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BETWEEN THE WOODS AND THE WATER: THE EARLY UPPER PALEOLITHIC FROM THE ROMANIAN KARST

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Cuvinte-cheie: Peșteri, tranziția la Paleoliticul Superior, Paleolitic Superior Inițial, demografie, geoarheologie.
(Abstract)

Romania has thousands of karstic caves in the Carpathian and Dobrudja regions, some of which have yielded important early prehistoric finds including human fossils and cave art. However, despite over a century of exploration and systematic archeological investigations, cave excavations have yet to produce large, well-stratified Pleistocene artifact assemblages that are known in neighboring regions. This article explores possible reasons for the low number of significant assemblages and discusses the ramifications for the Paleolithic record while making future recommendations for research.

Introduction

At the geographic heart of the European landmass, Romania is thought to have played an important role as a past crossroads of human movement through the continent linking the Black Sea and Balkan Peninsula with Central and Western Europe through the Iron Gates[1]. Regarding the earliest modern human peopling of Europe, western Romania is pivotal, having three caves with some of the continent's earliest well-dated and well-preserved human fossils, numerous large open-air Paleolithic sites and the promise of early cave art[2].

Perplexingly, caves and other karstic features have yet to uncover considerable Paleolithic artifacts, osseous tools and/or associated butchered Pleistocene faunal remains. This is particularly true around the early Upper Paleolithic—the timeframe where Neanderthals disappeared and modern humans are thought to have first entered the Europe. This is also in stark contrast to the rich open-air archeological record[3] and the surrounding karstic records of Hungary[4], Bulgaria[5] and Serbia[6], that all claim numerous archeological sequences some of which date continuously back to the Early Pleistocene[7]. Thus, the paucity of Upper Paleolithic cave sites in Romania points to either an anomalous situation or an absence of adequately evaluated and understood collections.

Here, we review the Romanian Pleistocene karstic archeological record then discuss cave geomorphology, raw material availability, and landscape use as potential reasons for the changes in lithic frequency from the Middle to early Upper Paleolithic concluding with recommendations for future research.

Background

Romanian caves have long been the object of scientific interest. Investigations started in the 18th century typically focusing on their geological and paleontological archives[8]. The first archeological excavations started around the turn of the 20th century carried out primarily by Transylvanian German and Hungarian scholars[9]. During a visit

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1 For example, during the early Upper Palaeolithic or later during the Neolithic. See Bar-Yosef 1998; McCormick 2001; Larson *et alii* 2007.

2 Soficaru *et alii* 2006; 2007; Doboș *et alii* 2009; Ghemiș *et alii* 2011; Trinkaus *et alii* 2012; Anghelinu and Niță 2014.

