



INSTITUT ZA  
ANTROPOLOGIJU



# ARHEOLOŠKA I PALEONTOLOŠKA ISTRAŽIVANJA U SPELEOLOŠKIM OBJEKTIMA

## ŠPILJE KAO DOKUMENTI IZ PROŠLOSTI

KOMISIJA ZA SPELEOLOGIJU  
STRUČNI SEMINAR O ZNANSTVENIM ISTRAŽIVANJIMA U PEĆINAMA  
HGSS STANICA ZAGREB  
26. 11. 2022.

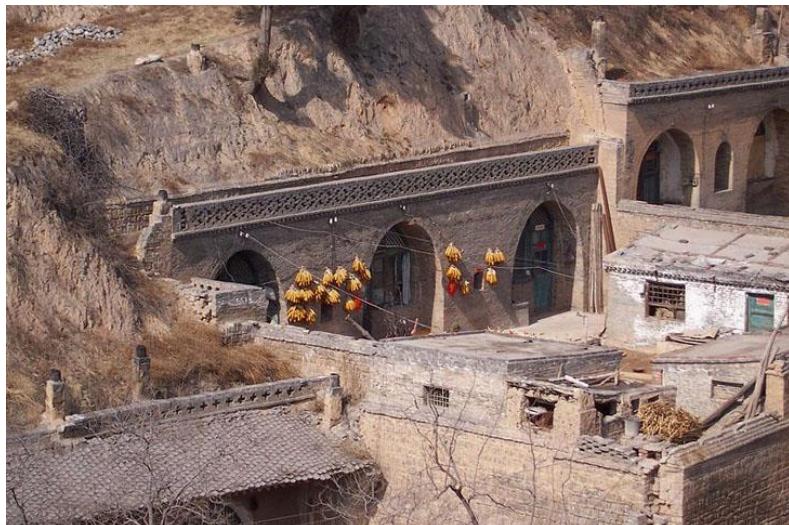
[ivor@inantro.hr](mailto:ivor@inantro.hr)

**Ivor Janković**, Institut za antropologiju/SO Velebit

## Važnost špilja

Važni podaci za mnoga polja znanosti (ali i razne druge djelatnosti):

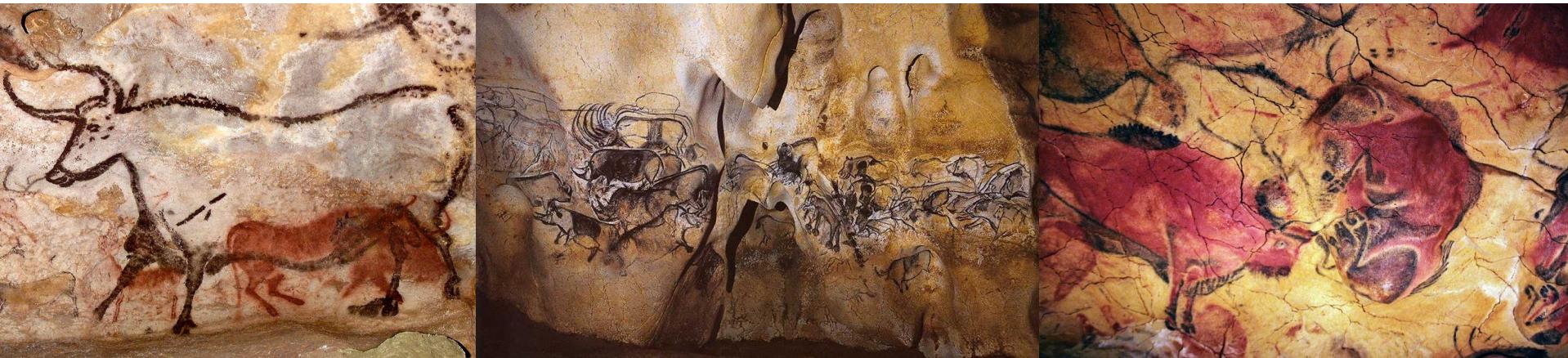
- klima i okoliš, geologija, biologija, paleontologija, arheologija, antropologija....
- pogodne za istraživanja budući da sedimenti nisu toliko podložni atmosferilijama
- turističke destinacije
- mjesta od važnosti (objektivni ali i subjektivni razlozi, religijski razlozi itd.)





## Špilje kao „vremenske kapsule”

- koriste se od najranijih vremena (lovne stanice, kratkotrajna ili trajnija staništa...)
- tragovi ljudskog boravka, alatki, vatre, lovnih životinja, ukopi, umjetnost...
- brojni podaci o životu u prošlosti, ekosustavima itd.



The final Neanderthals in France (33,000–30,000 years ago) began to make ornaments from animal bone and teeth, such as this necklace from Arcy sur Cure.

## Najstariji tragovi ljudskog boravka u špiljama na tlu Hrvatske

- Šandalja I kod Pule: kamena alatka iz donjeg paleolitika

- pećine kao staništa neandertalaca (srednji paleolitik):

Hušnjakov brijež (Krapina)

pećina Vindija

Veternica

Velika Pećina

Romualdova pećina

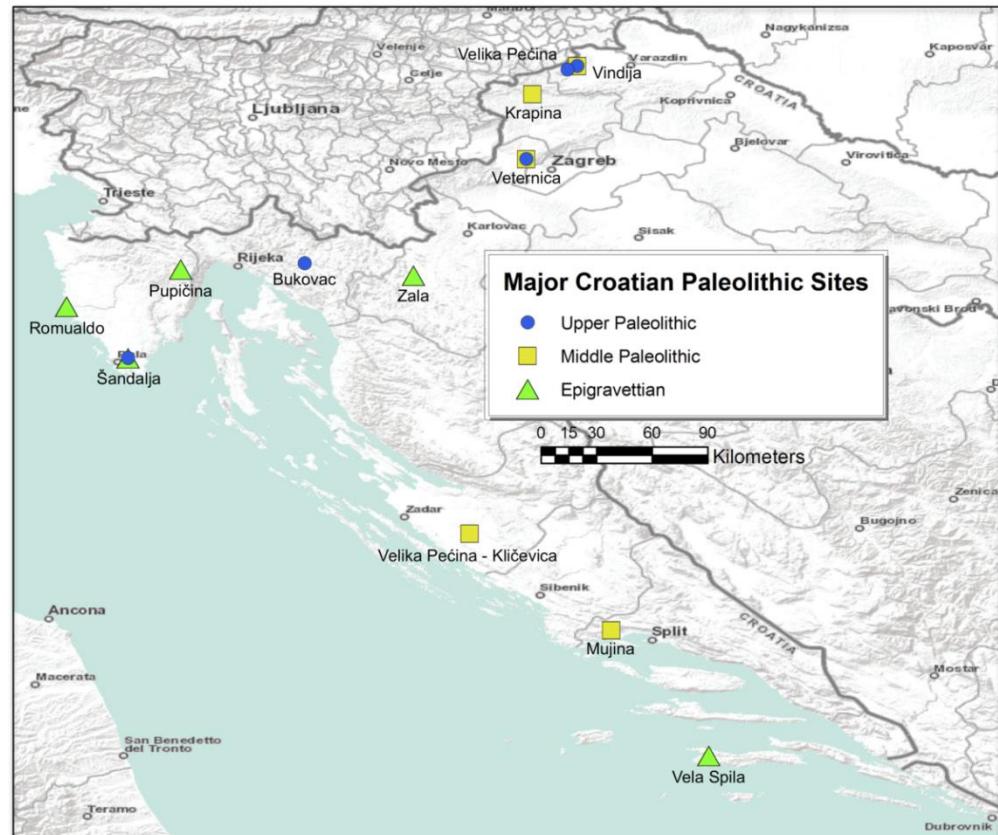
Mujina pećina .....

