location from yard of „Ozren“ medical facility.



Сл. 31. Мечја рупа, план основе.
Fig. 31. Mečja rupa cave, ground plan.

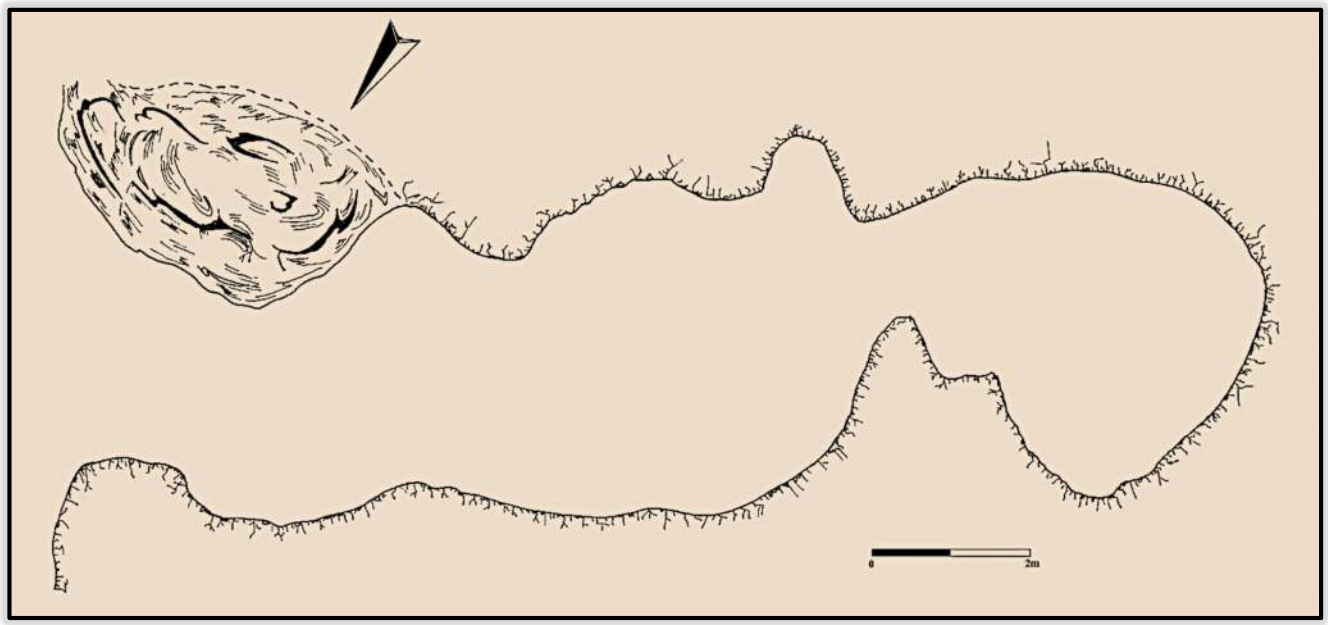
Сл. 32. Црвена рупа, пећински стуб велике дворане и данашњи изглед пећинског улаза
Fig. 32. Crvena rupa, cave column in the big chamber and present cave entrance

Сл. 33. Леденик, улаз у пећину.
Fig. 33. Ledenik, cave entrance.



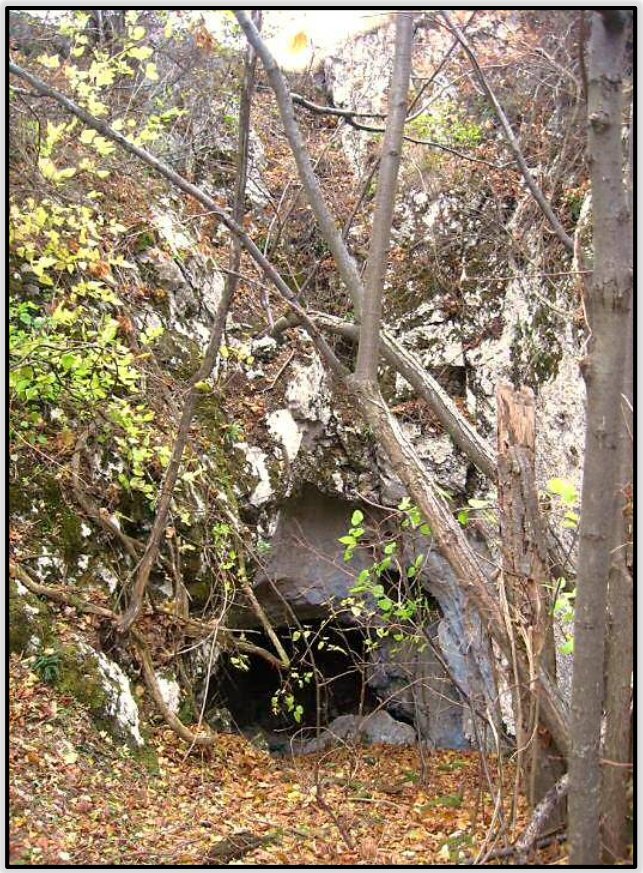
Сл. 34. Леденик, план основе.
Fig. 34. Ledenik, ground plan.

Сл. 35. Пећина код Стрелишта, улаз у пећину.
Fig. 35. Cave near Strelište, cave entrance

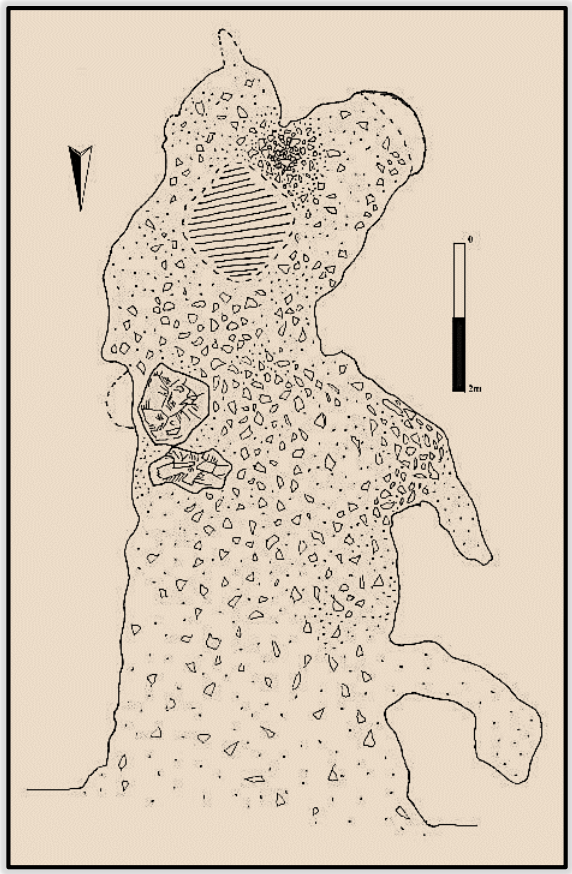


Сл. 36. Пећина код Стрелишта, план основе.
Fig. 36. Cave nesar Strelište, ground plan.

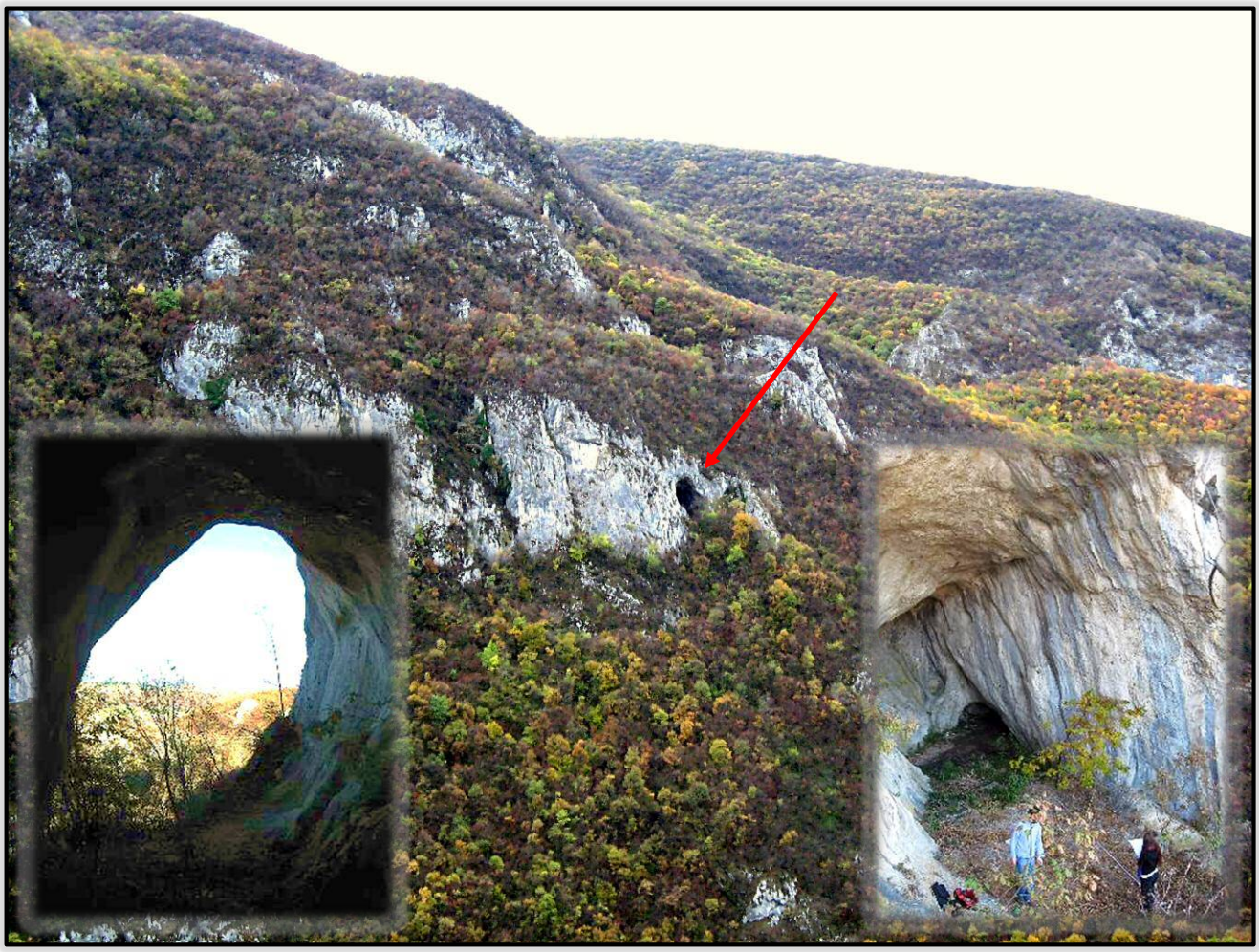
Сл. 37. Големопадинска пећина 1, план основе.
Fig. 37. Golemopadinska cave 1, ground plan.



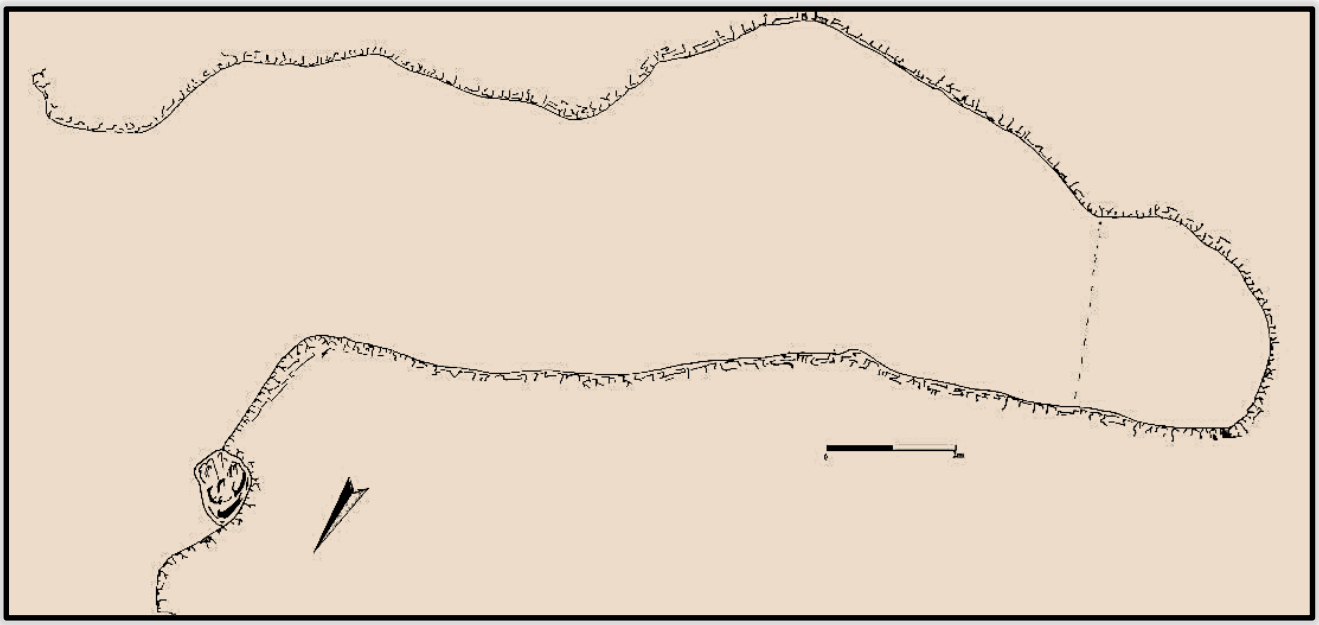
Сл. 38. Големопадинска пећина 2, улаз у пећину.
Fig. 38. Golemopadinska cave 2, cave entrance.