3 Păunescu 1965; Mogoșanu 1978; Otte *et alii* 2007; Dobrescu 2008; Sitlivy *et alii* 2012; Schmidt *et alii* 2020

4 Lengyel 2018.

5 Hublin *et alii* 2020; Kozłowski – Ginter 1982; Kozłowski *et alii* 1992; Sirakov *et alii* 2010.

6 Mihailović 2014; Alex *et alii* 2019.

7 Strait *et alii* 2016; Radović *et alii* 2019; Lindal *et alii* 2020.

8 Povară 2019.

9 Păunescu 2001; Anghelinu and Boroneanț 2019.

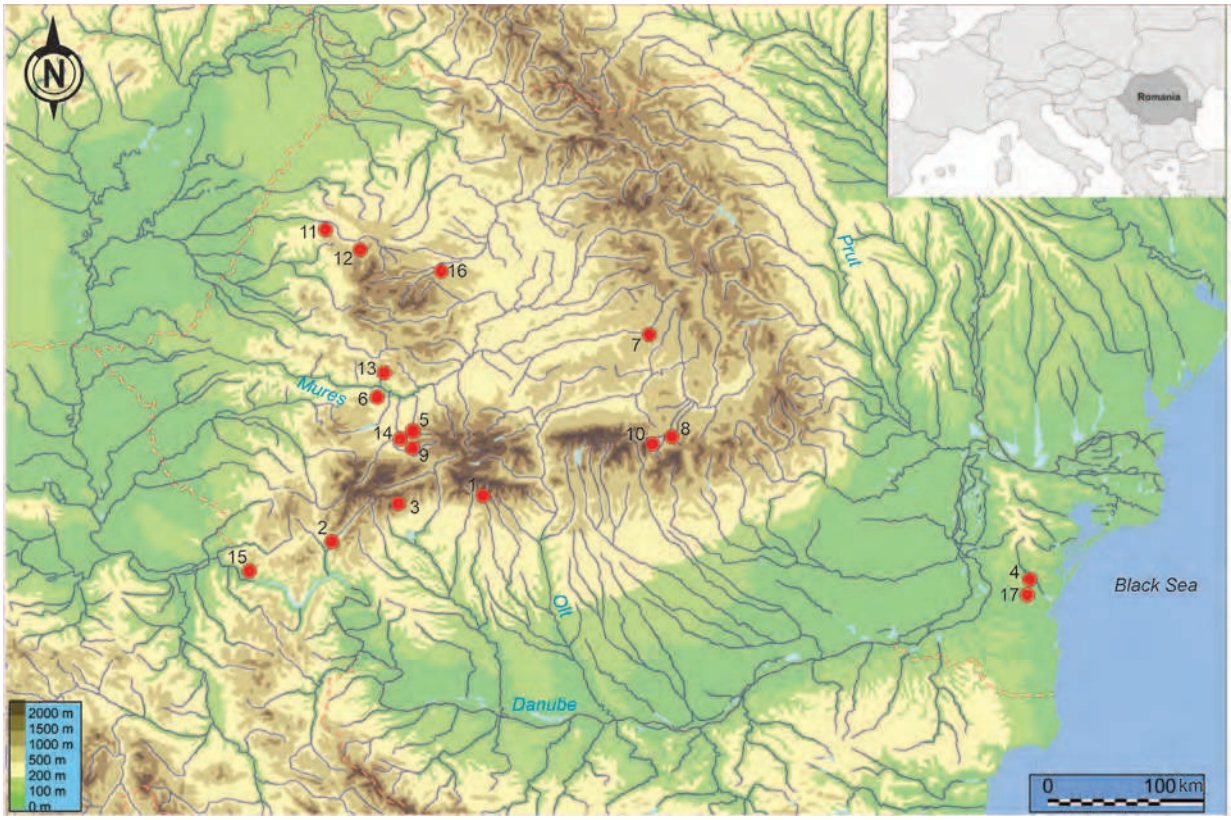

Figure 1. *Map of Romanian caves discussed in text / Harta peșterilor discutate în text*
1. Baia de Fier – Peștera Muierii; 2. Băile Herculane: 2a – Peștera Hoților, 2b – Peștera 24, 2c – Peștera 26; 3. Boroșteni – Peștera Cioarei; 4. Cheia – Peștera La Izvor; 5. Cioclovina – Peștera Uscată; 6. Nandru: 6 a – Peștera Curată, 6 b – Peștera Spurcată; 7. Merești: 7a – Abri 122, 7b – Peștera Calului; 8. Râșnov – Peștera Gura Cheii; 9. Ohaba Ponor – Peștera Bordu Mare; 10. Peștera: 10a – Peștera Liliecilor, 10b – Peștera Mică, 10c – Peștera Valea Coacăzii; 11. Peștera – Peștera Igrița; 12. Lorău – Peștera Boiului; 13. Crăciunești: 13a – Peștera Balogu, 13b – Peștera Groapa Lupului, 13c – Peștera Zidul de Sus, 13d – Peștera Șura de Jos; 14. Federi: 14a – Peștera 1 din Coasta Vacii, 14b – Peșterile 2 și 3 din Coasta Vacii; 15. Pescari – Peștera Livadița; 16. Someșul Rece – Peștera Oaselor; 17. Târgușor – Peștera La Adam.

to Transylvania in 1924, the seminal prehistorian Abbé H. Breuil examined some of these assemblages and testified that numerous caves were inhabited during the Pleistocene[10]. Later, among the important figures involved in Paleolithic cave research (roughly in chronological order) were M. Roska[11], C. S. Nicolăescu-Plopşor[12], F. Mogoşanu[13], A. Păunescu[14] and M. Cârciumaru[15] who explored much of the karstic landscape of Romania.

Notwithstanding, Romania has over 12,000 registered caves[16] of which 2908 are fossil[17] and have the potential to contain fossilized sediments. However, the number of excavated caves is small; among those that have reported archeology (N=205) only a quarter have reported Paleolithic finds (N=54)[18] and of these, most are small assemblages that are undated or poorly temporally constrained.

Caves that have been associated with the Paleolithic can be grouped into two categories:

• First, those that have been systematically excavated and uncovered occupation residues with variously sized lithic assemblages sometimes associated with worked faunal remains and/or hearths (Table 1 – upper section). Among these, the bulk of the lithic material has been assigned to the Middle Paleolithic with lithic assemblage sizes ranging between 27 and over 3000 artifacts although some also contain smaller Aurignacian assemblages and

[10] Breuil 1925.
[11] Roska 1925.
[12] Nicolăescu-Plopșor 1957.
[13] Mogoșanu 1978.
[14] Păunescu 2001.
[15] Cârciumaru *et alii* 2000.
[16] Ponta – Onac 2019.
[17] From www.speologie.org, search word 'fosil' in 'Descrierea' field.
[18] From the National Archaeological Repertory; http://ran.cimec.ro; search words: *areal carstic, așezare în peșteră, atelier în peșteră, locuire în peșteră.* Subsearch word: *Paleolitic.* Search date May 11, 2020.

artifacts from later periods (N<173). However, for most of them, the stratigraphy from which they were recovered is poorly known and they are consequently undated. Where radiometric ages are available, most are imprecise due to old radiocarbon methods or they are wide-ranging due to uncertain artifact provenience or an incomplete understanding of post-depositional processes; both make it difficult to decode palimpsests and fully untangle occupational histories[19].

• Second are caves where Paleolithic artifacts were discovered through small test trenches and only informally reported on in the literature. No subsequent research has confirmed their validity as sites and artifacts are generally missing from repositories for verification (Table 1 – lower section). For example, Balogu Cave (village of Crăciuneşti, Hunedoara County) was excavated through a test trench by M. Roska and H. Breuil who reported charcoal fragments, broken bones with use-wear and a few limestone flakes but their whereabouts are currently unknown[20]. In later publications, the cave was incorporated into the literature as a verified Paleolithic site[21]. Our own 2019 test trenches in Balogu Cave, one of which was adjacent to the old test trench, revealed no material traces of hominin presence. A similar situation was encountered in the Groapa Lupului Cave, a few hundred meters from Balogu where in spite of thick Pleistocene sediments and earlier finds, later test-pitting by A. Păunescu recovered unretouched quartzite flakes and two flint chips[22]. While these investigations may not necessarily overturn previous findings, they cast reasonable doubt on some of these earlier collections and at least imply a sparse occupation of the cave during the Paleolithic.