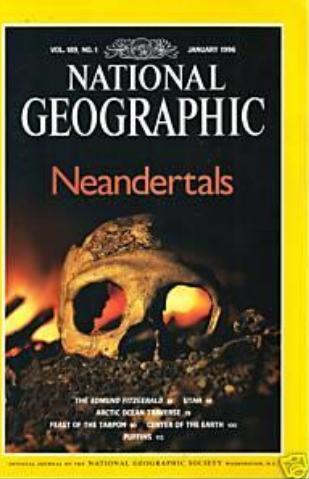
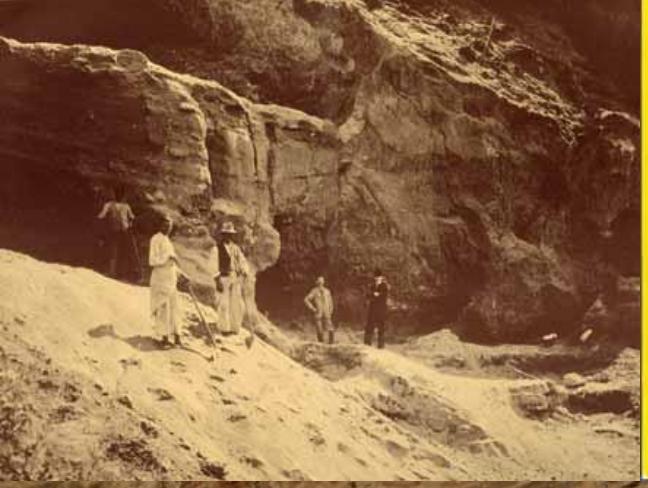
- nalazišta iz gornjeg paleolitika:

Pećina Bukovac

Šandalja II

Vela Spila.....



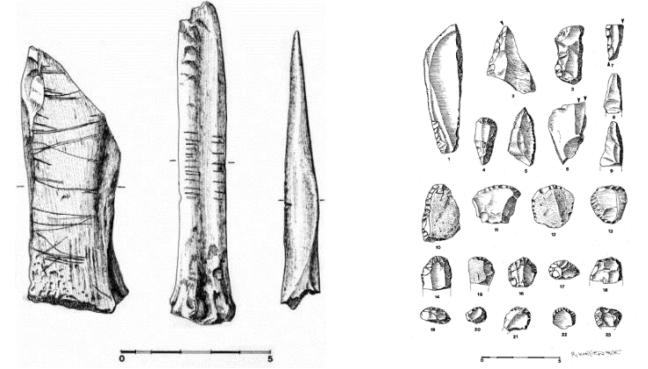


# Science

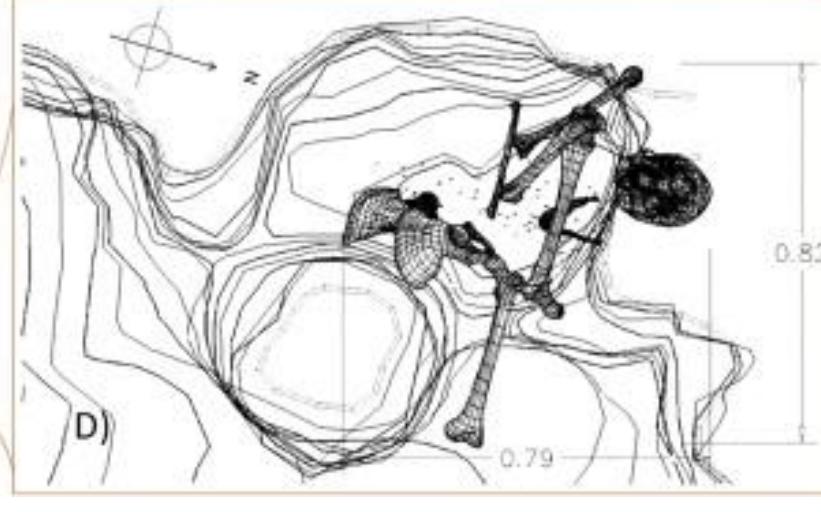
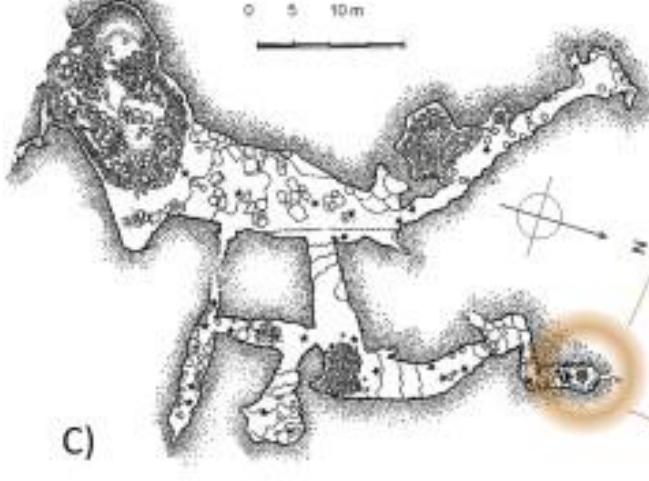
7 May 2010 \$10



AAAS



# Speleolozi imaju vrlo važnu ulogu u mnogim otkrićima (često su prvi pronašlači!)





Javier Trueba / Madrid Scientific Films

## DESCUBRIMIENTOS EN EL YACIMIENTO DE ATAPUERCA



### LA GRAN DOLINA

Aquí aparecieron, en 1994, los primeros restos de 'Homo antecessor', de hace unos 800.000 años , y cientos de herramientas de piedra.