Сл. 39. Големопадинска пећина 2, план основе.
Fig. 39. Golemopadinska cave 2, ground plan.



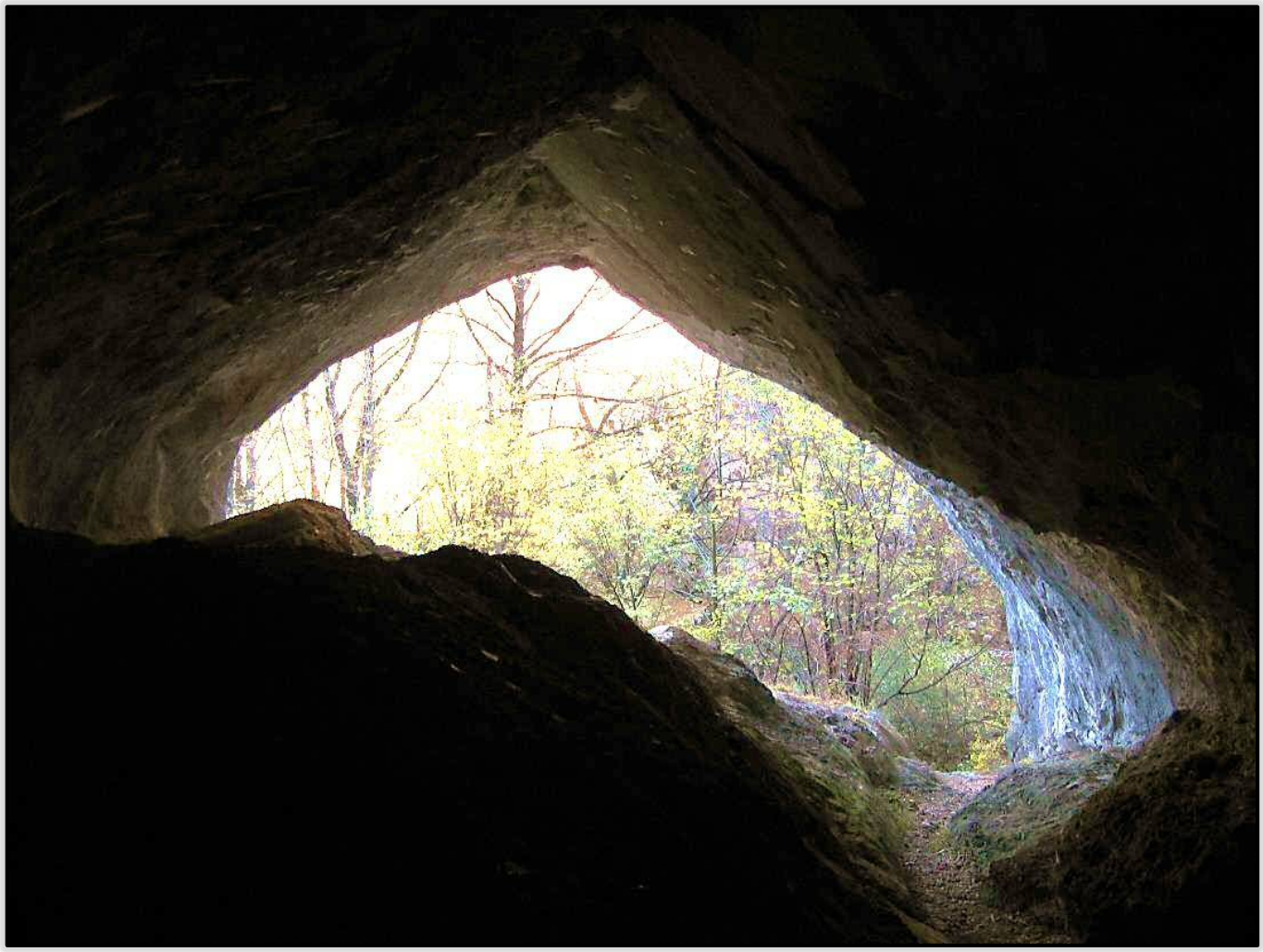
Сл. 40. Лептеријска пећина, положај пећине, пећински улаз и унутрашњост објекта.
Fig. 40. Lepterijska cave, view on cave location from yard of Sokograd fort, cave entrance, cave interior.



Сл. 41. Лептеријска пећина, план основе.
Fig. 41. Lepterijska cave, ground plan.

Сл. 42. Маркова пећина, поглед на улаз из унутрашњости пећине и поглед на положај пећине са Сокоградске тврђаве.
Fig. 42. Markova cave, view on entrance from the cave interior and view on cave location from yard of Sokograd fort .

Сл. 43. Маркова пећина, план основе.
Fig. 43. Markova cave, ground plan.



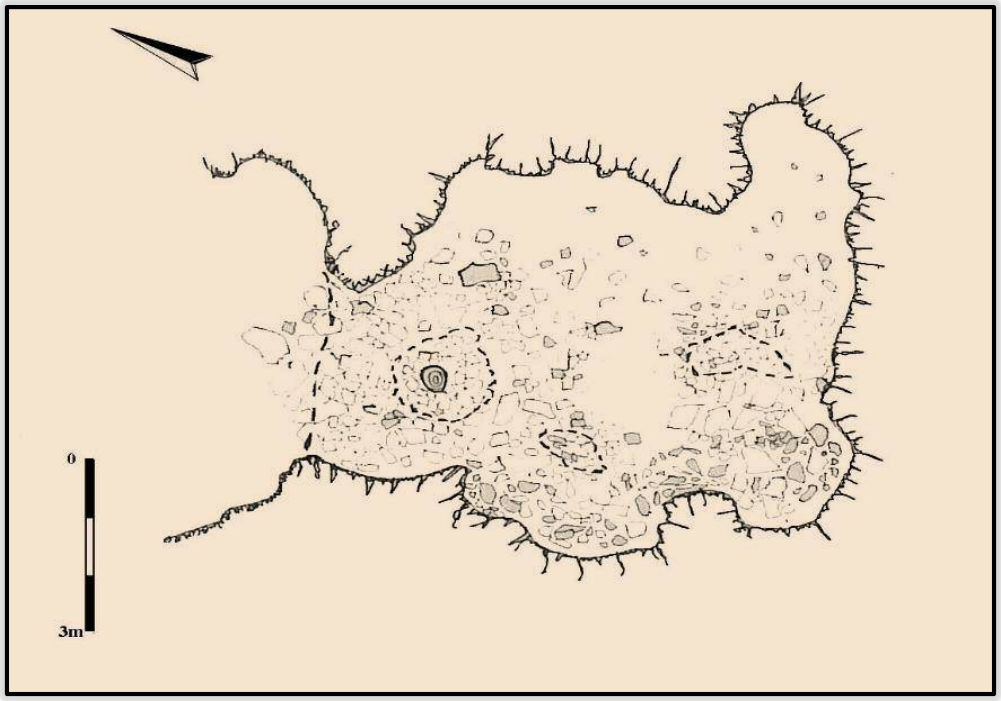
Сл. 46. Поповичка пећина, поглед на улаз из унутрашњости пећине.
Fig. 46. Popovička cave, view on entrance from the cave interior.

Сл. 45. Поповичка пећина, поглед на пећински улаз и локални пејзаж.
Fig. 45. Popovička cave, view on cave entrance and local landscape.

Сл. 46. Влашка пећина, унутрашњост објекта и пећински улаз изнутра и споља
Fig. 46. Vlaška cave, cave interior and cave entrance from inside and outside the cave

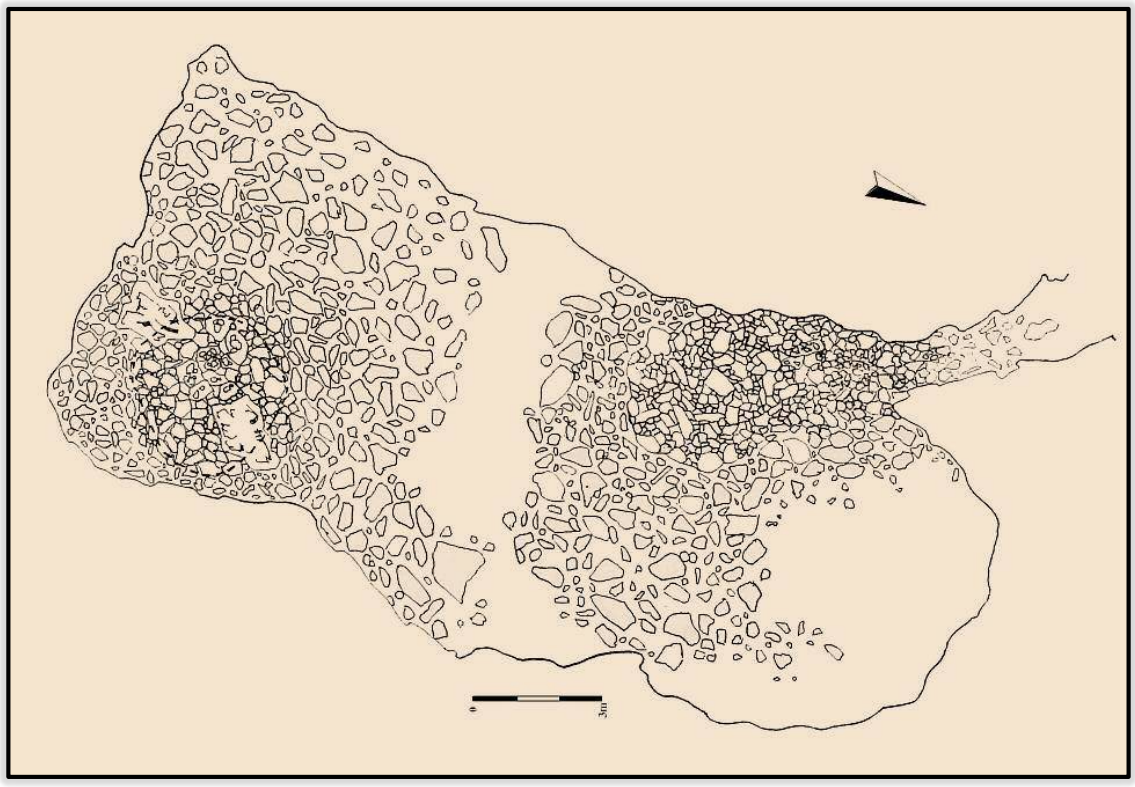
Сл. 47. Влашка пећина, план основе.
Fig. 47. Vlaška cave, ground plan.

Сл. 61. Језерска пећина, пећински улаз.
Fig. 61. Jezerska cave, cave entrance.

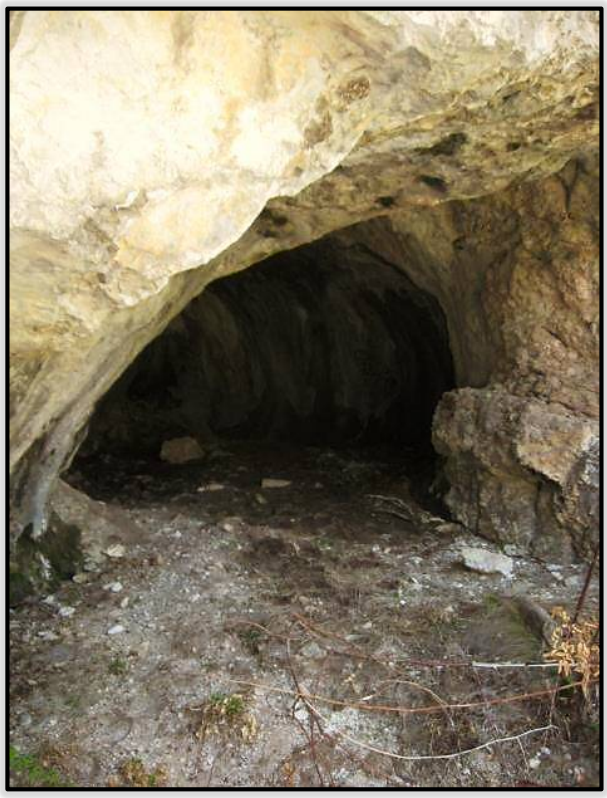


Сл. 49. Језерска пећина, пални основе.
Fig. 49. Jezerska cave, ground plan.