Between these two categories, what is clear is that Romanian cave assemblages are few, sparing in artifacts and our understanding of them is impeded by the antiquity of most excavations. As a result of the past excavation techniques that today seem sub-standard (e.g. lack of three dimensional measurements, appropriate wet-screening) it is possible and even probable that the number of artifacts at some sites is underestimated whereas others may have been erroneously attributed.

Many caves have also been prone to anthropic activities with no connection to research. In addition to clandestine excavations, guano deposits have long been exploited, with major impact on sediment preservation. The Cioclovina skull stands as a notorious example of context destruction; it was discovered in a mining cart carrying guano, during the Second World War[23]. Cheia – La Izvor Cave was completely emptied of sediment in the 1970s and turned into a bar, even after excavations had confirmed it was an archeological site[24].

In some cases, such as the newly re-excavated Abris 122, setbacks may be overcome through the fastidious examination of older collections through the combination of studying well-provenienced material ideally combined with keyhole excavations targeting stratigraphy and pedology, geochemical/sediment analysis and archeometric studies where remaining sediments permit[25]. However, this approach is not without its challenges as the integrity of legacy Paleolithic inventories are seldom clear and past researchers have irregularly left suitable witness profiles behind where stratigraphies can be re-evaluated and proxies extracted[26]. Thus, it seems that much of the archeological data from Romanian caves and the conclusions that are drawn from them remain tentative without the discovery of new artifact-bearing deposits.

Cave geomorphology

A potential reason why Romanian caves have yielded few Upper Paleolithic artifacts is that Late Pleistocene climate-driven sedimentation, erosion, and/or rockfall may have erased or inhibited the recovery of Upper Paleolithic findspots[27]. Such a proposition has been explored as a viable explanation for a similar, if less dramatic situation of open-air site where slack sediments from higher elevations have been prone to mass wasting by deflating upland areas and redeposition in valley floors[28]. This scenario is an unlikely situation in Romania where much of the karstic record preserves well-stratified Pleistocene deposits[29] with thick sedimentary cover; enough to preserve Pleistocene fauna, geochemical proxies and sediments in many cases.

In contrast, most of the caves we refer to in this paper have not benefitted from multi-proxy analyses to reveal their sedimentary history and mode/type of post-depositional processes, and their constant re-interpretation relies solely on

19 Doboş 2008; Cosac *et alii* 2018.
20 Breuil 1925; Roska 1925.
21 Jungbert 1979; Păunescu 2001.
22 Păunescu 1999.
23 Soficaru *et alii* 2007.
24 Păunescu 1999.
25 Sitlivy *et alii* 2012; Cosac *et alii* 2018.
26 Chu *et alii* in press.
27 Iovita *et alii* 2014.
28 Jámbor 2012; Tourloukis 2016.
29 Onac – Goran 2019.