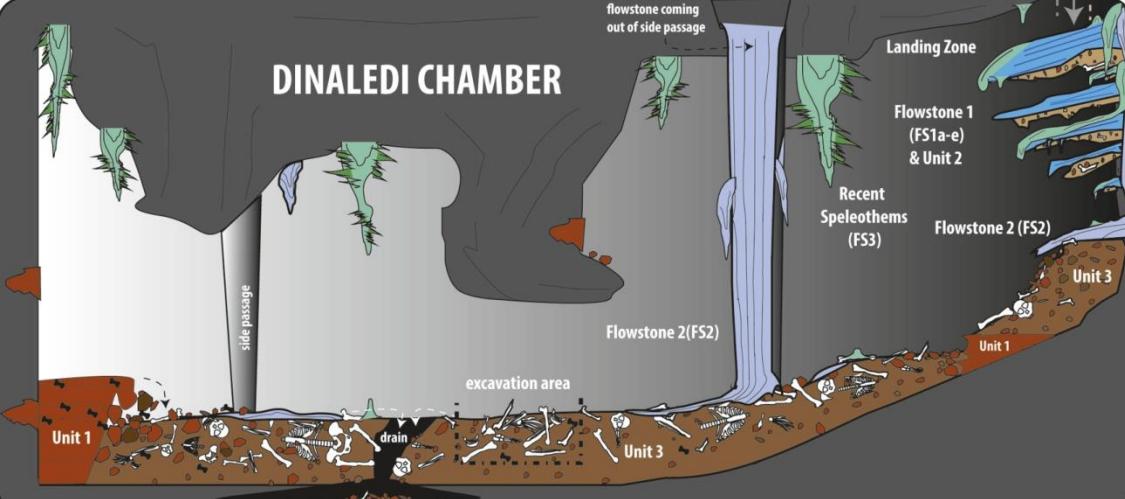
### LA SIMA DE LOS HUESOS

Aquí se encuentra la mayor acumulación de fósiles humanos conocida. En esta galería ciega se han encontrado restos de, al menos, 28 individuos distintos, más de una docena de cráneos y 6.500 fragmentos óseos de hace unos 400.000 años. De un fémur se ha logrado extraer y secuenciar ADN mitocondrial ahora.



### Restos de homínidos

El cráneo 'número 5', apodado Miguelón, fue extraído en 1992 y presentado en 1993.



**NATIONAL GEOGRAPHIC**

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JASON TREAT, NGM STAFF, NGM MAPS. SOURCE: LEE BERGER,  
UNIVERSITY OF THE WITWATERSRAND (WITS), SOUTH AFRICA