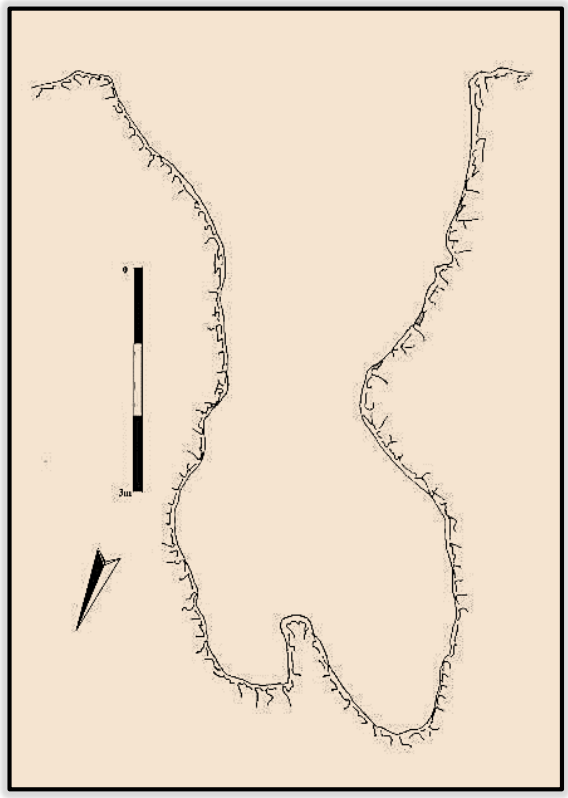
Сл. 50. Власина пећина, унутрашњост и пећински улаз
Fig. 50. Vlasina cave, interior and cave entrance



Сл. 51. Власина пећина, план основе.
Fig. 51, Vlasina cave, ground plan.

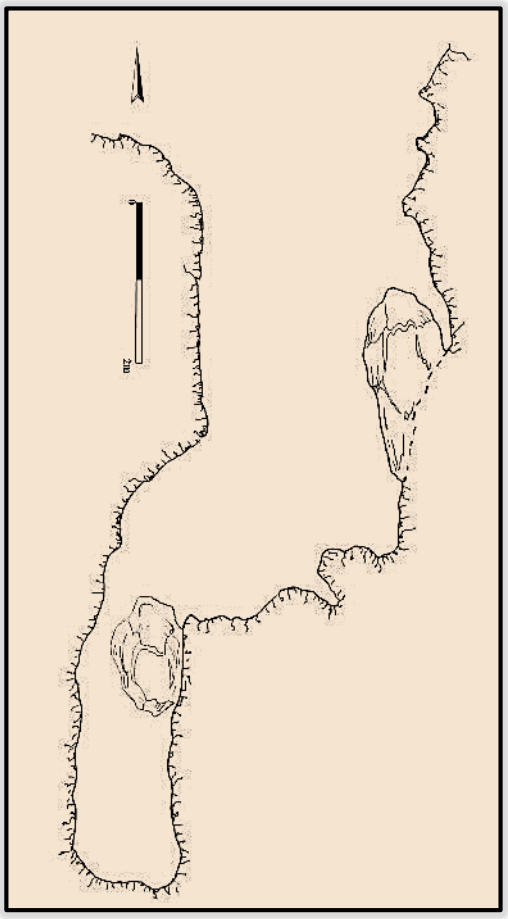


Сл. 52. Раденковски камен, улаз.
Fig. 52. Radenkovski kamen, entrance.

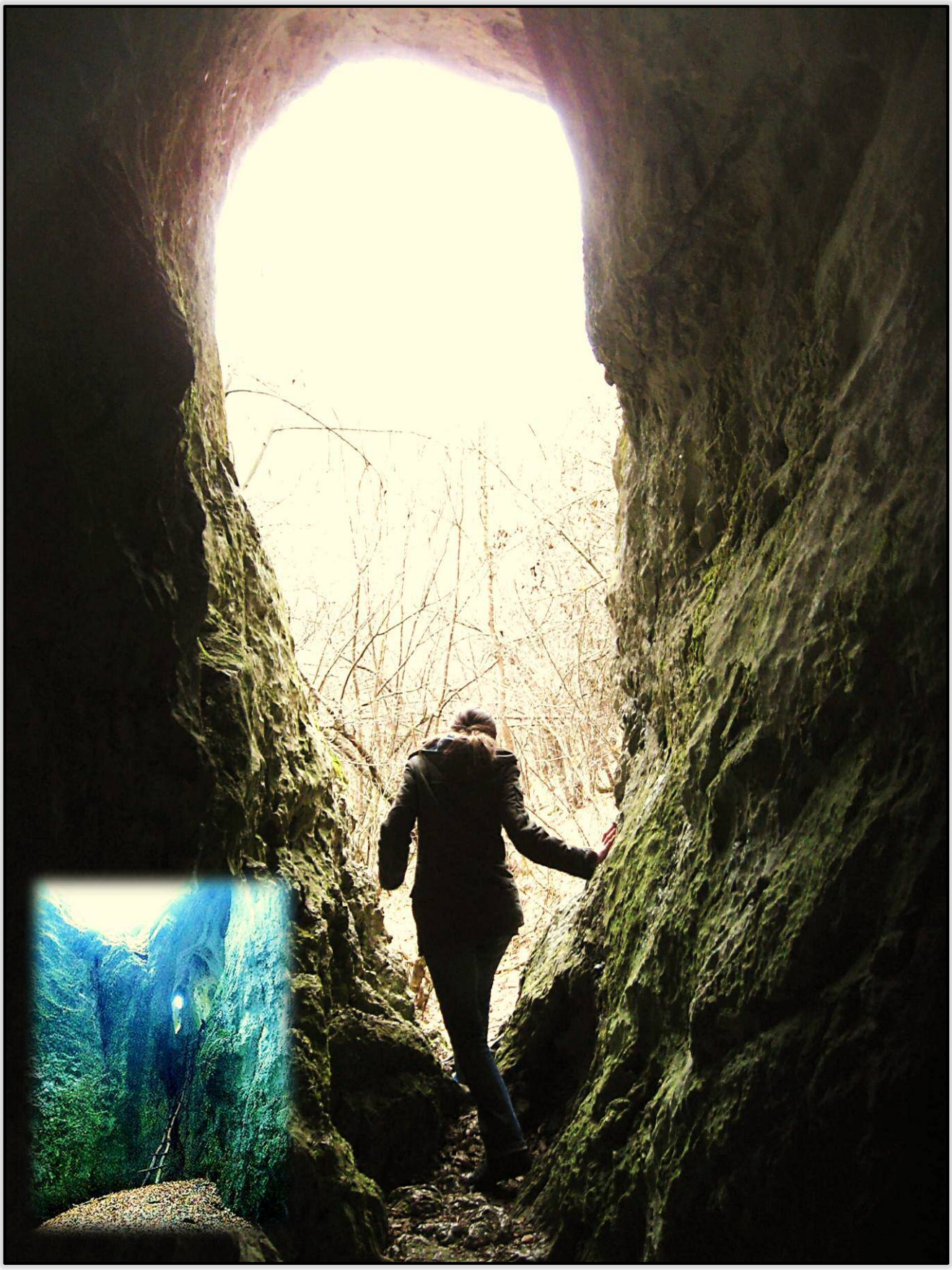


Сл. 53. Раденковски камен, план основе.
Fig. 53. Radenkovski kamen, ground plan.

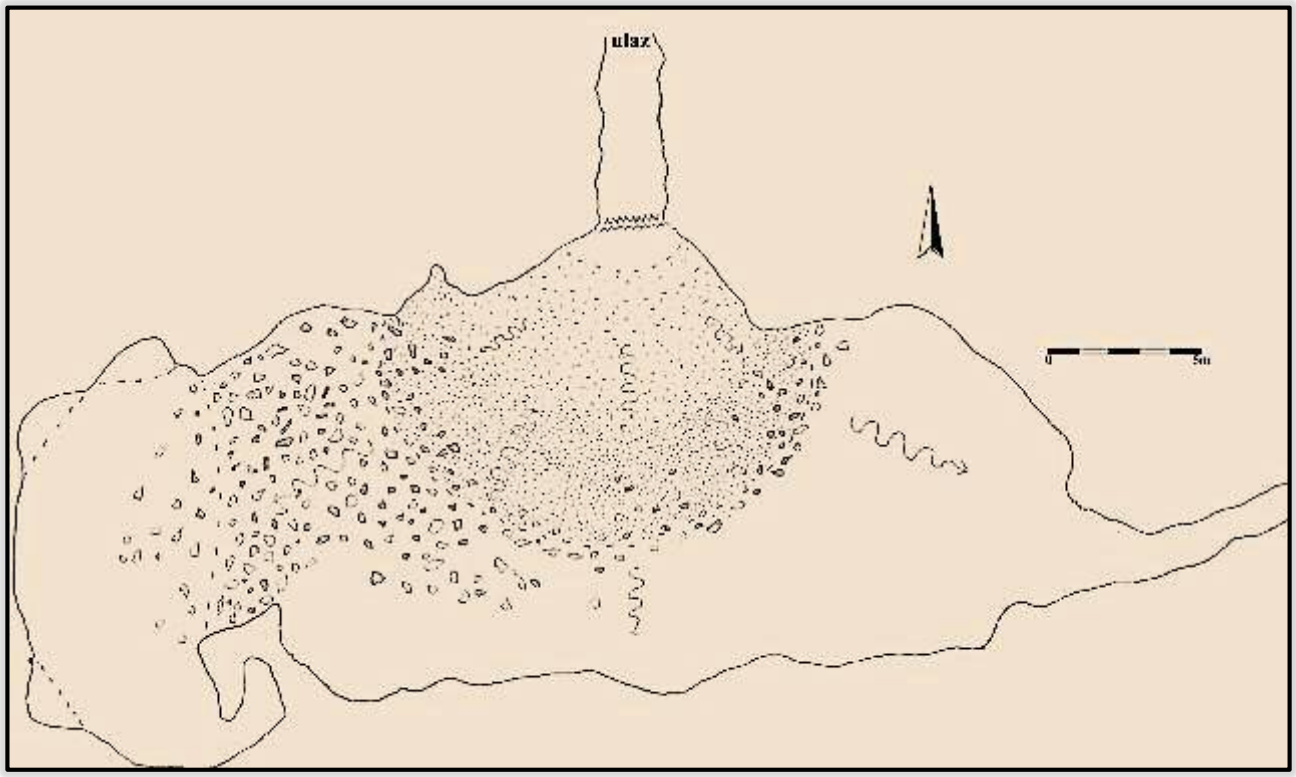
Сл. 54. Говеђа пештера, улаз.
Fig. 54. Goveđa peštera, entrance.



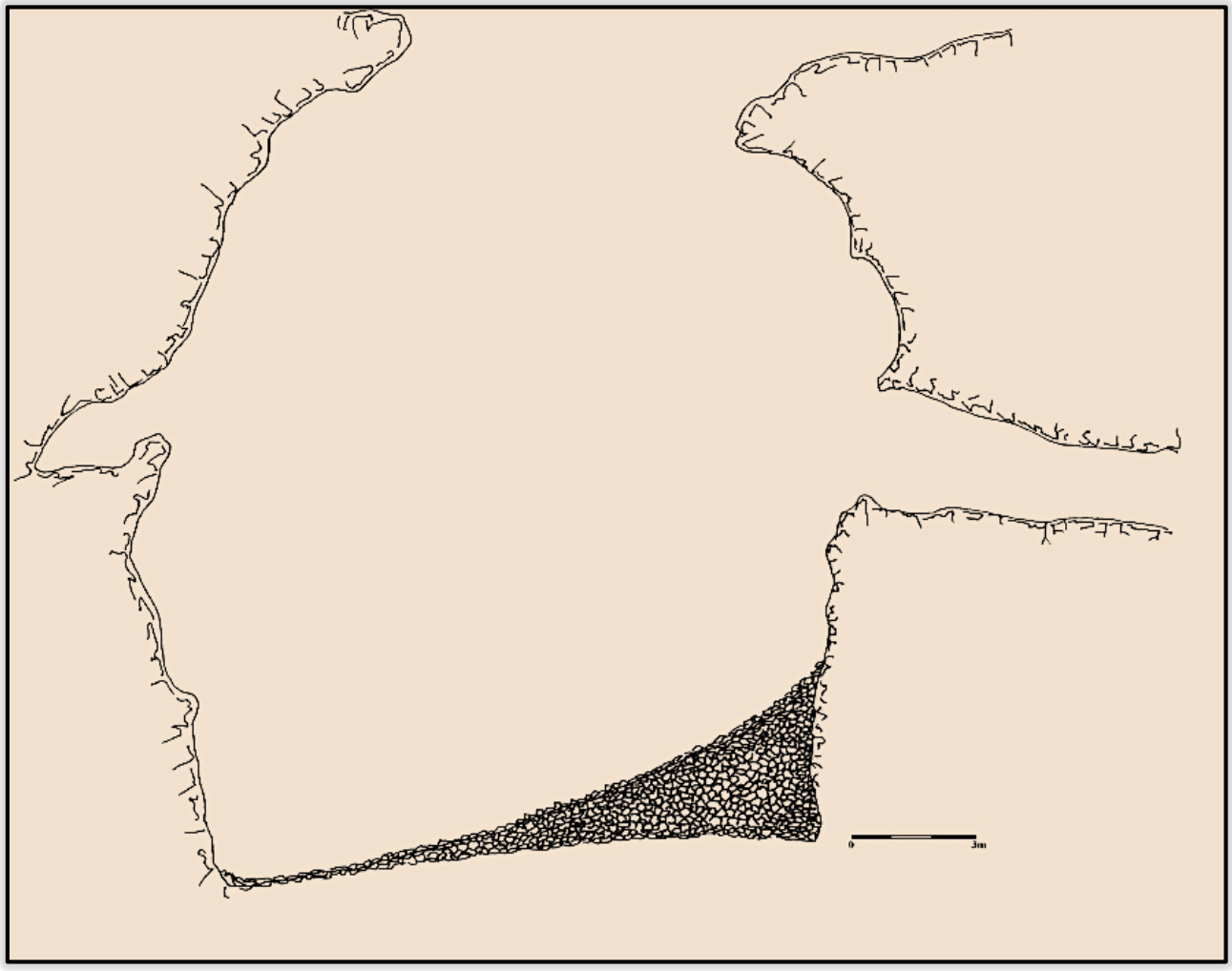
Сл. 55. Говеђа пештера, план основе.
Fig. 55. Goveđa peštera, ground plan.