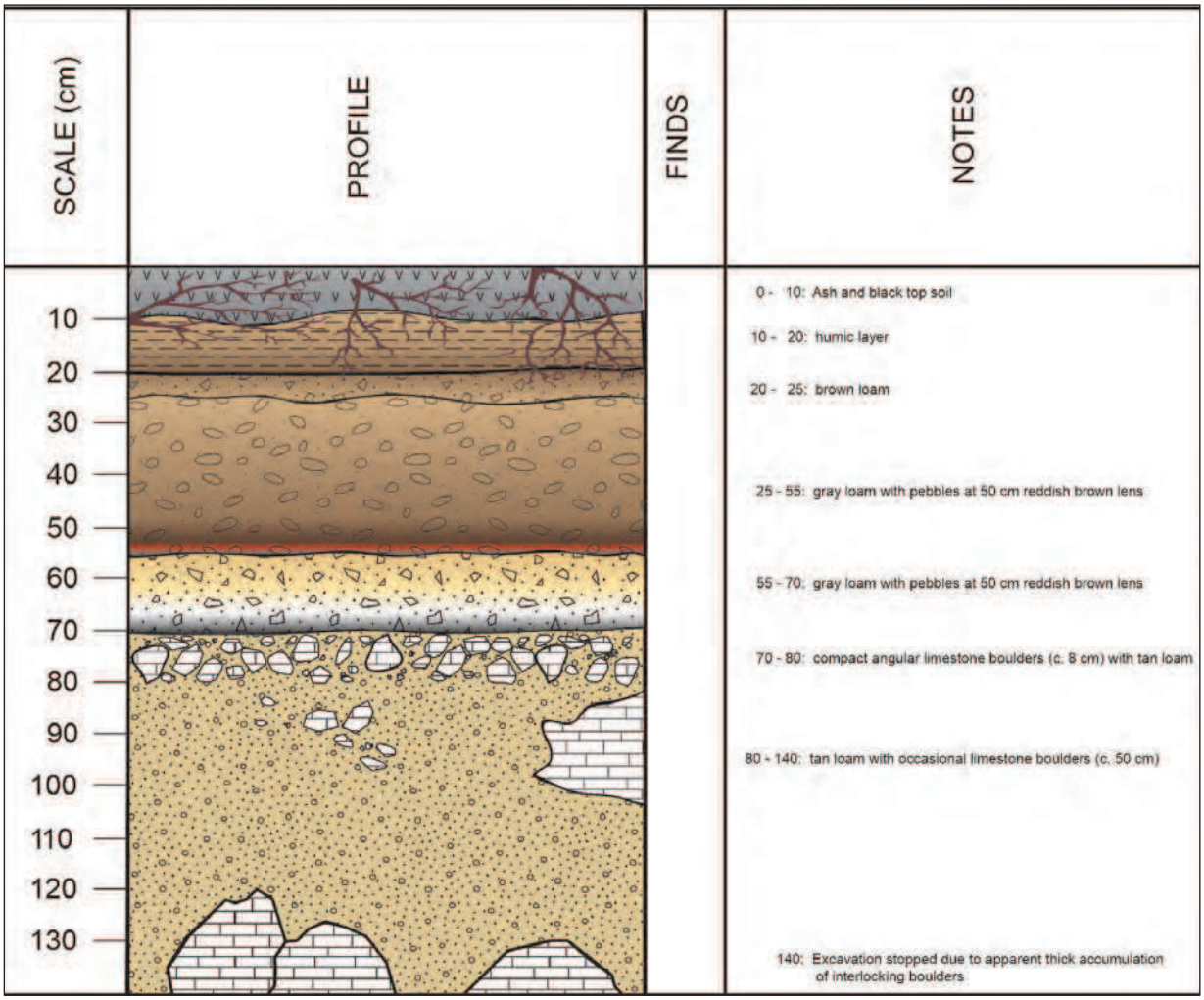

Figure 2. *Profile of the 1x1m² test trench from Peştera 24 with short descriptions. Sedimentary symbols are taken from the U.S. Geological Survey (2006) and period missing / Profilul sondajului de 1x1m² din Peştera 24, cu scurte descrieri. Simbolurile tipurilor de sediment sunt preluate din U.S. Geological Survey (2006).*

lithic assemblages. The radiocarbon ages indicate their occupation was around the H5 event and GI 12, a time period which witnessed important and sudden climate changes. A study of Peştera Urşilor, which has traced back the history of the cave up to 300 ka and identified the alternating low-energy/high-energy processes has revealed that during the H5 event/GI 12 occurred important changes responsible for sediment reworking.[30]. Similarly, complex research carried out at Peştera cu Oase for reconstructing the paleoenvironment during the MIS 3, highlighted that despite milder climate conditions, multiple processes were involved in sediment reworking[31]. The cranium from Peştera Muierii, found washed in a pit and bearing rolling marks[32], accounts for intense post-depositional processes that have not yet been investigated.

Thus, the sedimentary history of the cave sites discussed here and on the factors impacting the sediment dynamics throughout the MIS remain woefully understudied.

From our own test trenches in the Cerna Valley of Western Romania near the Iron Gates, at Peştera 24 and Peştera 26 (1x1 m each), Pleistocene sediment accumulations were thick but also devoid of archeological residues despite their assumed suitability for occupation (Figures 2 and 3). While it is possible that these small test pits "missed" occupation layers, larger excavations at nearby Peştera Hoţilor (c. 10 km SW), with similar stratigraphy only recovered a small amount of Middle and early Upper Paleolithic artifacts in spite of a wealth of later Upper Paleolithic assemblages (Table 1). A similar situation was detected (in an excavation over an area of c. 18 m²) at nearby Tabula Traiana Cave in Serbia (c. 30 km SW) where in spite of modern

[30] Constantin *et alii* 2014.
[31] Constantin *et alii* 2013.
[32] Doboş *et alii* 2010.