## *Homo naledi*, a new species of the genus *Homo* from the Dinaledi Chamber, South Africa

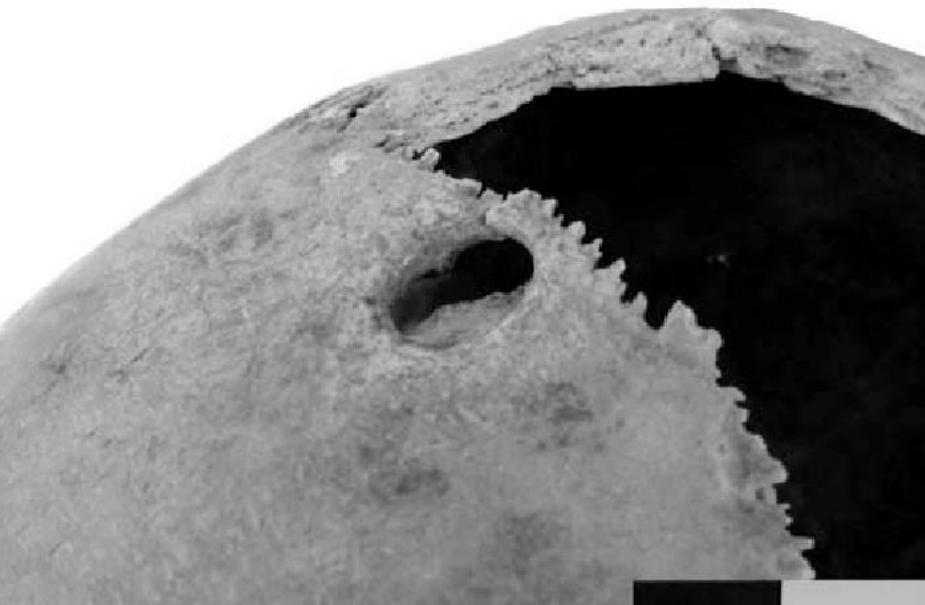
eLIFE  
elife sciences.org

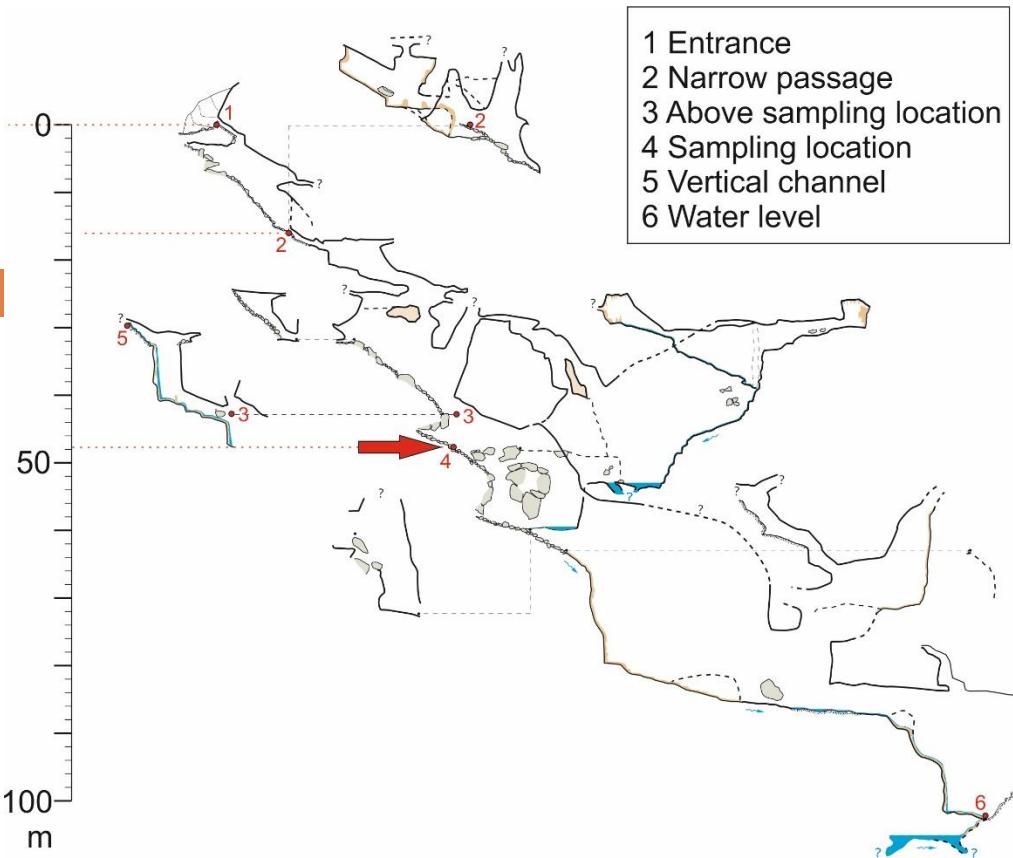


### Bezdanjača pod Vatinovcem



Sl. 1. Tlocrt, uzdužni i poprečni profili pećine Bezdanjače u Lici. Strelica pokazuje mjesto gdje je ležala kostjela lubanja s patološkim defektom.  
Abb. 1. Grundriss, Längs- und Querprofile der Höhle Bezdanjača in der Lika. Der Pfeil berechnet die Stelle, wo der menschliche Schädel mit dem pathologischen Defekt lag.





- 1 Entrance
- 2 Narrow passage
- 3 Above sampling location
- 4 Sampling location
- 5 Vertical channel
- 6 Water level



Eppenberger et al. European Radiology Experimental  
<https://doi.org/10.1186/s41747-020-00166-1> (2020) 4:41

European Radiology  
 Experimental



#### TECHNICAL NOTE

Open Access

## Radiographic analysis and virtual cleaning of a bioarchaeological remain enclosed in mineral deposits from a limestone cave



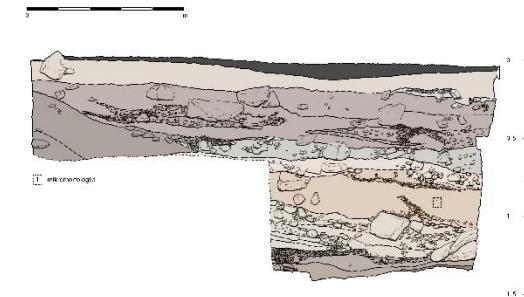
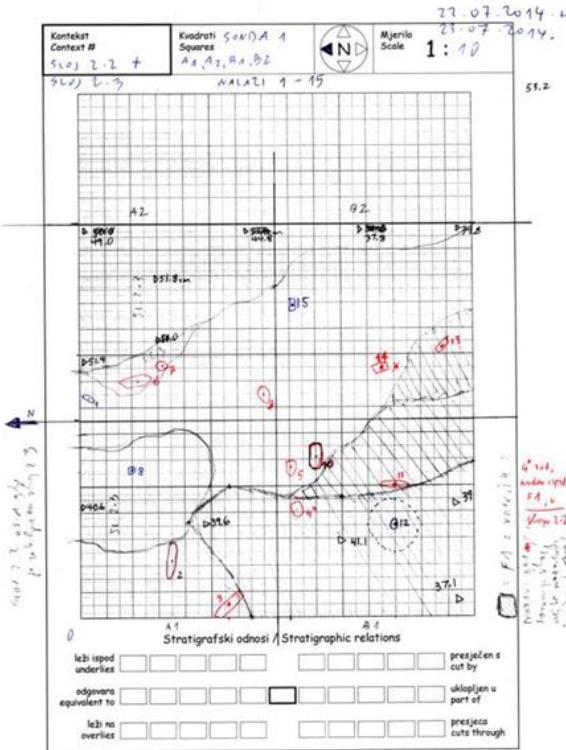
Patrick E. Eppenberger<sup>1</sup> , Mislav Čavka<sup>2,3</sup>, Siniša Radović<sup>4</sup>, Dalibor Paar<sup>5</sup>, Nenad Buzjak<sup>6</sup>, James C. M. Ahern<sup>7</sup>, Philipp Biedermann<sup>1</sup>, Philipp Gruber<sup>1,8</sup>, Mario Novak<sup>9</sup> and Ivor Janković<sup>7,9</sup>

cm  
 web.ncbi.nlm.nih.gov

Zbog toga je ključno znati **što učiniti kada nađemo** (ne ako, nego kada) **na arheološki** (paleontološki, antropološki itd.) **nalaz:**

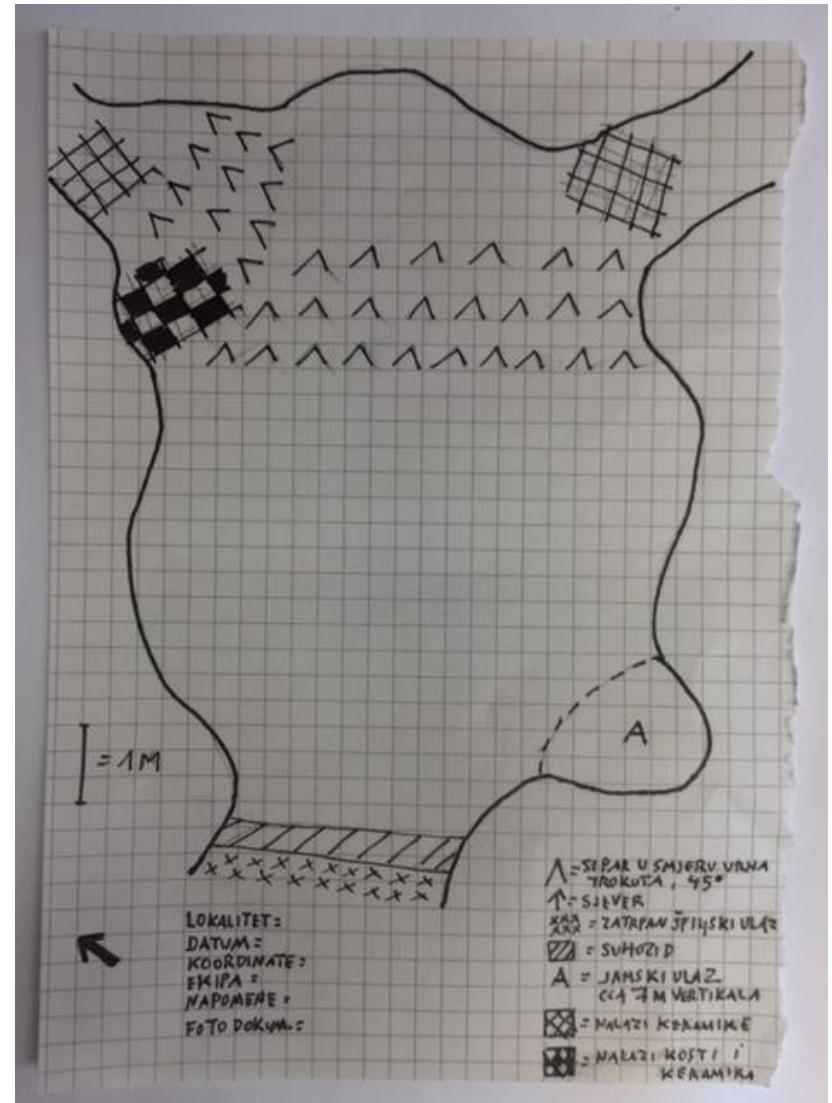
- **ne micati nalaz** (gube se bitni podaci : zamislite što bi bilo da pomaknete tijelo ili oružje na mjestu zločina). Nalaz micati isključivo ako je ugrožen (na rubu litice i sl.)