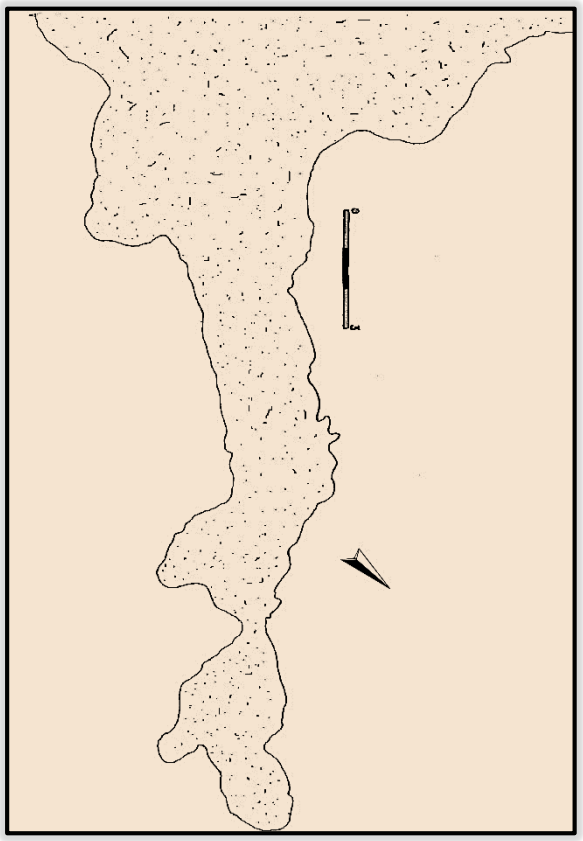
Сл. 56. Читлучка пећина, поглед на улаз из улазног ходника пећине и главна дворана пећине.
Fig. 56. Čitlučka cave, view on entrance from the entrance passage and main hall of the cave.



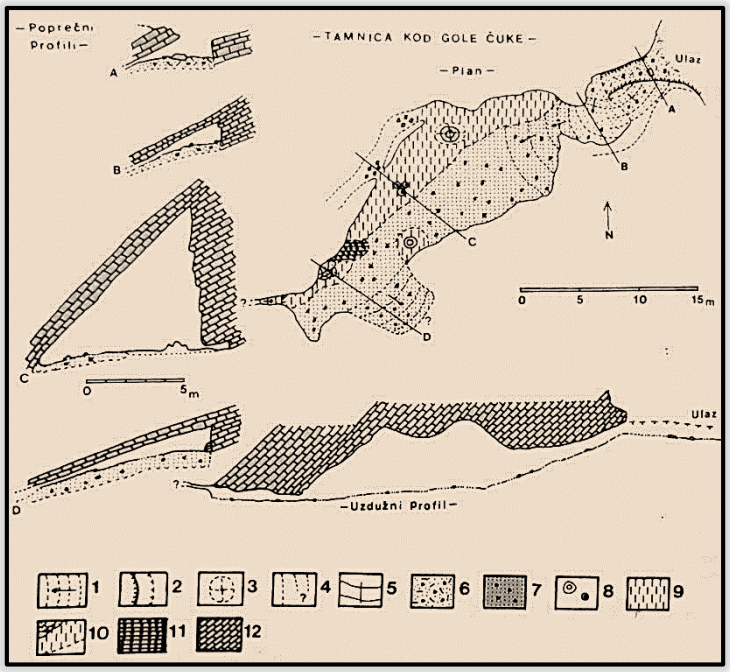
Сл. 57. Читлучка пећина, план основе.
Fig. 57. Čitlučka cave, ground plan.



Сл. 58. Читлучка пећина, уздужни пресек.
Fig. 58. Čitlučka cave, longitudinal section.



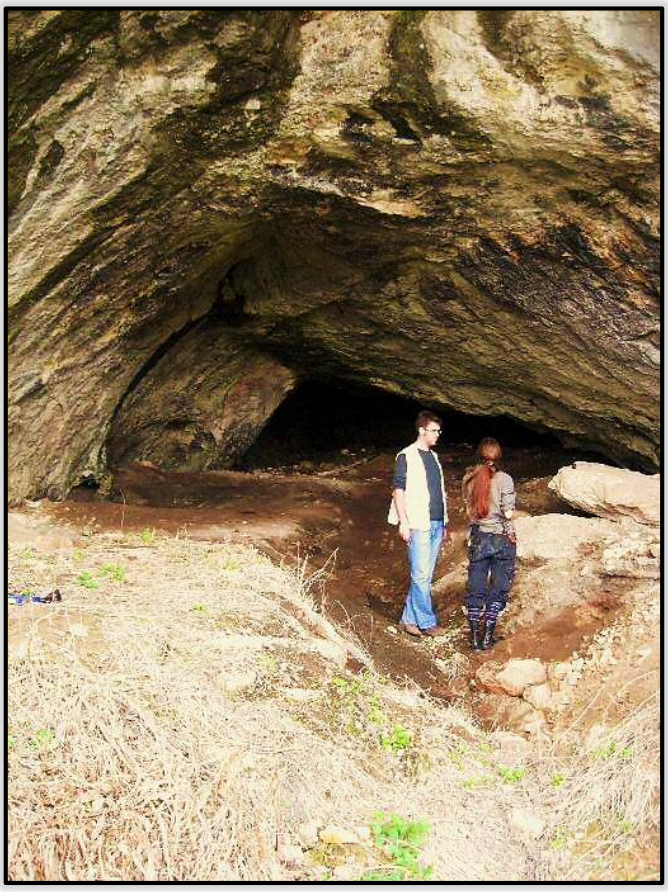
Сл. 59. Дугопољска пећина, план основе.
Fig. 59. Dugopoljska cave, ground plan.



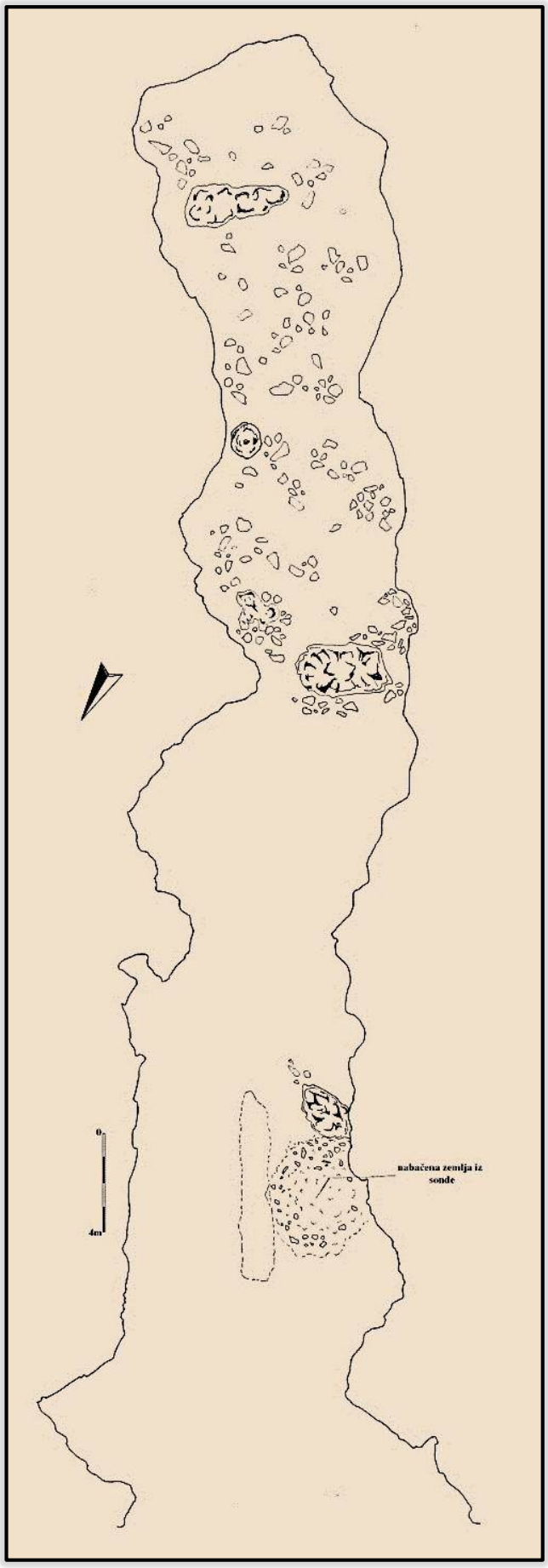
Сл. 60. Тамница, план основе и пресек: 1. нагиб канала, 2. одсек, 3. оџак (план), 4. приближне димензије, 5. положај попречног пресека канала, 6.стења и кречњачка дробина, 7. глина и кречњачка дробина, 8. сталагмити (план), 9.сига, травертинске наслаге (салив), 10. сига, травертинске каде (зидно-подни салив), 11. пећинска бреча, 12. поремећени слојевити кречњак. (из Nešić, 2001, Skica 63).
Fig. 60. Tamnica, ground plan and cave section: 1. slope, 2. intersection, 3. chimney, 4. approximate measurements, 5. channel transverse section, 6. detritus and limestone gravel, 7. clay and limestone gravel, 8. stalagmites (plan), 9. tufa, travertine deposits (flowstone), 10., tufa, travertine pools (wall-ground flowstone), 11. cave breccia, 12. disturbed layered limestone (from Nešić, 2001).

Сл. 61. Пећина у Стурњаку, поглед на пејзаж око пећинског учаза.
Fig. 61. Cave in Sturnjak, view of landscape around the cave entrance.

Сл. 62. Пећурски камен, локација пећине у клисура Изгара.
Fig. 63. Pećurski kamen, cave location and Izgara gorge.



Сл. 64. Пећурски камен, пећински улаз и једна од археолошких сонди.
Fig. 64. Pećurski kamen, cave aentrance and one of the archaeologiacl trenches.

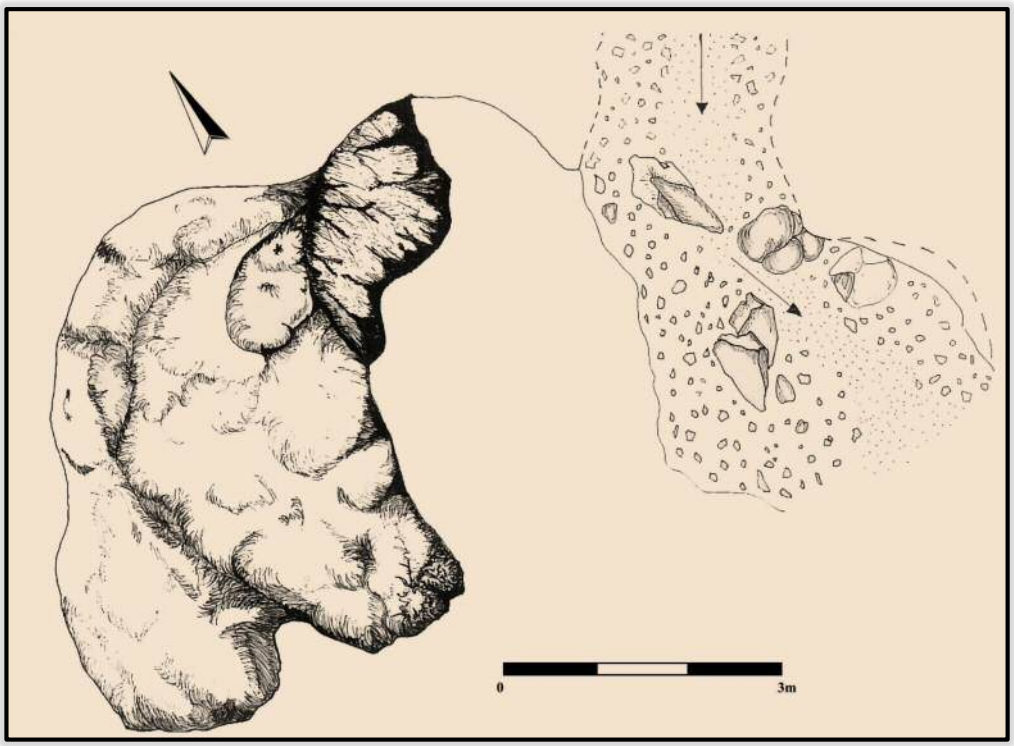


Сл. 65. Пећурски камен, план основе.
Fig. 65. Pećurski kamen, ground plan.

Сл. 66. Пећурски камен, поглед на улаз и археолошке сонде из унутрашњости пећине
Fig. 66. Pećurski kamen, view on entrance and archaeological trenches from cave interior.