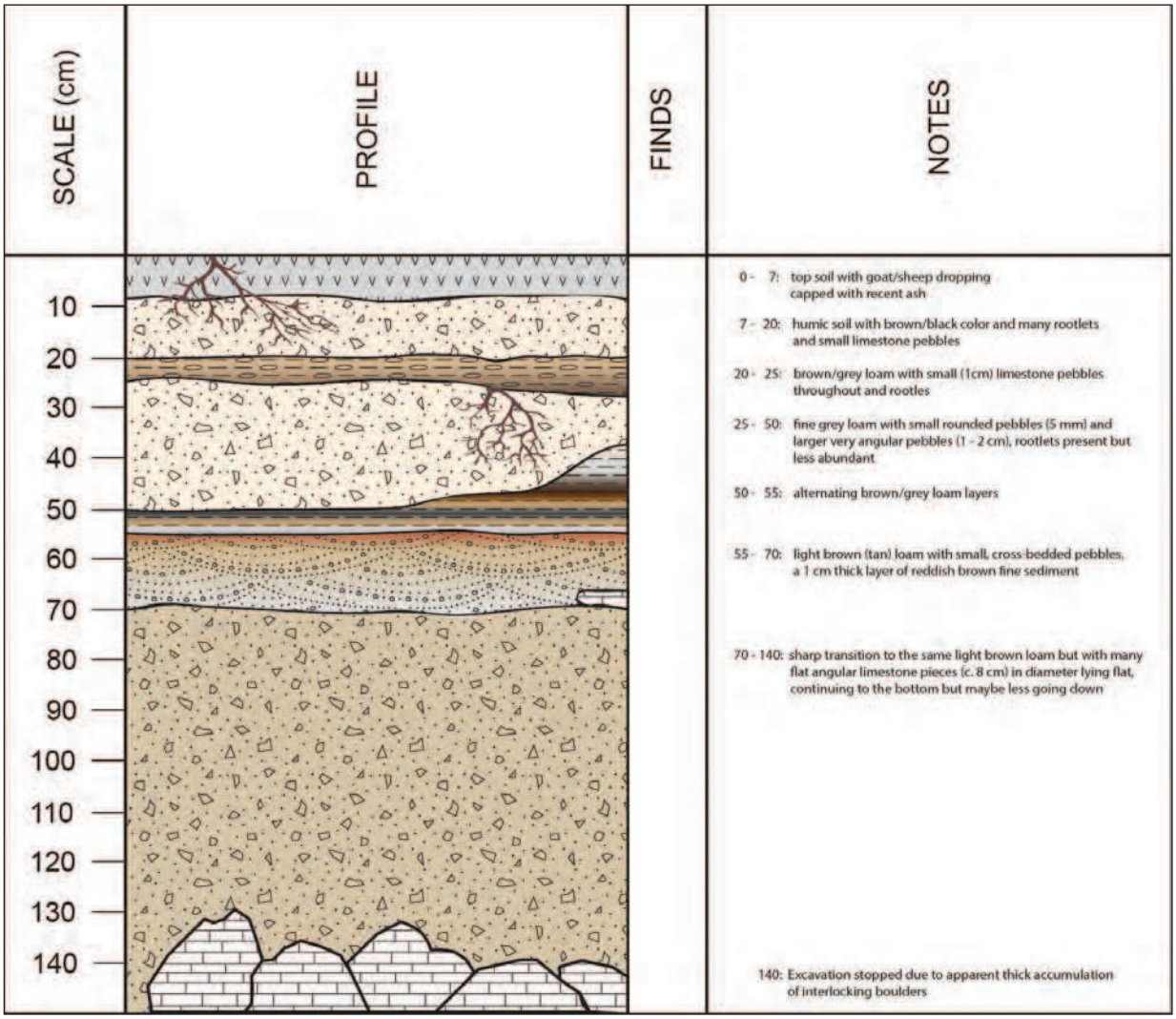

Figure 3. *Profile of the 1x1m² test trench from Peștera 26 with short descriptions. Sedimentary symbols are taken from the U.S. Geological Survey / Profilul sondajului de 1x1m² din Peștera 26, cu scurte descrieri. Simbolurile tipurilor de sediment sunt preluate din U.S. Geological Survey (2006).*

excavation methods and chronological control, only modest Paleolithic assemblages were uncovered.

Raw materials

Another factor contributing to the scarcity of Paleolithic finds in Romania may be that the Carpathian arc is poor in fine-grained silicates that render easily knappable and identifiable lithic artifacts[33]. Indeed, in areas of Romania where suitable raw material is readily available, open-air sites are large and abundant such as in the Prut Valley and Banat[34]. A similar pattern has been observed in adjacent Northern Serbia surveys of river valleys in suggest that Paleolithic artifact density likely correlate to raw material availability[35]. These regions may indeed translate to higher human activity having been frequented as raw material sources, though an alternative hypothesis is that the high quality flint simply amplifies our ability to recognize Paleolithic forms.

At the same time, it is intriguing that at least one open-air Middle Paleolithic occupation, Zăbrani (western Romania) shows the choice of quartzite and other coarse-grained rocks over fine-grained rocks, readily available[36]. This fact should invite reflection on modern standards applied in discriminating *good* over *poor* quality raw materials.

In the karstic regions, where raw material use is centered on Quartzite and other coarse-grained rocks (Table 1), hominins may have modulated their knapping behavior or relied on non-lithic resources such as bone, wood and/or other organic

[33] Biró 2009; Mester 2013.
[34] Lazarovici *et alii* 2018; Moreau *et alii* 2018.
[35] Kajtez – Heffter 2020.
[36] Tuffreau *et alii* 2007; 2009.

materials for subsistence that have decayed or been difficult to identify as implements. Such may have been the case during the early Upper Paleolithic where high quality raw materials were essential to produce fine bladelets[37]. As is known from other regions of the Carpathian Basin such as Eastern Slovakia, where hominins relied on poor quality limnosilicites, Upper Paleolithic forms were manufactured on flakes; bladelet production was not possible despite close proximity to higher quality raw material sources such as obsidian[38]. One can imagine parallels to the Asian Pleistocene record, where hypothesized dependence on quartzite as a raw material led to changes in lithic technology and an impoverished lithic record (the so-called Movius Line) and even an increased hominin reliance on other modes of tool and weapon manufacture[39].

Landscape use, climate and biogeography

Differential land-use patterns between the Middle and Upper Paleolithic have been used to explain the relative paucity of Upper Paleolithic artifacts in the Romanian karstic record in the past. Redating campaigns in neighboring Serbia have suggested that late surviving (39 ka cal BP) Neandertal populations persisted in Southeastern Europe until relatively late impeding the influx of early modern human populations into upland areas and effectively restricting their activities to river valleys[40]. Given the late dates for the Mousterian in Romania and the early dates for Aurignacian assemblages in the Banat[41], transposing these theories from the Balkans to the Carpathians seems plausible but both rely on a paucity of secure dates and a direct translation of lithic technocomplexes to hominin species, a presumption that while often tacitly accepted, remains unverified.

An alternative, though untested explanation is that Upper Paleolithic witnessed a shift in cave occupation intensity reflecting different mobility patterns related to the availability of resources in the highland areas[42]. Given the strong climatic fluctuations in western Romania between 44 and 40 ka ago[43] it is conceivable that upland resource availability may have altered hominin land-use strategies as climate has been shown to be an effective driver of mobility patterns in the Carpathians and elsewhere.

In contrast, when typologically classified, it has been suggested that Western Romanian caves show no discernable change in technoeconomic strategies, artifact curation intensity and land-use strategies in settlement patterns during the time bracket covering the Middle and Upper Paleolithic[44].

However, several aspects went overlooked concerning the relation between the raw material and the techno-typological features of the lithic assemblages. Specifically, the comparison of formal tool attributes and proportions between quartzite and flint assemblages, and also between Middle Paleolithic and Upper Paleolithic assemblages. Quartz/ites, due to their coarse-grained fabric, smaller degree of isotropy, lack of water-content[45], hamper the identification of all the 'formal' tools when applying the typological standards defined for fine-grained rocks[46]. Provided the bad reputation quartzite has among knappable rocks, the correlation observed by Andrefsky[47] between the quality and abundance of the raw material on the one hand and the proportion of formal-informal tools on the other, seems like a path to explore in the situation discussed here. This renders the Romanian assemblages largely insensitive to retouch-based proxies of changes in land-use and mobility, which we therefore do not consider effective indicators of provisioning strategy at these sites.