- **dobro dokumentirati položaj nalaza** (smještaj, odnose prema drugim nalazima itd.)
    - i arheološka istraživanja nepovratno uništavaju nalazište (važnost dokumentacije)
    - **što prije javiti stručnjacima**



- ...no može i ovako:
- važno je zabilježiti sve informacije iz kojih se može rekonstruirati određen podatak  
npr:

- lokalitet, položaj, datum, ekipa...
- crtež s legendom (jasno označenom), mjerilom, sjeverom, lokacijom nalaza
- ostalim relevantnim podacima
- fotografijama s mjerilom



## Važno: suvremene metode omogućavaju mnoga nova istraživanja i analize:

- važnost nalaza, no i ostalih čimbenika
- važnost inter i multidisciplonarnog pristupa u istraživanju
- od izuzetne važnosti: u školovanju speleologa ukazati na sve aspekte podataka kako bi se spriječila devastacija i donijele ispravne odluke

Primjer: nekad je naglasak bio na samim nalazima (arheološkim, antropološkim itd) (doba antikvarianizma).

Razvoj arhologije i znanstvenog pristupa: važnost priče koju nalazi pričaju

Danas: razumijevanje konteksta i nalaza u složenim (okolišnim itd) uvjetima tadašnjeg vremena

Novija tehnološka i analitička pomagala i metode: geofizikalne analize, analize sedimentne dna, geoarheološke i sedimentološke analize, tafonomija i formacija nalaza: važno je sve i nikako ne želimo svojim postupcima utjecati na buduće analize

Primjer: nova metoda analize DNA iz sedimenata! (sediment ili environmental DNA)

Potpuno novi uvid u prošlost

## Article

# Pleistocene sediment DNA reveals hominin and faunal turnovers at Denisova Cave

<https://doi.org/10.1038/s41586-021-03675-0>

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## Open access



Elena I. Zavalav<sup>1</sup>, Zenobia Jacobs<sup>2,3</sup>, Benjamin Vernoit<sup>1</sup>, Michael V. Shunkov<sup>4</sup>, Maxim B. Kozlikin<sup>4</sup>, Anatoly P. Derevianko<sup>1</sup>, Elena Essel<sup>1</sup>, Cesare de Filippo<sup>1</sup>, Sarah Nagel<sup>1</sup>, Julia Richter<sup>1</sup>, Frédéric Romagné<sup>1</sup>, Anna Schmidt<sup>1</sup>, Bo Li<sup>2,3</sup>, Kieran O'Gorman<sup>2</sup>, Viviane Slon<sup>1,5</sup>, Janet Kelso<sup>1</sup>, Svante Pääbo<sup>1</sup>, Richard G. Roberts<sup>3,5</sup> & Matthia Meyer<sup>1</sup>

Denisova Cave in southern Siberia is the type locality of the Denisovans, an archaic hominin group who were related to Neanderthals<sup>1–4</sup>. The dozen hominin remains recovered from the deposits also include Neanderthals<sup>5,6</sup> and the child of a Neanderthal and a Denisovan<sup>7</sup>, which suggests that Denisova Cave was a contact zone between these archaic hominins. However, uncertainties persist about the order in which these groups appeared at the site, the timing and environmental context of hominin occupation, and the association of particular hominin groups with archaeological assemblages<sup>5–11</sup>. Here we report the analysis of DNA from 728 sediment samples that were collected in a grid-like manner from layers dating to the Pleistocene epoch. We retrieved ancient faunal and hominin mitochondrial (mt) DNA from 685 and 175 samples, respectively. The earliest evidence for hominin mtDNA is of Denisovans, and is associated with early Middle Palaeolithic stone tools that were deposited approximately 250,000 to 170,000 years ago; Neanderthal mtDNA first appears towards the end of this period. We detect a turnover in the mtDNA of Denisovans that coincides with changes in the composition of faunal mtDNA, and evidence that Denisovans and Neanderthals occupied the site repeatedly—possibly until, or after, the onset of the Initial Upper Palaeolithic at least 45,000 years ago, when modern human mtDNA is first recorded in the sediments.

Denisova Cave consists of three chambers (designated Main, East and South Chambers) that contain deposits with stratigraphic sequences extending from the Middle Pleistocene to the Holocene epoch. The Pleistocene deposits have chronologies that have been constructed from the radiocarbon dating of bone, tooth and charcoal<sup>3</sup> (to around 50 thousand years ago (ka)) and optical dating of sediments<sup>8</sup> (to more than 300 ka). Optical ages for Main and East Chambers (Fig. 1a–c) can be aligned on a common time scale (Extended Data Fig. 1) but excavations are ongoing in South Chamber, where layers are only tentatively recognized. Mitochondrial DNA and nuclear DNA have been recovered from eight hominin fossils, enabling four to be assigned to Denisovans (Denisova 2, Denisova 3, Denisova 4 and Denisova 8)<sup>4–6</sup>, three to Neanderthals (Denisova 5, Denisova 9 and Denisova 15)<sup>5,6,12</sup>, and one to the child of a Neanderthal and a Denisovan (Denisova 11)<sup>7</sup>. However, there are too few fossils to enable the detailed reconstruction of the timing and sequence of hominin occupation, and the association of the early Middle Palaeolithic, middle Middle Palaeolithic and Initial Upper Palaeolithic assemblages identified at the site with specific hominin groups. Moreover, two Denisovan fossils (Denisova 3 and Denisova 4)—but no modern human remains—have been recovered

from the Initial Upper Palaeolithic layers, so it is debated whether archaic hominins or modern humans created the associated ornaments and bone tools<sup>9–11</sup>.