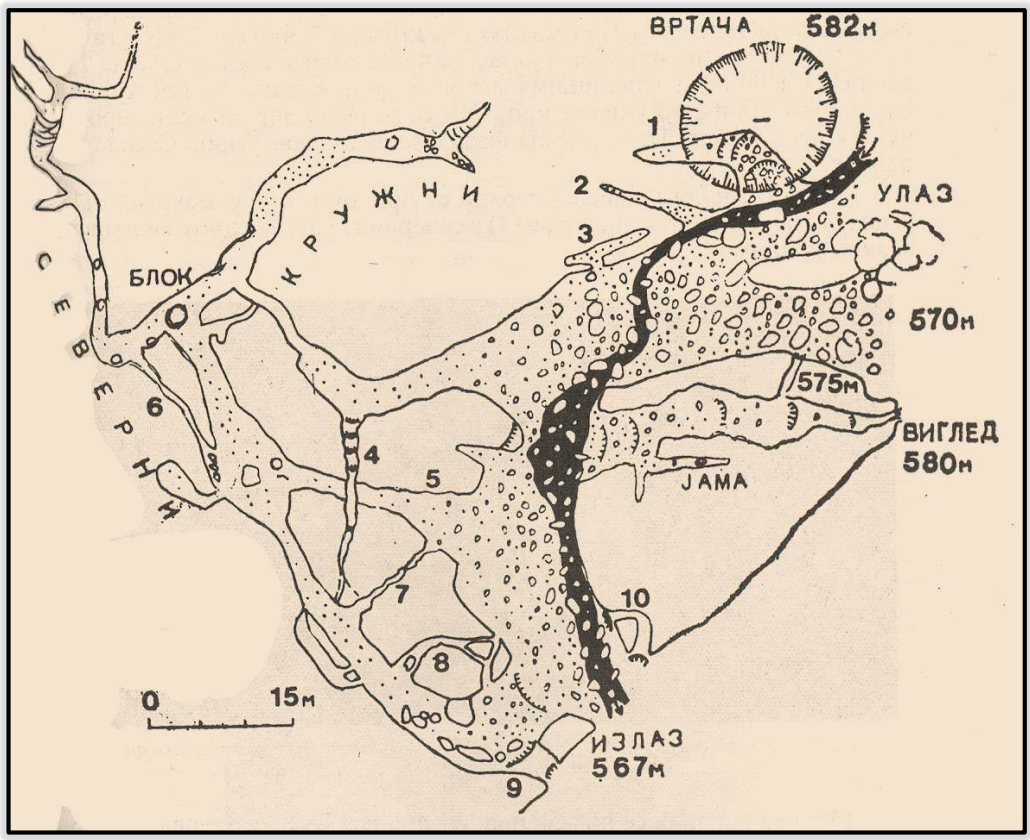
Сл. 64. Пећурски камен, пећински улаз.
Fig. 64. Pećurski kamen, cave entrance.

Сл. 65. Пећина Новаковци, улаз и плато испред пећине.
Fig. 85. Novakovci cave, entrance and plateau in front of the cave.



Сл. 66. Пећина Новаковци, план основе.
Fig. 66. Novakovci cave, ground plan.

Сл. 67. Сесалачка пећина, пећински комплекс са југозапада.
Fig. 67. Sesalačka cave, cave complex from south-west.

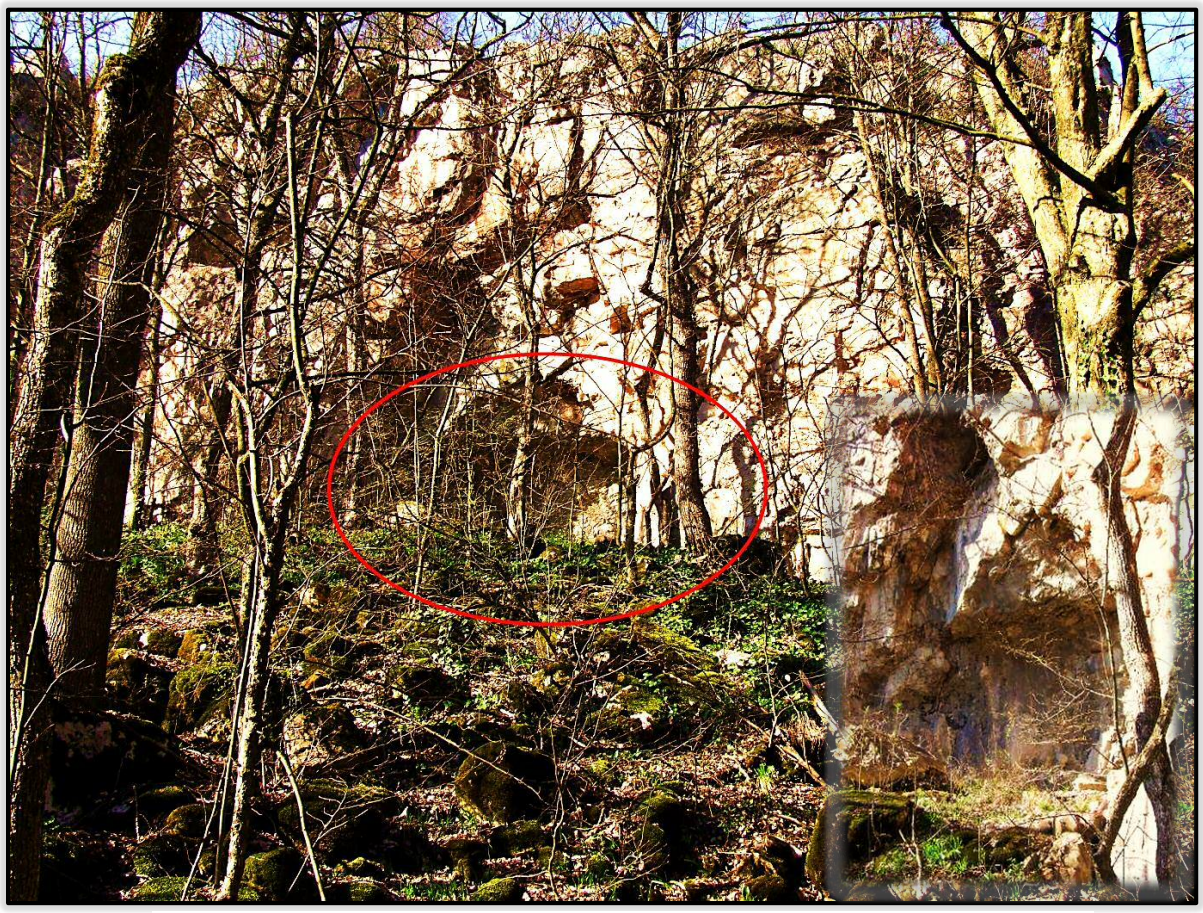


Сл. 68. Сесалачка пећина, план основе (из Петровић 1997)
Fig. 68. Sesalačka cave, ground plan (from Петровић 1997).

Сл. 69. Милушиначка пећина 1, улаз и план пећине (из Цвијић,1895).
Fig. 70. Milušinačka cave 1, cave entrance and ground plan (plan from Cvijić, 1895).

Сл. 70. Милушиначка пећина 1, археолошке сонде из 2012. године.
Fig. 70. Milušinačka cave 1, archaeological trenches from 2012.

Сл. 71. Милушиначка пећина 2, поглед на улаз из унутрашњости.
Fig. 71. Milušinačka cave 2, cave entrance and ground plan (plan from Cvijić, 1895)



Сл. 72. Рујишка пећина, поглед са југозапада.
Fig. 72. Rujiška pećina, view from south-west.

Сл. 73. Рујишка пећина, унутрашњост пећине са пећинским накитом.
Fig. 73. Rujiška cave, cave interior and speleothem.

Сл. 74. Буковичка пећина, поглед на улаз из унутрашњостии пећине; плато испред пећине и пећински накит.
Fig. 74. Bukovička cave, view on entrance from cave interior; the plateau in front of the cave entrance and speleothems.

Сл. 75. Стожер камен, остаци пећинских зидова.
Fig. 75. Stožer kamen, remains of cave walls.

Сл. 76. Косиња падина, поглед на објекат са улаза.
Fig. 76. Kosinja padina,object surface from the entrance.

Сл 77. Крушјанска пећина, северни део објекта.
Fig. 77. Krušjanska cave, northern and nort-western part of the object.

Сл. 78. Рујишка жљебина, јужни део објекта.
Fig. 78. Rujiška žljebina, southern part of the object.

BIBLIOGRAPHY

Alex, B., Boaretto, E., 2014, Radiocarbon Chronology of Pešturina Cave, y: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans*, 39–49.

Anelli, F., 1933, Ricerche paletnologiche nella Grotta Betal presso Postumia (N. 1611– VG). *Atti del I Congresso speleologico nazionale*, *11*, 231–237.

Argant, J. Dimitrijević, V., 2007, Pollen analyses of Pleistocene hyaena coprolites from Montenegro and Serbia, *Геолошки анали Балканскога полуострва 68*, 73–80.

Arsuaga, J. L., Carretero, J. M., Martínez, I., Gracia, A., 1991, Cranial remains and long bones from Atapuerca/Ibeas (Spain), *Journal of Human Evolution*, *Vol 20*, *Iss. 3*, 191–230.

Arsuaga, J. L., Martínez, I., Gracia, A., Carretero, J. M., Lorenzo, C., García, N., Ortega, A. I., 1997, Sima de los Huesos (Sierra de Atapuerca, Spain), The site, *Journal of Human Evolution 33*, 109–127.

Атанацковић, С. Б., 1959, Фитогенетски приказ озренског амфитеатралног басена и ближе околине, *Зборник радова географског института „Јован Цвијић" 16*, 121–148.

Bailey, G. N., Carter, P. L., Gamble, C. S., Higgs, H. P., 1983, Asprochaliko and Kastritsa: further investigations of Palaeolithic settlement and economy in Epirus (North-West Greece). *Proceedings of the Prehistoric Society*, *Vol. 49*, 15–42.

Basler, Đ., 1974, Paleolitsko prebivalište Badanj kod Stoca, *Glasnik Zemaljskog muzeja 29*, 5–18.

Basler, Đ., 1975, Crvena Stijena: Zbornik Radova, Zajednica Kulturnih Ustanova, Nikšić.

Beron, P., Daaliev, T., Jalov, A., 2006, Caves and speleology in Bulgaria, Pensoft Publishers, Bulgarian Federation of Speleology and National Museum of Natural History, Sofia.

Bertini, B. V., 2012, The hunting of large mammals in the Upper Palaeolithic of Southern Italy: A diachronic case study from Grotta del Romito. *Quaternary International 252*, 155–164.

Binford, L., 1968, Post-Pleistocene adaptations, y: Binford, S., Binford L., New Perspectives in Archaeology, Chicago: Aldine Publishing, 313–342.

Bischoff L. J, Shamp D. D., Aramburu A., Arsuaga L. J., Carbonell, E., De Castro, J. M., 2003, The Sima de los Huesos Hominids Date to Beyond U/Th Equilibrium (>350 kyr) and Perhaps to 400–500 kyr, New Radiometric Dates, *Journal of Archaeological Science 30 (3)*, 275–280.

Blackwell, B., Chu, S., Chaity, I., Huang, Y. E. W., Mihailović, D., Roksandić, M., Dimitrijević, V., Blickstein, J., Huang, A., Skinner, R. A., 2014, ESR Dating Ungulate Tooth Enamel from the Mousterian Layers at Pešturina, Serbia, y: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans,* 21–39.

Borić, D., Dimitrijević, V., White, D., Lane, C., French, C., Cristiani, E., 2012, Early Modern human settling of the Danube corridor: the Middle to Upper Palaeolithic site of Tabula Traiana Cave in the Danube Gorges (Serbia), *Antiquity 86*, *Iss. 334*.

Brodar, M., 1955, Pokusno izkopavanje v Mokriški jami, *Arheološki vestnik 6*, 204–226.

Brodar, M., 1959, Mokriška jama, nova visokoalpska aurignaška postaja v Jugoslaviji, Razprave IV. razr. SAZU, 5. Ljubljana, 415–469.

Brodar M., Osole F., 1979, Nalazišta paleolitskog i mezolitskog doba u Sloveniji, y: Praistorija Jugoslovenskih zemalja I, paleolitsko i mezolitsko doba, Akademija nauka i umjetnosti Bosne i Hercegovine, 129–135.

Burke, A., 2000, Hunting in the Middle Palaeolithic, *International Journal of Osteoarchaeology*, *Vol. 10*, *Iss. 5*, 281–285.

Vacca, B., 2012, The hunting of large mammals in the Upper Palaeolithic of Southern Italy: A diachronic case study from Grotta del Romito, *Quaternary International, Vol. 252*, 155–164.

Гавела, Б., 1988, Палеолит Србије, Аранђеловац – Београд.

Гавриловић, Д., 1965, Крашки рељеф у Србији, *Земља и људи, св. 15*

Gavrilović, D., 1975, Katastar pećina kao osnova za speleološko rejoniranje krasa u istočnoj Srbiji, *Naše jame 17*, 35–45.

Gavrilović D., 1999, Tufa – phenomen of the fluviokarst in East Serbia, САНУ посебна издања Књ. DCXXII, одељење природно-математичких наука, књ. 69. Београд.