Notwithstanding of the difficulties inhibiting the direct interpretation of the Pleistocene karstic record, such as uneven excavation quality, poor chronometric control and disparate artifact classification systems, the direct translation of lithic counts, curation indices and time-averaged palimpsests to past individuals, settlement systems and site occupancy modes remain questionable assumptions that are not easily overcome in the best of cases[48]. The vagaries of the legacy Romanian karstic Paleolithic assemblages as they stand, make it difficult, even impossible to confidently disentangle the technological aspects within disparate timeframes of duration of occupations[49].

Thus, the abundance of Middle Paleolithic sites in Romania (which in most cases are also small) may simply be larger palimpsests of similar

37 Woods 2011.
38 Chu *et alii* 2019.
39 Brumm 2010; Bar-Yosef *et alii* 2012.
40 Alex *et alii* 2019, Mihailović 2019.
41 Schmidt et alii 2013.
42 Anghelinu – Boroneanț 2019.
43 Staubwasser *et alii* 2018.
44 Riel-Salvatore *et alii* 2008.
45 Mourre 1997.
46 Knutsson 2015.
47 Andrefsky 1994.
48 Bicho –Cascalheira 2020; Mellars –French 2011; Dogandžić and McPherron 2013; Mellars –French 2013.
49 Bicho –Cascalheira 2020.

occupation modes. Even at open air sites in the Late Middle Paleolithic, localities that have been interpreted in the past as long-term camps, are recently being seen as representing recurrent short occupations by small human groups or passages of hunters during some activities or mobility[50].

Regardless of the validity of these hypotheses, which can only be falsified with improved climatic record, robust chronologies and well-contextualized archeological data, the fact remains that there are no long and rich occupational sequences from the early Upper Paleolithic in the karst. However, combined with the probable longer time-scale of Middle Paleolithic deposits and the potential for increased sedimentary input during the Late Pleistocene (as is evidenced in other regions of Central Europe[51]), it is at least possible that changes in lithic volumetric density may not be representative of actual human occupation or shifts in settlement preference, but rather are geogenic in nature. Without the comprehensive sedimentological history of each cave, the distinction between palimpsest and discrete levels remains tentative. For the time being, this can only be speculative, though the application of geoscientific methods combined with high resolution fieldwork that has shown to be an effective method in other neighboring regions, may hold tangible answers.

A word on the Initial Upper Paleolithic/ Transitional assemblages

A curiosity is why Romania, having the oldest modern human fossils in Europe, the only direct evidence of Neandertal/modern human interbreeding and an early and archaic Aurignacian, has not put forth any evidence for either Initial Upper Paleolithic/Transitional assemblages, which are thought to respectively be the remnants of precocious modern human incursions and Neandertals/ modern human interaction[52]. Transitional assemblages such as the Szeletian are well known in neighboring Hungary and Romania lies astride early Initial Upper Paleolithic assemblages in Bulgaria (Temnata, Bacho Kiro)[53], Moravia (e.g. Brno Bohunice, Stránská Skála III, Bohunice-Kejbaly I,II)[54] and the Ukraine (e.g. Korolevo I, 2 and Kulychivka[55]).

Among the myriad of reasons for their absence/ presence in other regions such as avoidance, differential cultural transmission, site formation processes and artifact recycling[56], we focus on the research history in Romania as one important aspect. The Middle to Upper Paleolithic transition was rarely (if at all) addressed by archeologists in the literature and most of the information is inferred from texts not directly focused on the topic. However, there was a general consensus about the delayed chronology for the Mousterian and subsequent Upper Paleolithic and about the uniqueness of the Central-European lithic industries when compared to western Europe:

- The 'classic' paradigm in Romania was following the Western Europe: local evolution of Neandertals into modern humans[57], parallel evolution of technocomplexes (i.e. Périgordian as locally developed and the allochtonous Aurignacian)[58], and gradual decrease of flake percentage in Upper Paleolithic assemblages[59]. Some particularities emerged though in regard to the Paleolithic in Romania. C. S. Nicolăescu-Plopşor suggested that the quartzite assemblages were produced by modern humans; this assumption relied on the presumed association of human fossils of Peştera Muierii to the Mousterian layers[60]. The transition, which in his view was represented by the Szeletian spreading from Hungary[61] tallied with the idea of local transitional technocomplexes, thus the Szeletian being homologous to the Châtelperronian of Western Europe[62]. Mogoşanu moved forward on the idea of parallel evolutions. After his research in Banat, he suggested that modern humans evolved into two parallel cultural groups, one producing Aurignacian toolkits in fine-grained rocks, while others continued using the quartzite throughout the remaining of the Pleistocene[63].
- Another more recent perspective, tacitly assumed the transition process happened outside Romania (at least), and that Romania was a refuge for late surviving Neandertals, and therefore they must have created the quartzite industries from Carpathian caves[64]. Still, some

50 Daschek –Mester 2020.
51 Hahn 1988.
52 Harvati *et alii* 2007; Doboş *et alii* 2010; Fu *et alii* 2015.
53 Kozlowski 2004; Hublin *et alii* 2020.
54 Richter *et alii* 2008; 2009.
55 Gladilin 1989; Gladilin –Demidenko 1989; Cohen –Stepanchuk 1999.
56 Coco et alli 2020; Mihailović in press.
57 Pradel 1966.
58 Bordes 1972; Pradel 1955.
59 Păunescu 1970; de Sonneville-Bordes 1972.
60 Nicolăescu-Plopşor 1954; 1956; Nicolăescu-Plopşor *et alii* 1957a.
61 Nicolăescu-Plopşor 1957c.
62 Delporte 1963.
63 Mogoşanu 1978.
64 Cârciumaru 1999; Păunescu 1989.

observe a gradual change from the Middle to Upper Paleolithic and regard the transition as a time frame rather than a specific industrial category[65], sometimes referred to as Carpathian facies, influenced more or less by the Szeletian[66].