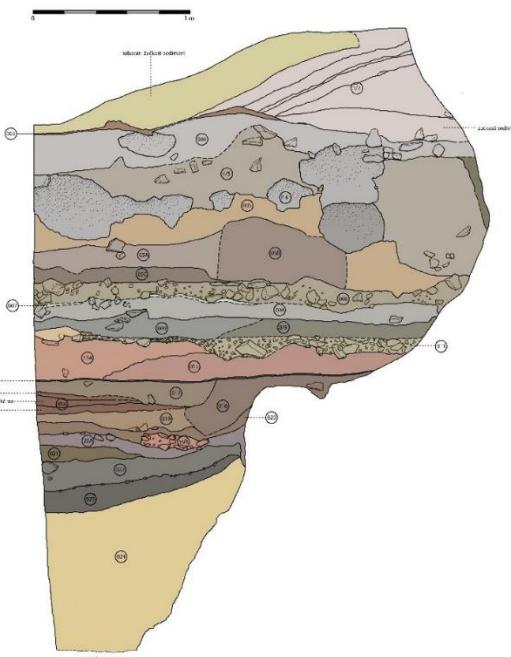
A pilot study of DNA preservation in sediments from Denisova Cave identified ancient hominin mtDNA in 12 out of 52 samples<sup>13</sup>, which suggested a path to reconstructing the occupational history of the site at higher resolution than is feasible from the scarce hominin fossil record. Here we report the analysis of 728 sediment samples, collected in a 10–15-cm grid-like pattern from the exposed Pleistocene deposits in all three chambers (Extended Data Figs. 2, 3a, b, Supplementary Information sections 1, 2). Using automated laboratory protocols, DNA was extracted from each sample, converted to single-stranded libraries and enriched for mammalian and hominin mtDNA<sup>13,14</sup>, which we identified to the biological-family level using an established analysis pipeline<sup>13</sup>.

## **Patterns of DNA preservation**

We identified ancient mammalian mtDNA in 685 samples (94%) from all sampled layers, including those older than 290 ka (Extended Data



### Romualdova pećina - Sjeveroistočni profil mjerilo 1:10



<sup>1</sup>Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. <sup>2</sup>Centre for Archaeological Science, School of Earth, Atmospheric and Life Sciences, University of Wollongong, Wollongong, New South Wales, Australia. <sup>3</sup>Australian Research Council Centre of Excellence for Australian Biological Heritage, University of Wollongong, Wollongong, New South Wales, Australia. <sup>4</sup>Institute of Archaeology and Ethnography, Russian Academy of Sciences, Siberian Branch, Novosibirsk, Russia. <sup>5</sup>Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel. <sup>6</sup>Department of Human Molecular Genetics and Biochemistry, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel. <sup>7</sup>The Shmunitz Family Anthropology Institute, The Dan David Center for Human Evolution and Biohistory Research, Tel Aviv University, Tel Aviv, Israel. E-mail: elena.zavalav@weizmann.ac.il; zenobia@uow.edu.au; rgrbo@uow.edu.au; mmeyerj@weizmann.ac.il

Ivor JANKOVIĆ, James C. M. AHERN, Rory BECKER,  
Tihomir PERCAN, Darko KOMŠO

## LJUBIĆEVA PEĆINA: LASERSKO SKENIRANJE I GEOFIZIKALNA MJERENJA U SEZONI 2019.

## LJUBIĆEVA PEĆINA: LASER SCANNING AND GEOPHYSICAL WORK IN THE 2019 SEASON

dr. sc. Ivor Janković  
Institut za antropologiju, Zagreb  
Department of Anthropology, University of Wyoming  
ivor.jankovic@inantro.hr

dr. sc. James C. M. Ahern  
Department of Anthropology, University of Wyoming  
JAherm@uwyo.edu

dr. sc. Rory Becker  
Department of Anthropology and Sociology,  
Eastern Oregon University  
rbecker@eou.edu

Tihomir Percan, Hrvatski restauratorski zavod, Odjel za  
kopnenu arheologiju, sjedište Jurčići  
tpercan@h-rz.hr