Galanidou, N., 2000, Patterns in Caves: Foragers, Horticulturists, and the Use of Space, *Journal of Anthropological Archaeology 19*, 243–275.

Гарашанин, М., Гарашанин, Д., 1951, Археолошка налазишта у Србији, Просвета, Београд.

García, N., Arsuaga, J. L., Torres, T. 1997, *The carnivore remains from the Sima de los Huesos Middle Pleistocene site (Sierra de Atapuerca, Spain)*. Journal of Human Evolution, Vol. 33, Iss. 2-3, 155–174.

Ghemis, C., Clottes, J., Gély, B., Prud'homme, F., 2011, *An Exceptional Archaeological Discovery – The „Art Gallery" in Coliboaia Cave, Apuseni Mountains, Romania,* Acta arhaeologica Carpathica, vol. XLVI, 5–18.

Gheorghiu, A., Nicolăescu-Plopşor, C. S., Haas, N., Comşa, E., Preda, C., Bombiţă, G., Enea, G., Gheorghiu, F., Iofcea, S., Nicolăescu – Plopşor, D., Neagoe, A., Silveanu, R., Surdu, I. I., 1954, Raport preliminar asupra cercetărilor de paleontologie umană de la Baia de Fier (Reg. Craiova) din 1951*, Probleme de Antropologie 1*, 73–86.

Guadelli, A., Fernandez, P., Guadelli, J., Miteva, V., Sirakov, N., 2013, The retouchers form the Gravettian Levels in Kozarnika Cave, *The Sound of Bones. Proceedings of the 8th Meeting of the ICAZ Worked Bone Research Group in Salzburg 2011 – 8th Meeting of the ICAZ Worked Bone Research Group, Salzburg: Austria (2011*), 155–162.

Дакић, Б., 1967, Сокобањска котлина, економско-географска студија, Посебна издања, књига 19, Београд.

Darlas, A., 2007, Le Moustérien en Grèce à la lumière des récentes recherches, *L'anthropologie, Vol. 111, Iss. 3*, 346–366.

Daujeard, C., Moncel, M-H., 2010, On Neanderthal subsistence strategies and land use: a regional focus on the Rhône valley area in southeastern France, *Journal of Anthropological Archaeology*, *Vol. 29*, *Iss 3*, 368–391.

Diklić, N., 1962, Prilog poznavanju šumskih i livadskih fitocenoza Ozrena, Device i Leskovika kod Sokobanje, *Glasnik Prirodnjačkog muzeja u Beogradu, knj. 18,* 49–83.

Диклић Н., 1996, Јосиф Панчић (1814–1888), у: Сарић, М., *Живот и дело српских научника*, Биографије и библиографије, књига 1, Српска академија наука и уметности, Београд.

Димитријевић, В., 1997а, Плеистоценска сисарска фауна источне Србије, у: Лазић, М., (ур.) Археологија источне Србије, Филозофски факултет, Центар за археолошка истраживања, Београд,.

Димитријевић, В., 1997б, Горњоплеистоценски сисари из пећинских наслага Србије, *Геолошки анали Балканског полуострва, 61,* 179–370.

Dimitrijević, V., 2011, Mlajšepleistocensa hijena *Crocuta crocuta* (Goldfuss, 1823) iz jame Baranica (jugovzhodna Srbija): tekmovanje za brlog, y: Toškan, B. (ur.), Drobci ledenodobnega okolja, Zbornik ob življenjskem jubileju Ivana Turka, Ljubljana, 69–85.

Димитријевић, В., Јовановић, К., 2002, Квартарни сисари из Мириловске пећине код Ћуприје (Источна Србија), *Зборник радова одбора за крас и спелеологију 7*, 113–124.

Димитријевић Љ., Радојевић А., Филиповић И., 2010, Термични режим Сокобањске котлине, Гласник српског географског друштва, свеска бр. 1, 145–157.

Đukanović, D., 1960, Klima Sokobanje, Beograd.

Ђуричић, Љ., 1996, Пробно сондирање у Мириловској пећини, *Гласник српског археолошког друштва 11*, 173–177.

Đuričić, Lj., 1997, The chipped stone industry from the rock-shelter of Trebački krš, y: D. Srejović (ed.), *Prehistoric Settlements in Caves and Rock-shelters in Serbia and Montenegro, Fascicule I*, Centar za arheološka istraživanja, Beograd, 75–102.

Ђуричић, Љ., 1997, Врућа пећина, вишеслојно налазиште, *Старинар XLVIII*, 195–199.

Đuričić, Lj., 2006, *A contrabution to research on Bioče Mousterien*, Гласник српског археолошког друштва 22, 179–196.

Ђуровић, П. (ур.), 1998, Спелолошки атлас Србије, Посебна издања САНУ, књ. 52, Београд.

Evans, M., 2005*,* Nanophase magnetism and past global change, *Journal of Physics: Conference Series 17, Fifth International Conference on Fine Particle Magnetism*, IOP Publishing, 150–153.

Жујовић, J., 1893, Геологија Србије, део први, Српска краљевска академија.

Зеремски, М., 2002, *Крас Озрена и Девице*, САНУ, Зборник радова за крас и спелеологију VII. Београд, 1–29.

Zilhao, J., Trinkaus, E., Constantin, S., Milota, S., Gherase, M., Sarcina, L., Danciu, A., Rougier, H., Quilès, J., and Rodrigo, R.*,* 2007, The Peştera cu Oase People, Europe's Earliest Modern Humans, Chapter 21, y: Mellars, P. (ed.), Rethinking the Human Revolution: new behavioural and biological perspectives on the origin and dispersal of modern humans, McDonald Institute monographs, Cambridge, 249–262.

Hahn, J., 1977, Aurignacien, das ältere Jungpaläolithikum in Mittel- und Osteuropa, Fundamenta, Monographien zur Urhesichte, Reihe A, Böhlau, Köln.

Zupanič, J., 1970, Petrografska istraživanja paleolitskih artefakata krapinskog nalazišta, y: Malez, M. (ur.), Krapina 1899–1969, Zagreb.

Inizan, M. L, Reduron-Ballinger M., Roche, H., Tixier, J., 1999, Technology and Terminology of Knapped Stone, Nanterre: CREP.

Ivanova S., Sirakova S., 1995, Chronology and cultures of the Bulgarian Paleolithic, y: Bailey, D. W., Panayotov, I., Prehistoric Bulgaria, Prehistory Press, 9–54.

S. Ivanova, M. Gurova, N. Spassov, V. Popov, J. Makedonska, Ts. Tzankov, D. S. Strait, 2012, Preliminary Findings of the Balkan Paleo Project: Evidence of Human Activity at the "Gateway" of Europe During the Late Pleistocene, *Bulgarian e-Journal of Archaeology*, *Vol. 2*, *Iss*. *2*, 1–24.

Јевремовић, М., Јованчић, С., 2009 Свет лова и дивљачи у ловиштима Србије, Војноиздавачки завод, Београд.

Jović, V., 1997, Kremen, y: Srejović, D. (ur.), Arheološki leksikon, Savremena administracija, Beograd, 524.

Јовановић, П., 1924, Бања, *Српски етнографски зборник 29*, *Насеља и порекло становништва 17*, Српска краљевска академија.

Јовановић, П., 1923, Геоморфологија сокобањске котлине, *Гласник географског друштва*, *бр.9*, 59–82.

Jovanović-Dunjić R., 1956, Tipovi pašnjaka i livada na Rtnju, *Zbornik radova Instituta za ekologiju i biogeografiju srpske akademije nauka i umetnosti, 6(1)*, 1–45.

Јовановић, Ј., Радивојевић, А., 2006, Особености туристичког потенцијала Сокобање, *Гласник Српског географског друштва LXXXVI*, *бр. 2*, 27–299.

Jovanović, V., Srećković-Batoćanin D., 2009, Osnovi geologije, Zavod za udžbenike, Beograd.

Јовић, В., 2002, Одговори окружних лекара на геолошку анкету Друштва српске словесности из 1860., *Флогистон 12*, 147–174.

Калуђеровић, З., 1986, Извештај о археолошком ископавању Смолућке пећине 1986. године, *Новопазарски зборник 10,* 225–226.

Калуђеровић, З., Ђурић, Н., 1996, Кременац код Ниша – палеолитско налазиште, *Старинар XLVII*, 289–290.

Калуђеровић, З. 1996, Сокобањска котлина – палеолитска налазишта. *Старинар XLVII*, 290–292.

Каниц, Ф., 1967, Краљевина Србија и српски народ, Београд.

Каниц, Ф., 1985, Србија, земља и становништво, Српска књижевна задруга, Београд.

Karavanić, I., Smith, F. H., 1998, The Middle/Upper Paleolithic interface and the relationship of Neanderthals and early modern humans in the Hrvatsko Zagorje, Croatia, *Journal of Human Evolution*, *Vol. 34*, *Iss*. *3*, 223–248.

Karavanić, I., 1993, Gornjopaleolitičke kamene i koštane rukotvorine iz špilje Vindije, *Opuscula Archaeologica, radovi Arheološkog zavoda*, *Vol. 17, No.1*, 53–163.

Karavanić, I., 2003, Mujina pećina: tragovi života dalmatinskoga pračovjeka, Kaštel Lukšić.

Karavanić, I., Janković, I., 2008, Srednji i rani gornji paleolitik u Hrvatskoj, *Opuscula Archaeologica radovi Arheološkog zavoda,* 21–54.

Klein, G.R., 1999, The Human Career: Human Biological and Cultural Origins, University of Chicago Press, 1999.

Kozłowski, J. K., Kozłowski, S. K., Radovanović, I., 1994a, Meso-and Neolithic Sequence from the Odmut Cave (Montenegro), Wydawnictwa Uniwesytetu Warszawskiego, Warszawa.

Kozłowski, J. K. (ed.), 1982, Excavation in Bacho Kiro Cave (Bulgaria): Final report, Warszawa: Panstwowe Wydawnictwo Naukowe.

Kozlowski, J. K., Laville, H. and Ginter, B., 1994b, Temnata Cave: Excavations in Karlukovo Karst Area, Bulgaria, vol. 1, Jagellonian University Press, Kraków.

Komšo, Darko., 2003, Pećine Istre – mjesta življenja od prapovijesti do srednjeg vijeka / The Caves of Istria – Place of Living from Prehistory to the Middle Ages, *Histria Antiqua, 11/2003*, 41–54.

Komšo, Darko., 2008, Pećina Laganiši – mjesto života i smrti, I porečki susret arheologa, rezultati arheoloških istraživanja na području Istre, Zbornik radova s međunarodnog znanstvenog skupa, Poreč, 29. rujna 2006, Svezak I, Poreč, 9–16.

Korkuti, M., 2003, Researches and Studies of Prehistory in Albania: 3, Konispol Project, у: Recent Research in the Prehistory of the Balkans, Ур: Grammenos, D. V. Publications of the Archaeological Institute of Northern Greece, Nr.3., Thessaloniki, 212–225.

Костић, М.,1969, Алексиначка котлина – друштвеногеографска проучавања, *Зборник радова Географског института „Јован Цвијић”*, *књ. 22*, 453–591.

Крстић Б., Ракић Б., и др., 1974, Основна геолошка карта лист Алексинац 1:100 000.

Krešić, N., 1988, Karst i pećine Jugoslavije, Naučna Knjiga, Beograd.

Кукин, А., Медовић, П., Хаџић, В., 1992, Повезаност археолошких, педолошких и геолошких истраживања и узајамно коришћење добијених резултата, у: Срејовић, Д., (ур.), Археологија и природне науке, Научни скуп САНУи ВАНУ (23. и 24. октобар 1990. Београд, 25. октобар 1990. Нови Сад), Одељење историјских наука књ. 21., Београд.

Kuhn, S., Mihailović D., Dimitrijević, V., 2014, The Southeast Serbia Paleolithic Project: An Interim Report, у: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans*, 97–106.

Kyparissi-Apostolika, N., (ed.), 2000, Theopetra Cave. Twelve years of excavation and research 1987–1998. Proceedings of the International Conference, Trikala, 6–7 November 1998, Greek Ministry of Culture and Institute for Aegean Prehistory, Athens.

Langley, M., 2013, Storied landscapes makes us (Modern) Human: Landscape socialisation In the Palaeolithic and consequences for The archaeological record, *Journal of Anthropological Archaeology*, *Vol 32*, *Issue 4*, 614–629.

Лазаревић, Р., 2008, Катастри спелеолошких објеката, *Гласник СГД*, *св. LXXXVIII*, *бр.1*, 21–28.

Leakey, M., 1971, Olduvai Gorge, Excavationsin Beds I and II, 1960–1963. vol. 3. Cambridge University Press, Cambridge.

Lim, I., 1985, Rock-shelter Use Today: An Indicator of Usandawe Prehistory, Chapter 16, у: Misra, N. V., Bellwood, P., (eds.), *Recent Advances in Indo-Pacific Prehistory: Proceedings of the International Symposium Held at Poona, December 19–21, 1978*, Leiden, 105–110.

Ložek, V. ,1955, Mekkyši Československanckych Kvartey, Rozpr. Ust. Ustav. geologey 17.

Madelaine S., Maureille B., Cavanhié N., Couture-Veschambre C., Bonifay E., Armand D., Bonifay M. F., Duday H., Fosse P., Vandermeersch B., 2008, Nouveaux restes humains Moustériens rapportés au squelette Néandertalien de Regourdou 1 (Regourdou, commune de Montignac, Dordogne, France), *Paleo 20*, 101–114.