Thus, the only explicit reference to the transitional industries, reflected by the Szeletian, belongs to Nicolăescu-Plopşor. It was connected to the bifaces of the small assemblage of Nandru – Peştera Spurcată, which he regarded as Szeletian.[67] Further, based on similarities with assemblages of Peştera Muierii[68] and Bordu Mare[69] (i.e. presence of few bifaces, quartzite-dominated assemblages), he assumed they were also Szeletian, and consequently its presence was not an accidental occurrence.[70] He further identified the Aurignaco-Szeletian in the northeast, at Ceahlău-Cetăţica I, where the assemblages featured blade débitage together with bifaces[71]. However, the Szeletian, seen as a non-Levallois industry dominated by bifacial tools and retouched blades and bladelets[72] has little to do with the industries found in the three aforementioned caves, which aside from the bifaces (N<7), feature a high percentage of flakes[73]; the bifaces from the lower level of Ceahlău-Cetăţica I were either assigned to the Aurignacian[74] or to a Late Mousterian/ early Upper Paleolithic industry[75].

The lack of historical consideration of transitional assemblages in Romania thus raises the issue as to whether such assemblages are truly absent or if they have not been identified either through excavation or in previously studied collections. Transitional assemblages across Europe are known to have a variety of expressions[76] but given the proximity to other transitional assemblages in neighboring countries, suggests that the latter may be a more likely scenario.

Conclusion and recommendations

The karstic record of Romania has until now, provided a meager source of Paleolithic material particularly from the early Upper Paleolithic though there is potential to find impressive and meaningful results given the number of unexplored caves and evidences for hominin presence. The main problem is that the record remains stifled by legacy excavations with poorly documented and disjointed assemblages. By reviewing the Middle and early Upper Paleolithic cave records, we suggest that the relative paucity of early Upper Paleolithic compared to Mousterian artifacts may not be the result of shifting behavioral patterns be they climate driven or otherwise. Rather, that there is no clearly observable change as Middle Paleolithic assemblages are also generally low in artifact counts, especially considering that their taphonomic histories are poorly understood and they probably represent time averaged sequences spanning tens of thousands of years. If the early Upper Paleolithic in Romania represents only a temporal fraction of that (some 5 ka), then the low volumetric find density is predictable.

Thus, more primary data is needed in this regard to help understand the European Paleolithic record from the center of the continent, rather than by superimposing evidence from Western European records upon it[77]. That can only come from new discoveries rather than re-visiting the languishing artifacts from fragmented, uncontextualized museum collections. Given the magnitude of such an undertaking, this should be constructively directed, targeting karstic regions where high quality raw materials are in close proximity (>20km) and where Pleistocene deposits are well represented though we are just at the beginning of understanding these factors[78]. Efforts might also benefit from predictive models incorporating elements such as aspect, exposure, geology, biota, topography, and other micro-climatic variables that are all essential to an understanding of human settlement patterns. Once areas of interest are identified, advances in geophysical techniques (e.g. remote sensing, magnetometry, electrical resistivity and ground-penetrating radar) would amplify results and minimize destruction of valuable archives. Such an approach would also include the active prospection of hitherto underexplored archives such as abris that in other parts of the world such as Southwestern France and the Levant, are known to be rich in Paleolithic remains.

At best, such work would provide exciting new data points and valuable contextualization of the early human fossil record from Romania. At worst,

65 Cârciumaru – Anghelinu 2000.
66 Carciumaru – Pleșa 2004.
67 Nicolăescu-Plopșor *et alii* 1957b.
68 Nicolăescu-Plopșor *et alii* 1957a.
69 Nicolăescu-Plopșor *et alii* 1957c.
70 Nicolăescu-Plopșor 1957; Nicolăescu-Plopșor – Zaharia 1959.
71 Nicolăescu-Plopșor *et alii* 1961.
72 Adams –Ringer 2004; Mester 2018.
73 Păunescu 2001; Doboș 2008.
74 Păunescu 1999.
75 Steguweit *et alii* 2009.
76 Kuhn 2003.
77 Brantingham *et alii* 2004.
78 Moreau *et alii* 2018.

this may only confirm the present situation at hand in Romania but leaves the challenging task of explaining why the Paleolithic record in Romania is indeed so atypical.

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REFERENCES

Adams – Ringer 2004

B. Adams, A. Ringer, New C^{14} dates for the Hungarian Early Upper Palaeolithic. *Current Anthropology* 45 (2004), 4, 541–551.

Alex *et alii* 2019

B. Alex, D. Mihailović, S. Milošević, E. Boaretto, Radiocarbon chronology of Middle and Upper Paleolithic sites in Serbia, Central Balkans. *JAS: Reports* 25 (2019), 266–279.

Anghelinu – Boroneanț 2019

M. Anghelinu, A. Boroneanț, The archaeology of caves in Romania. (G. Ponta, B. Onac), *Cave and Karst Systems of Romania* (2019), Springer, Cham, 501–517.