Darko Komšo, Arheološki muzej Istre u Puli  
komsodarko@gmail.com

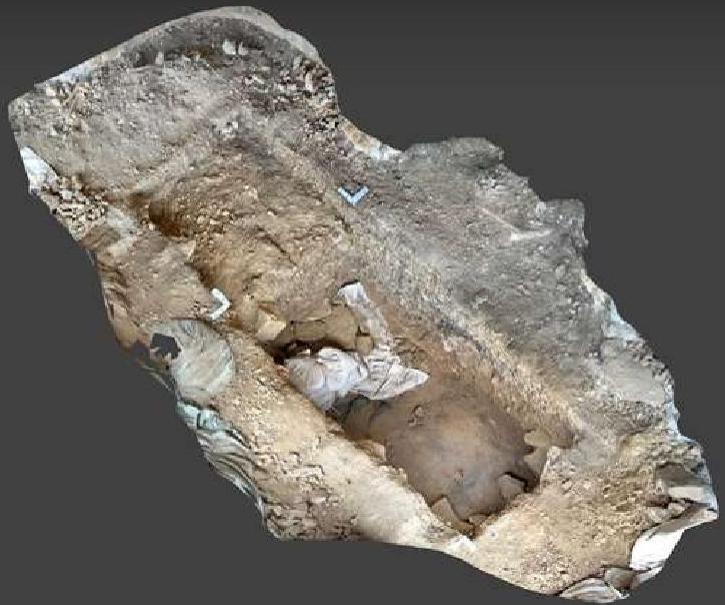
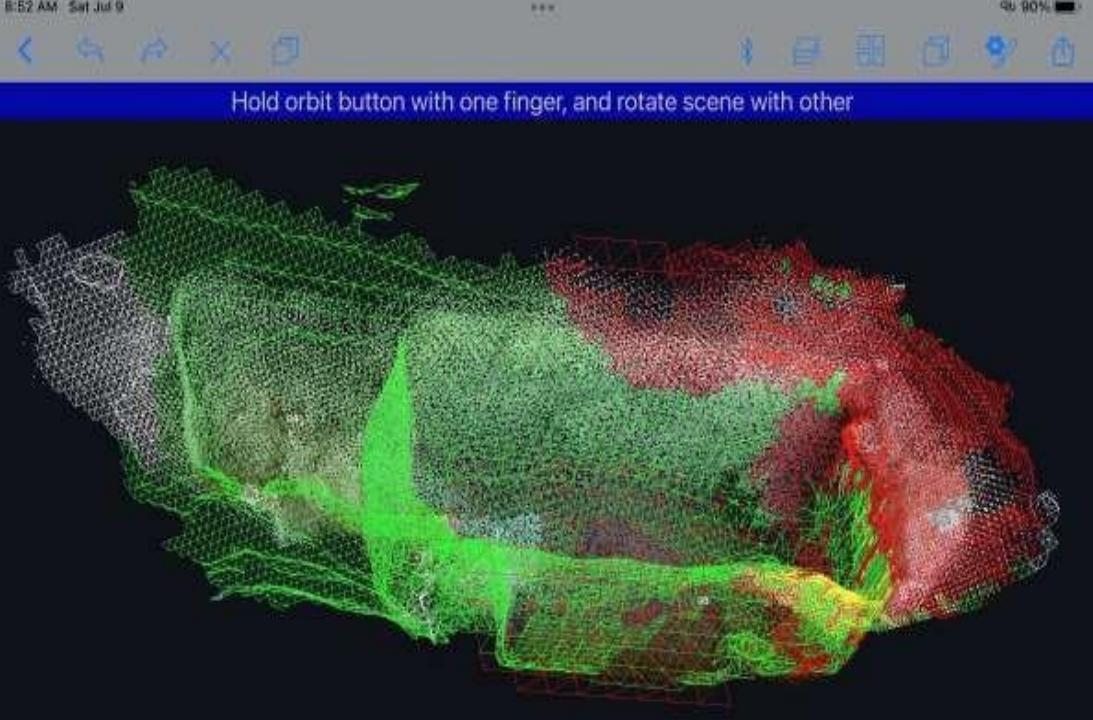
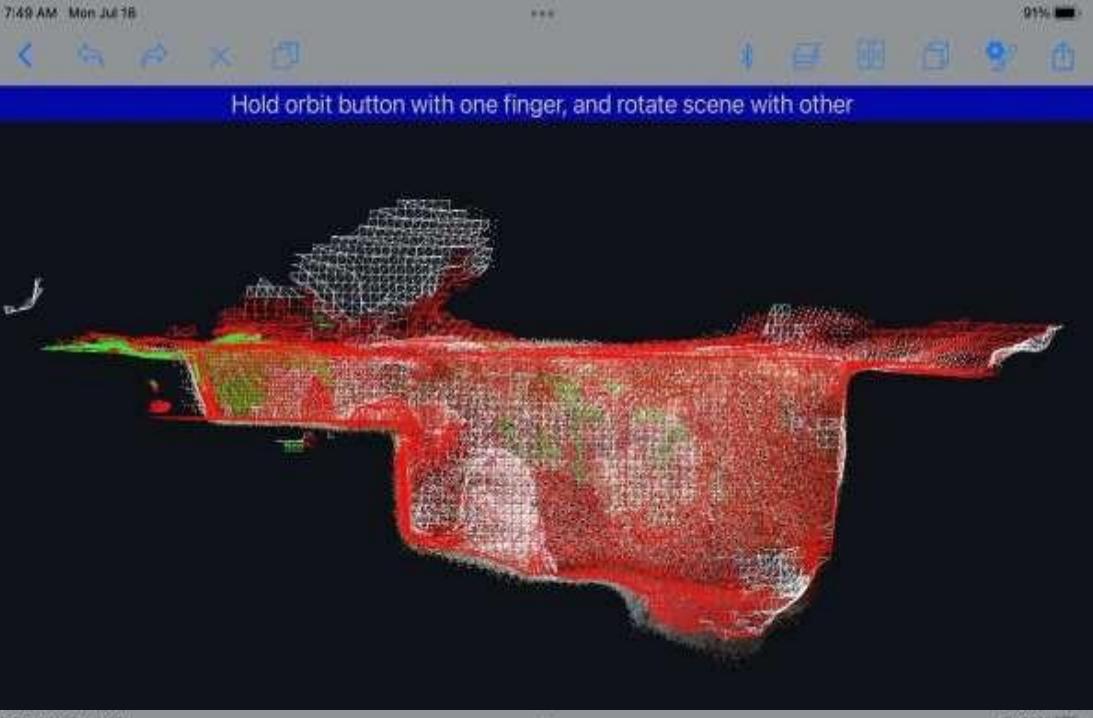
Ivor Janković PhD  
Institute for Anthropological Research, Zagreb  
Department of Anthropology, University of Wyoming  
ivor.jankovic@inantro.hr

James C. M. Ahern PhD  
Department of Anthropology, University of Wyoming  
JAherm@uwyo.edu

Rory Becker PhD  
Department of Anthropology and Sociology, Eastern  
Oregon University  
rbecker@eou.edu

Tihomir Percan, Croatian Conservation Institute,  
Department for Land Archaeology, branch office Jurčići  
tpercan@h-rz.hr

Darko Komšo, Archaeological Museum of Istria, Pula  
komsodarko@gmail.com



# Earth Resistance Tomography for Detecting Previous Excavation Trenches in Cave and Rock Shelter Sites in the Lim Channel, Croatia

Rory Becker<sup>1</sup>, Ivor Janković<sup>2</sup>, Darko Komšo<sup>3</sup>, James C. M. Ahern<sup>4</sup>, Katarina Gerometta<sup>5</sup>, Jacobo Weinstock<sup>6</sup>

<sup>1</sup>Department of Anthropology/Sociology, Eastern Oregon University, La Grande, Oregon, USA

<sup>2</sup>Institute for Anthropological Research, Zagreb, Croatia<sup>3</sup>Archaeological Museum of Istria, Pula, Croatia

<sup>4</sup>Archaeological Museum of Istria, Pula, Croatia

<sup>5</sup>Department of Anthropology, University of Wyoming, Laramie, Wyoming, USA

<sup>6</sup>Department of History, University of Pula

<sup>5</sup>Department of Archaeology, University of Southampton, Southampton, United Kingdom

## ABSTRACT

Earth Resistance Tomography (ERT) is a geophysical prospecting technique that has the capacity to model subsurface sediments. This technique is applied at the Cave near Rovinjsko Selo 1 site which is in the Lim Channel, Croatia. ERT is used as a means for positively identifying a previous excavation trench location within site which, in turn, informs the excavation planning process. The potential benefits of this technique are discussed for future excavation planning efforts at Romuald's Cave, another cave site location in the Lim Channel. While beneficial in this study, the technique's utility will vary in other locations according to site conditions, amount of previous excavation activities, and age of earlier excavation activities which affects both the geophysical survey design and applicability of ERT to the specific site environment.