Malez M., *Novi pogledi na stratigrafiju Krapinskog nalazišta*; y: Malez, M. (ur.), Krapina 1899–1969; Zagreb, 1970. 15–16.

Malez M., Rukavina D., Sliškovic T., Kapel A., 1974, Two New Sites of Pleistocene Fauna and of the Palaeolithic in Bosnia; Bulletin Scientifique, Conseil des Academies des Sciences et des Arts de la RSF de Yougoslavie, Section A, Tome 9, No. 3-4, 80–82.

Malez, M., 1979a, Nalazišta paleolitskog i mezolitskog doba u Hrvatskoj, y: Benac, A. (ur.), Praistorija jugoslavenskih zemalja I, paleolitsko i mezolitsko doba, Sarajevo, 221–227.

Malez, M., 1979b, Fosilni čovek na tlu jugoslavenskih zemalja, y: Benac A., Praistorija jugoslavenskih zemalja I, paleolitsko i mezolitsko doba*,* Sarajevo, 83–102.

Malez, M., Salković, S., 1988, Kvartamogeološki i paleontološki odnosi u Pećini iznad Hajdučkog izvora kod Čitluka nedaleko Sokobanje (SR Srbija), *Naš Krš 24-25*, 89–99.

Manolis, S; Aiello, L; Henessy, R; Kyparissi-Apostolika, N., 2000, Middle Palaeolithic Footprints from Theopetra Cave (Thessaly, Greece), y: Kyparissi-Apostolika, N. (ed.), Theopetra Cave: Twelve years of excavation and research 1987–1998, *Proceedings of the International Conference, Trikala, 6–7 November 1998,* Athens, 81–94.

Marín-Arroyo, B. A., 2014, Middle Pleistocene subsistence in Velika Balanica, Serbia*:* preliminary results*,* Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans*, 121–129.

Marković, J. D., 1950, Fosilna flora bigra doline Gradišnice kod Soko Banje, *Glasnik prirodnjačkog muzeja u Beogradu*, *br. 3*, 119–130.

Марковић, Ј., 1962, Физичка географија Југославије, Београд.

Марковић, Ј., 1977, Рељеф слива Сокобањске Моравице, *Зборник радова географског института „Јован Цвијић" књ. 29*, 35–68.

Марковић-Марјановић, Ј., 1956, Лесне оазе у долини Јужне Мораве, *Гласник природњачког музеја 5,* 111–133.

Марковић-Марјановић, Ј., 1978, Плеистоцене климатске промене у Нишкој котлини, Српско географско друштво, Посебна издања, књ. 48. Београд.

Мартиновић, Ж., Костић, М., 1972, Термални терен бање Јошанице, *Гласник Српског географског друштва*, *св. LII*, *бр. 1*, 49–68.

Mellars, P., 1996, The Neanderthal Legacy, An Archaeological Perspective from Western Europe, Princeton University Press, Princeton, New Jersey.

Милић, Ч., 1968, Јаме као индикатори периглацијала у красу Источне Србије, *Цвијићев зборник српске академије наука и уметности* 69–81.

Милић, Ч., 1976, Речни сливови као елементи рељефа Источне Србије, СГД, посебна издања, Књ. 42, Београд.

Милићевић, Ђ. М., 1876, Кнежевина Србија, Државна штампарија у Београду.

Миловановић, Г., 2005, Врело (Моравски Голак), Библиотека „Хроника насеља, села и градова", Ниш.

Miracle, P. T., Brajković, D., 1992, Revision of ungulate fauna and Upper Pleistocene stratigraphy of Veternica Cave (Zagreb, Croatia), *Geologia Croatica 45*, 1–14.

Милојевић, С. М., 1936, Врела Моравице у Сокобањској котлини, *Гласник српског географског друштва св. 23*, 77–78.

Milota, Ş., Gherase, M., Sarcină, L., Rodrigo, R., Moldovan, O., Trinkaus, E., Constantin, S., Zilhão, J., 2013, Exploration and documentation of the Peştera cu Oase, у: Trinkaus, E., Constantin, S., Zilhão, J. (eds.), Life and Death a t the Peştera cu Oase, A Setting for Modern Human Emergence in Europe, New York: Oxford University Press, 5–15.

Mihailović, B. 2008, The Gravettian site Šalitrena pećina near Mionica, Western Serbia, у: Darlas A., Mihailović D. (eds.) The palaeolithic of the Balkans, Proceedings of the XV World Congress UISPP (Lisbon, 4–9 September 2006) Vol. 17, Session C33, 101–106.

Михаиловић, Б., 2013, Шалитрена пећина, *Резултати нових археолошких истраживања у северозападној Србији и суседним територијама*, Београд – Ваљево, 5–17.

Михаиловић, Д., 1992, Оријасијенска кремена индустрија са локалитета Црвенка-Ат у близини Вршца, Центар за археолошка истраживања, Књига 11, Београд

Михаиловић, Д., Ђуричић, Љ., Калуђеровић, З., 1997, Истраживање палеолита на подручју источне Србије. у: Лазић, М. (ур.)., Археологија источне Србије, Београд: Филозофски факултет, Центар за археолошка истраживања, 33–44.

Михаиловић, Д. 2004, Истраживања пећинских археолошких налазишта у сливу Тимока и Нишаве, *Зборник радова Одбора за крас и спелеологију*, *бр. 8*, 135–144.

Михаиловић, Д. 2006, Петроварадинска тврђава – палеолитско налазиште, *Археолошки преглед,1*, 9–12.

Михаиловић, Д., Михаиловић, Б., 2006, Палеолитско налазиште Хаџи Проданова пећина код Ивањице, *Археолошки Преглед 1(2003)*, 13–17 .

Mihailović D., 2009a Upper paleolithic and mesolithic chiped stone industries from Crvena Stijena, Beograd.

Михаиловић, Д., 2009б, Средњопалеолитско насеље на Петроварадинској тврђави, окресана камена индустрија из сектора I и II (ископавања 2003. и 2004. године), Едиција Петроварадин, свеска II, Нови Сад.

Михаиловић, Д., 2009в, Пећински комплекс Баланица и палеолит Нишке котлине у регионалном контексту*, Архаика 2*, 3–26.

Михаиловић, Д., Богосављевић-Петровић, В., 2010. Самаила – Влашка глава, палеолитско налазиште на отвореном простору, *Наша прошлост 10*, 21–43.

Михаиловић, Д., Милошевић, С., 2012*,* Истраживања палеолитског налазишта Пештурина код Ниша, *Гласник САД 28*, 87–106.

Mihailović, D., 2014a, Investigations of middle and upper paleolithic i the Niš basin, y: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans,*107–121.

Mihailović, D., 2014b, Paleolit na centralnom Balkanu, kulturne promene i populaciona kretanja, Srpsko arheološko društvo, Beograd.

Mišić V., Dinić A., Reliktna šumska vegetacija u klisuri Moravice kod Sokobanje, *Zbornik radova, 6. Simpozijum o flori jugoistočne Srbije i susednih područja, Sokobanja, 4–7. jul 2000*, 104–110.

Мишовић, С., 2004, Регионална географија, Београд.

Nešić, D., 2001, Kraška morfologija u slivu Toponičke reke, neobjavljena magistarska teza, Geografski fakultet, Beograd.

Нешић, Д., 2002, Резултати спелеолошких и спелеоклиматолошких истраживања Великог леденика на Девици, Ртањске и Тупижничке леденице, *Гласник српског географског друштва*, *св. LXXXII, Бр. 2*, 45–55.

Nikodijević, Č. V., 1970a, Pedološka karta SFRJ, List Zaječar 3, 1:50 000, Institut za proučavanje zemljišta Topčider - Beograd; Vojnogeografski institut – Beograd; Zavod za kartografiju „Geokarta" – Beograd.

Nikodijević, Č. V., 1970b, Pedološka karta SFRJ, List Zaječar 3, 1:50 000.

Новаковић, М., Миљковић, Б., Цветковић, Д., 1970, Геолошка студија Сокобањског терцијарног басена I*,* Београд.

Odar, B., 2012, Potočka zijalka. Fertility Rites in The Raining Cave, *Studia Mythologica Slavica XV,* 9–34.

Осоле, Ф., 1976, Палеолит у Словенији, у: Гавела Б., Велика археолошка налазишта у Словенији, Коларчев народни универзитет, „Научно Дело" Београд, 5–15.

Osole, F., 1990, Betalov spodmol, rezultati paleolitskih izkopavanj S. Brodarja I, *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji 18*, 7–41.

Osole, F., 1991, Betalov spodmol, rezultati paleolitskih izkopavanj S. Brodarja II. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji 19*, 7–129.

Павловић, М., Радивојевић, А., 2009, Промене у функционалним типовима насеља општине Сокобања, *Гласник српског географског друштва 89 (3)*, 81–93.

Павловић, М., Радивојевић, А., Димитријевић, Љ., 2011, Клима Сокобање и њен утицај на развој пољопривреде, *Зборник радова географског института „Јован Цвијић" 61 (1)*, 13–30.

Панџић И., 2014, Археолошки дневник палеолитских истраживања, Музеј републике Српске, Бања Лука.

Петковић, В. К., 1933*, Геолошка карта Краљевине Југославије,* лист Зајечар 1:100.000, Београд.

Петковић, К, 1935, Геологија Источне Србије, посебна издања Српске Краљевске Академије, књ. 2, Београд.

Petrović, D., 1967, *Geomorfologija*, Beograd.

Петровић, Д. 1984, Сесалачка пећура, *Зборник радова ПМФ – Институт за географију, св. XXXI*, 9–18.

Петровић, Д.,1988, Историја српске спелеологије, Српско географско друштво, посебна издања књ. 66., Београд.

Петровић, Д., 1997, Сесалачка пећура, у: Петровић Д., Петровић Ј., Морфологија и хидрографија краса, Завод за уџбенике и наставна средства, Београд, 177–185.

Petrović J, 1968, Osnovi speleologije, Beograd.

Петровић, П. 1968, *Trebič* kod *Sokobanje*. *Arheološki pregled*, 10, 1969, 132–135.

Петровић, .Ј., 1974, Крш Источне Србије, Посебна издања СГД, књ. 40, Београд.

Петровић, Ј., Пећине и Јаме СР Србије, Београд, 1976.

Петровић, К. ур., 1977, Геологија Србије II – 3- Стратиграфија – Кенозоик, Завод за регионалну геологију и палеонтологију Рударско-геолошког факултета, Београд.

Попов, Р., 1921, *Материали за предисторията на България. Спелеологични изследвания в околността на гр. Търново, с. Беляковец, Дряновския монастир и с. Карлуково*, Годишник на Народния Музей за 1920 год., София.

Попов, Р., 1931, Пещерата Темната дупка. Ново находище от палеолита в България Народен музей София.

Попов, Р., Фосилни и субфосилни животински останки в изследваните до сега пещери на България, Известия на Българското пещерно дружество, I, С, 1926. София, 1936.

Popov, R., 1939, The Animal remains from the cave of Bacho Kiro, *Bulletin of the American School of Prehistoric Research 15*, 85–126.

Протић, К. С., 1889, Путовање кроз Србију 1719–1720, Отаџбина, књ. 22., Београд.

Phoca-Cosmetatou, N., 2005, Landscape use in Northeast Italy during the Upper Palaeolithic. Preistoria Alpina 41, 23-49.

Радевъ, Н. (1926), *Материали за изучаване на пещеритѣ въ България – 1.* Естеств. Истор. Музей при Н. В. Царя, София, 1926. 168–169.:

Радовановић, И., 1986, Новија истраживања палеолита и мезолита у Црној Гори, *Гласник српског археолошког друштва 3*, 63–76.

Радојковић, Р., 1904, *Клима Сокобање*, Српски архив за целокупно лекарство, Државна штампарија, Београд.

Rakić, M., 1977, Geneza i stratigrafija kvartarnih sedimenata u slivu Južne i Zapadne Morave (sa kraćim osvrtom na prilike u Dakijskom i Panonskm basenu), Rasprave zavoda za geološka i geofizička istraživanja, rasprava XVIII, Beograd.

Ракићевић, Т., 1980, Климатско рејонирање Србије, *Зборник радова географског факултета 27*, 31–42.

Rakovec, I., 2007, Fossil population structure and mortality of the cave bear from the Mokrica cave (North Slovenia), *Acta carsologica 36/3,* 475–484.

Ranđelović, N., Avramović, D., Đorđević, V., , Lilić, A., 2005, Flora Leskovika, 1, *Zbornik radova, 8. Simpozijum o flori jugoditočne Srbije i susednih područja*, Niš, 5–12.

Рашковић, Д., 2011, Примери налаза новца на локалитетима рановизантијских утврђења на југу централне Србије, *Ниш и Византија IX*, 171–186.

Rink, J., Schwarcz, H., Smith, F. H., Radovčić J., 1995, ESR ages for Krapina Hominids, *Nature 378*: *24*.

Rink, W. J., Karavanić, I., Pettit, P. B., van der Plicht, J, Smith F. H. & Bartoll J.; *ESR and AMS based 14C dating of Mousterian levels at Mujina Pećina, Dalmatia, Croatia*, Journal of Archaeological Science 29, London, 2002, 943–953.

Rink WJ, Mercier N, Mihailović D, Morley M.W., Thompson JW, Roksandic, M., 2013, Correction: New Radiometric Ages for the BH-1 Hominin from Balanica (Serbia): Implications for Understanding the Role of the Balkans in Middle Pleistocene Human Evolution, *PLoS ONE 8*, 1–7.

Richter, J., Gjipali, I., Hauck, T. C., Ruka, R., Vogels, O., Metalla, E., 2014, The Early Prehistory of Albania: First Results of the „German – Albanian Palaeolithic“ (GAP) Programme, y: Përzhita, L., Gjipali, I., Hoxha, G., Muka, B., (eds.), Proceedings of the International Congress of Albanian Archaeological Studies, 65th annivesary of Albanian Archaeology (21–22 November, Tirana 2013), Center for Albanian Studies and Institute of Archaeology, Tirana, 65–82.

Roksandić, M., Mihailović, D., Mercier, N., Dimitrijević, V., Morley, W. M., Rakočević, Z., Mihailović, B., Guibert, P., Babb, J., 2011, A human mandible (BH-1) from the Pleistocene deposits of Mala Balanica cave (Sićevo Gorge, Niš, Serbia), *Journal of Human Evolution,Vol 61, Issue 2*, 186–196.

Ruiz-Redondo, A., 2014, Seeking for the origins of Paleolithic graphic activity: Archaeological Rock Art survey in Serbia, Palaeolithic and mesolithic research in Central Balkans, y: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans* 131–138.

Русић В., Вељковић М. (ур.), 1982, Сокобања и срез Бањски 1836–1914, књига прва, Историјски архив Ниш и Самоуправна интересна заједница културе Сокобања, Ниш.

Ршумовић, Р., 1974, Географска регионализација Источне Србије, *Зборних радова Географског института „Јован Цвијић” 25,* 185–209.

Sirakov, N., Guadelli, J. L., Ivanova, S., Sirakova, S., Boudadi-Maligne, M., Dimitrova, I., Fernandez, P., Ferrier, C., Guadelli, A., Iordanova, D., 2010*,* An ancient continuous human presence in the Balkans and the beginnings of human settlement in western Eurasia: A Lower Pleistocene example of the Lower palaeolithic levels in Kozarnika cave (North-western Bulgaria), *Quaternary International, Volume 223-224*, 94–106.

Soficaru A, Dobos A, Trinkaus E, 2006, *Early modern humans from the Peştera Muierii, Baia de Fier, Romania.* y: Proceedings of the National Academy of Sciences 103, Nr. 46, November 2006, 17196–17201.

Спирић, М., 1995, Историја Алексинца и околине до краја прве владавине Кнеза Милоша, Скупштина општине Алексинац, Центар за културу, Алексинац.

Srejović, D., 1974, The Odmut cave – a new facet of the Mesolithic Culture of the Balkan Peninsula, *Archaeologica Iugoslavica 15,* 3–6.

Srejović, D., Marković, Č., 1986, Medena stijena – paleolitsko i mezolitkso nalazište, *Arheološki pregled 1987*, 37–38.

Stevanović, P., Marović, M., Dimitrijević, V., 1992, Geologija kvartara, Naučna knjiga, Beograd.

Stewart, J.R., van Kolfschoten, T., Markova , A., Musil, R., 2003, The Mammalian Faunas of Europe during Oxygen Isotope Stage Three**, y:** Neanderthals and Modern Humans in the European Landscape of the Last Glaciation - Archaeological Results of the Stage 3 Project, Ур: van Andel, T. H., Davies, W. D., The McDonald Institute for Archaeological Research: Cambridge, 2003, Chapter 7: 103-130.

Straus, L.G. 1990, Underground Archaeology: Perspectives on Caves and Rockshelters, in Archaeological Method and Theory (Vol. 2), In: M. B. Schiffer (editor), University of Arizona Press, 255-304.

Стојић, М., Јоцић, М., 2006, Културна стратиграфија праисторијских локалитета у нишкој регији, Археолошка грађа Србије – Ниш, Археолошки институт Београд и Народни музеј Ниш, Београд – Ниш.

Toškan, B., Dirjec, J., Bavdek, A., 2014, Lost in time? Repatriated animal remains from Anelli's excavations at Betalov spodmol (SW Slovenia), *RMZ, Materials and geoenvironment, Vol., 61, No. 2-3*, Univerza v Ljubljani, Naravoslovnotehniška fakulteta, Ljubljana 2014, 141–155.

Trinkaus, E., Milota, Ş., Rodrigo, R., Gherase, M., Moldovan, O., 2003, Early modern human cranial remains from the Peştera cu Oase, Romania, *Journal of Human Evolution 45*, 245–253.

Trinkaus, E., 2013, Radiocarbon Dating of the Peştera cu Oase human remains, y: Trinkaus, E., Constantin, S., Zilhão, J. (eds.), Life and Death a t the Peştera cu Oase, A Setting for Modern Human Emergence in Europe, New York: Oxford University Press, 229–233.

Tuniz, C., Fernardini, F., Turk, I., Dimkaroski, I., Mancini, I., Dreossi, D., 2012, Did neanderthals play music? X-ray computed micro-tomography of the Divje Babe 'flute', *Archaeometry*, *Volume 54, Iss. 3,* 581–590.

Turk, I., 1997, Mousterienska „Koscena Piscal" in druge najdbe iz Divjih Bab I v Sloveniji, Znanstvenoraziskovalni Center Sazu, Ljubljana.

Turk, I., 2007, Divje babe I, Paleolitsko najdišče mlajšega pleistocena v Sloveniji, 1. del: Geologija in paleontologija, Opera Instituti Archaeologici Sloveniae 13, Ljubljana.

Turk, I., 2014, Divje babe I, Paleolitsko najdišče mlajšega pleistocena v Sloveniji, 2. del: Arheologija, Opera Instituti Archaeologici Sloveniae 29, arheologija, Ljubljana,.

Урошевић, С., 1928, Буковик и Рожањ, студија терена кристаластих шкриљаца, *Геолошки анали Балканског полуострва*, *Књ. IX* , *део II*, Београд.

Урошевић, С., 1925, Племенити минерали и драго камење, Српска књижевна задруга, Београд.

Филиповић, В., 2008, Праисторијска налазишта у околини Сврљига, *Зборник бр. 16–17,* Народни музеј Ниш, 9–32.

Fiore, I., Gala, M., Tagliacozzo, A., 2004, Ecology and Subsistence Strategies in Eastern Italian Alps during the Middle Paleolithic. *International journal of Osteoarchaeology 14*, 273–286.

Fu Q., Hajdinjak M., Moldovan O.T., Constantin S., Mallick S., Skoglund P., Patterson N., Rohland N., Lazaridis I., Nickel B., Viola B., Prüfer K., Meyer M., Kelso J., Reich D., Pääbo S., 2015, An early modern human from Romania with a recent Neanderthal ancestor, *Nature 524*, *216–219.*

Hedges, R. E. M., Housley, R. A., Bronck, C. R., van Klinken, G. J., 1990, Radiocarbon dates from Oxford AMS system: Archaeometry Datelist, *Archaeometry 32*, 211–237.

Heffter, E., 2014, The Prospects for Utilizing Pedology, Geology and Other Landscape Data for Locating Open Air Sites in Serbia, y: Mihailović, D. (ed.), *Palaeolithic and mesolithic research in Central Balkans,* 49–56.

Higham T., Bronk Ramsey C., Karavanić I., Smith F. H. , Trinkaus E., 2006, Revised direct radiocarbon dating of the Vindija G1 Upper Paleolithic Neandertals, *Proceedings of the National Academy of Sciences USA 103, Washington, 2006*,.

Božović, D., Kovačec, A., Rević, S. (ur.), 1999-2009, Hrvatska enciklopedija, svezak I-XI, *Leksikografski zavod Miroslav Krleža*, Zagreb.

Huxtable, J., Gowlett, J. A. J., Bailey, G. N., Carter, P. L., Papaconstantinou, V., 1992, Thermoluminescence Dates and New Analysis of the Early Mousterian from Asprochaliko, *Current Anthropology 33*, 109–114.

Carbonell, E., Bermu´dez de Castro, J.M., Arsuaga, J. L., Dı´ez, J. C., Cuenca-Besco´ s, G., Sala, R., Mosquera, M. & Rodrı´guez, X. P., 1995, Lower Pleistocene hominids and artifacts from Atapuerca TD6 (Spain), *Science 269,* 826–830.

Цвијић, J., 1895, Пећине и подземна хидрографија у Источној Србији, *Глас српске краљевске академије XLVI.*

Цвијић, J., 1889, Ка познавању крша источне Србије, Просветни гласник, Београд.

Cvijić J., 1897, Brusque formation d'une doline en Serbie, Bulletin de la Societe de Spéléologie, Paris.

Цвијић, J., 1912, Ртањ, *Гласник Српског географског друштва, св. 2*, 276–298.

Цвијић, J., 1914. Истоци под Девицом, код села Читлука, *Гласник српског географског друштва, св. 3-4*, 215–219.

Цвијић, J., 1926, Циркулација воде и ерозија у карсту, *Гласник српског географског друштва, св. 12*, 1–16.

Цвијић, J., 1957, Подземна хидрографија и морфолошка еволуција карста, Посебна издања Српског географског друштва, св. 34, 1–40.

Clottes, J. Besesek, M., Gély, B., Ghemiş, C, Kenesz, M., Lascu, V.T., Meyssonnier, M., Philippe, M., Plichon, V., Prud'homme, F., Radu, V.A., Rus, T., Tociu, R.L., 2012. *Découverte d'une nouvelle grotte ornée paléolithique en Roumanie, dans le département du Bihor*. In : Clottes J. (ed.), L'art pléistocène dans le monde / Pleistocene art of the world / Arte pleistoceno en el mundo, Actes du Congrès IFRAO, Tarascon-sur-Ariège, septembre 2010, Symposium Art pléistocène en Europe ». Préhistoire, Art et Sociétés, Bulletin de la Société Préhistorique Ariège- Pyrénées 65-66, pp. 513-528.

Cuenco-Besco´ s, G., Laplana Conesa, C., Canudo, J. I. & Arsuaga, J. L., 1997, Small mammals from Sima de los Huesos, Journal of Human Evolution 33, 175–190.

Šarić J., 2002, Smolućka cave – unpublished chipped stone artifacts from excavations in 1987., *Старинар LVIII,* 9–27.

Šarić J., 2011, Lower Paleolithic site Kremenac near the village Rujnik (Serbia), *Старинар LXI*, 7–22.

Šaric, J., 2013, Kremenac, donjopaleolitsko nalazište*,* Arheološki institut, posebna izdanja 54, Beograd.

Šegota, T., 1979, Paleoklimatske i paleogeografske promjene, y: Benac, A. (ur.), Praistorija Jugoslovenskih zemalja I, paleolitsko i mezolitsko doba, Akademija nauka i umjetnosti Bosne i Hercegovine, Sarajevo, 21–35.

Шкорић, А., 1986, Постанак, развој и систематика тла, Загреб.

Krstić, B., Rakić, B., Veselinović, M., Dolić, D., Rakić, M., Anđelković, J., Banković, V., 1974, Osnovna geološka karta 1:10 000, list Aleksinac, K34-20, Beograd.

Quilès, J., Petrea, C., Moldovan, O., Zilhao, J., Rodrigo, R., Rougier, H., Constantin, S., Milota, S., Gherase, M., Sarcina, L., and Trinkaus, E., 2006, Cave bears (Ursus spelaeus) from the Pestera cu Oase (Banat, Romania): Paleobiology and taphonomy, *C. R.. Palevol 5*, 927–934.

Whallon, R., 2007, Spatial distributions and activities in epigravettian level 6 at the site of Badanj, Bosnia and Herzegovina, *Гласник српског археолошког друштва 23,* 9–26.

CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

551.44(497.11)
902.2(497.11)

MILOJEVIĆ, Petar, 1983-
Speleological Objects of Sokobanja as Potential Palaeolithic Sites / Petar Milojević, Irina Kajtez, Stefan Milošević = Die speleologischen objekte Sokobanjas als potenzielle paläolithische fundstätten = Petar Milojević, Irina Kajtez, Stefan Milošević ; [crteži Marjana Marinković ...
[et al.] ; fotografije Petar Milojević, Irina Kajtez ; prevod na engleski
jezik Danijela Stanojević, Dejan Stanojević]. - Sokobanja : Narodna biblioteka "Stevan Sremac", 2015 (Niš : Copy shop). - 144 str. [69] str. :
ilustr. ; 30 cm

Prevod dela: Спелеолошки објекти у Сокобањи као потенцијална палеолитска налазишта. - Tiraž 30. - Zusammenfassung: Die speleologischen objekte Sokobanjas als potenzielle paläolithische fundstätten. - Bibliografija: str. [55-69].

ISBN 978-86-82623-21-2

1. Kajtez, Irina, 1988- [аутор] [илустратор] [фотограф] 2. Milošević, Stefan, 1985- [аутор] [илустратор]
a) Спелеолошки објекти - Сокобањски крај b) Археолошка налазишта - Сокобањски крај
COBISS.SR-ID 220563212