**Key words:** Earth Resistance Tomography, Archaeological Prospection, Subsurface Modeling, Cave Sites, Rock Shelters



## SHORT REPORT

# High data density electrical resistivity tomography survey for sediment depth estimation at the Romuald's Cave site

Rory J. Becker<sup>1</sup> | Ivor Janković<sup>2</sup> | James C.M. Ahern<sup>3</sup> | Darko Komšo<sup>4</sup>

<sup>1</sup>Anthropology/Sociology Programme, Eastern Oregon University, La Grande, OR, USA

<sup>2</sup>Institute for Anthropological Research, Zagreb, Croatia

<sup>3</sup>Department of Anthropology, University of Wyoming, Laramie, WY, USA

<sup>4</sup>Archaeological Museum of Istria, Pula, Croatia

### Correspondence

Rory J. Becker, Anthropology/Sociology Programme, Eastern Oregon University, 1 University Boulevard, La Grande, OR 97850-2807, USA.  
Email: rbecker@eou.edu

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## Abstract

Electrical resistivity tomography (ERT) surveys were conducted at the Velika Pećina near Kljevica and Romuald's Cave sites in Croatia in 2014 and 2015. The goal of the surveys was to estimate sediment depth to bedrock. However, neither survey produced reliable results at the 0.5 m probe spacing. In 2017, the Romuald's Cave site was revisited utilizing a high data density survey of 0.1 m probe spacing. All three surveys were conducted with a GeoScan RM85 in a pole-pole configuration. The high data density survey produced reliable results given the subsurface information available from three excavation trenches in the first chamber of the cave. The 2015 and 2017 ERT survey results are presented along with the results from two additional high data density ERT surveys located in the back chamber of Romuald's Cave. These results suggest that utilizing high data densities may improve the reliability of ERT surveys in cave environments.

### KEY WORDS

cave site, early Mesolithic, Adriatic regionelectrical resistivity tomographyPaleolithic sediment depth estimation





# Umjesto zaključka

- špilje su u centru interesa mnogih (znanstvenici raznih profila, speleolozi itd.)
- imaju i ekonomski potencijal (turizam, važnost održivog pristupa)
- jedini pravi pristup je razumjeti motive različitih skupina i raditi na edukaciji

Chapter 7  
Get'm While They're Young: Advances  
in Participatory Heritage Education in Croatia

Ivor Janković and Sanjin Mihelić

## Introduction

We all know from our own lives that certain things, experiences and memories from our youth are strongly imprinted on us. Our childhood summers seemed longer and brighter than those of today. The thing is that during the tender age of puberty and near-adulthood, we are driven by experiences, and these experiences tend to stay with us to the old age. It does not matter what we do in our professional lives as adults and that very few of us became people we dreamt about becoming as children. However, those memories we keep often leave us with warm feelings towards certain aspects of other people's professions and world in general. It is thus crucial to introduce things we care about as professionals into everyone's lives during their childhoods. Most people will not grow up to become professional archaeologists, but that does not mean they do not care about them, either. Politicians and people in any profession have kind memories when some one brings up the topic of archaeology. Does this sound far-fetched? Possibly, but certainly not unimaginable. People care about things they understand at some level, especially if they are emotionally attached to them. Therefore, the goal is rather simple: Let us help them make good memories. This is the basic idea behind our attempt to involve children and younger people in certain aspects of archaeology – as the title of the paper puts it: Get them while they are young.

I. Janković (✉)  
Institute for Anthropological Research, Zagreb, Croatia  
e-mail: ivor.jankovic@inamto.hr

S. Mihelić  
Archaeological Museum in Zagreb, Zagreb, Croatia

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V. Apaydin (ed.), *Shared Knowledge, Shared Power*, SpringerBriefs in Archaeology,  
[https://doi.org/10.1007/978-3-319-68652-3\\_7](https://doi.org/10.1007/978-3-319-68652-3_7)



THE ARCHAEOLOGY PROJECT  
UKLJUČIVANJE JAVNOSTI:  
O VAŽNOSTI  
POPULARIZACIJE ZNANOSTI  
(S. Mihelić<sup>1</sup>, B. Cvrljančić<sup>2</sup>)

<sup>1</sup> Arheološki muzej u Zagrebu, Zagreb, Hrvatska, smihelic@amz.hr  
<sup>2</sup> Institut za antropologiju, Zagreb, Hrvatska, harbara.cvrljanic@inamto.hr

Ako ste već ušli u ruke ovu knjigu, uz to se, nadamo se, uđelimo u stolac ili našljeneć, depunirat ćemo si slijediti i logom da zaljubimo kako postoji raznjeće velika vjerojatnost da dajite perspektivu autora okupljenih oko projekta ARCHAOLIM, barem kada je značajno da se neka i nekogliko podrazumevaju da je znanost ova temelj na i nopravni kontekst kojim se na sustav način pristupa do oltečja, obrazovanja, a naposled i do ovjesne primjene zakonitosti i pravila koja uređuju mračni svijet.

Slijedeći stvar oko koje ne bismo trebali imati previše dvojbi tice da držive podjele prava i odgovornosti u vezi znanosti. Za potrebe, znanost će biti baviti znanstvenici, toliko je barem jasno. S druge strane, rezultati znanstvenih istraživanja trebaju biti dostupni i korištiti se u obrazovanju, a u posljednjem slučaju, i u svakodnevnom životu, u našem delovanju društvenim, a i u čitanju i raspravljanju. Ova međudanšina došao je do tog da se u nekima i u svakog društva određena energija usmjerena na bavljenje tranzakcijama, a usporavanjem koliko i kvalitetog uloga u pojedincima i društvima možemo se zaharavati i time da ih dijelimo na napredna te ona u kojima je na djelu "mačehinski" odnos prema znanosti. Sami osjetite kojem od dva nastava pripada vašem društvu.

Bez obzira na to (este li znanstveni tip ili ne), u jednu stvar možete biti saglasni, a u drugu ne, ali to je dobro, i tako je i učenje. Učimo se i učimo vi. Vjerujemo nam na riječ, to ne treba posebno provjeravati, ali poriče znanstvenici i podržavajući znanstvenog rada, možemo se uprijeti što je moguće učiniti da bi se povećao ukupni znanstveni proračun, naročito u svijetu u kojem se na pripadatelj državnih vrijednosti uhranjuju uspršni drugi koncepti, dok se manost naizgled poglavljen obavijaju Pepljagin plafon.

Arheološka istraživanja provedena su sredstvima projekata *Arheološka istraživanja kasnog Pleistocena i ranog Holocena u Limskom kanalu, Istra* (ARCHAEO-LIM, UIP-2013-11-7789) i *Prapovijesni llovci i sakupljači u Istri i obližnjim regijama: obrasci života tijekom kasnog pleistocena* (PREHISTRIA, IP-2019-04-7821).