Anghelinu – Niță 2014

M. Anghelinu, L. Niță, What's in a name: The Aurignacian in Romania. *Quaternary International* 351 (2014), 172–192.

Bar-Yosef 1998

O. Bar-Yosef, On the nature of transitions: The Middle to Upper Palaeolithic and the Neolithic revolution. *CAJ* 8, (1998), 2, 141–163.

Bar-Yosef *et alii* 2012

O. Bar-Yosef, M. Eren, J. Yuan, D. Cohen, Y. Li, Were bamboo tools made in prehistoric Southeast Asia? An experimental view from South China. *Quaternary International* 269 (2012), 9–21.

Bicho – Cascalheira 2020

N. Bicho, J. Cascalheira, Use of lithic assemblages for the definition of short-term occupations in hunter-gatherer prehistory. (J. Cascalheira, A. Picin), *Short-term occupations in Paleolithic archaeology: definition and interpretation* (2020) Springer, Cham, 19–38.

Biró 2009

K. Biró, Sourcing raw materials for chipped stone artifacts: The state-of-the-art in Hungary and the Carpathian Basin. (B. Adams, B. Blades), *Lithic materials and Paleolithic societies*, (2009), Wiley-Blackwell, 47–53.

Bordes 1972

F. Bordes, Du Paléolithique Moyen au Paléolithique Supérieur, continuité ou discontinuité? (F. Bordes), *The Origin of Homo sapiens*. Paris, 1972, 211-218.

Borić *et alii* 2012

D. Borić, V. Dimitrijević, D. White, C. Lane, C. French, E. Cristiani, Early modern human settling of the Danube corridor: The Middle to Upper Palaeolithic site of Tabula Traiana Cave in the Danube Gorges (Serbia). *Antiquity* Project Gallery 86 (2012), 334. http://www.antiquity.ac.uk/projgall/boric334/.

Brantingham *et alii* 2004

P. Brantingham, S. Kuhn, K. Kerry, *The Early Upper Paleolithic beyond Western Europe*. University of California Press (2004).

Breuil 1925

H. Breuil, Stations paléolithiques en Transylvanie. *Bulletin de la Société Scientifique de Cluj* 2 (1925), 193–217.

Brumm 2010

A. Brumm, The Movius Line and the bamboo hypothesis: early hominine stone technology in Southeast Asia. *Lithic Technology* 35, (2010), 1, 7–24.

Cârciumaru 1999

M. Cârciumaru, *Le Paléolithique en Roumanie*. Grenoble (1999).

Cârciumaru *et alii* 2000

M. Cârciumaru, M.-H. Moncel, R. Cârciumaru, Le Paléolithique moyen de la grotte Cioarei-Borosteni (commune de Peștișani, département de Gorj, Roumanie. *L'Anthropologie* 104 (2000), 185–237.

Cârciumaru *et alii* 2008

M. Cârciumaru, E.-C. Nițu, J.-G. Bordes, G. Murătoreanu, M. Cosac, R. Ștefănescu, *Le Paléolithique de la grotte Gura Cheii, Râșnov: étude interdisciplinaire*. Târgoviște (1999).

Chu 2018

W. Chu, The Danube corridor hypothesis and the Carpathian Basin: Geological, environmental and archaeological approaches to characterizing Aurignacian dynamics. *JWP* 31, (2018), 117–178.

Chu *et alii* 2020

W. Chu, Ľ. Kaminská, N. Klasen, C. Zeeden, G. Lengyel, The chronostratigraphy of the Aurignacian in the Northern Carpathian Basin based on new chronometric/archeological data from Seňa I (Eastern Slovakia). *JPA* 3, (2020), 77-96.

Chu *et alii* in press
Chu, W., A. Doboș, S. McLin, So many caves, so little time: a preliminary report from a western Romanian karst survey. *UISPP Journal* (in press).

Coco *et alii* 2020
Coco, E., Holdaway, S., Iovita, R., 2020. The effects of secondary recycling on the technological character of lithic assemblages. *JPA* 3, (2020), 3, 453 - 474.

Cohen – Stepanchuk 1999
V. Cohen, V.N. Stepanchuk, Late Middle and Early Upper Paleolithic evidence from the East European Plain and Caucasus: A new look at variability, interactions, and transitions. *JWP* 13 (1999), 265–319.

Constantin *et alii* 2014
S. Constantin, M. Robu, C. Munteanu, A. Petculescu, M. Vlaicu, I. Mirea, M. Kenesz, V. Drăgușin, D. Hoffmann, V. Anechitei, A. Timar-Gabor, R. Roban, C. Panaiotu, Reconstructing the evolution of cave systems as a key to understanding the taphonomy of fossil accumulations: The case of Urșilor Cave (Western Carpathians, Romania). *Quaternary International* 339-340, (2014), 25-40.

Cosac *et alii* 2018
M. Cosac, G. Murătoreanu, D. Veres, L. Niță, C. Schmidt, U. Hambach, R. Alexandru, R. Cuculici, D. Buzea, V. Dumitrașcu, Ș. Vasile, A. Petculescu, I. Dénes, Multi-proxy archaeological investigations of a Middle Palaeolithic occupation context in Eastern Transylvania, Romania." *Quaternary International* 485, (2018), 115–130.

Daschek – Mester 2020
É . Daschek, Z. Mester. A site with mixed occupation: Neanderthals and carnivores at Érd (Hungary)." *JAS: Reports* 29 (2020), 102-116.

Delporte 1963
H. Helporte, Le passage du Moustérien au Paléolithique supérieur. *BSMSP* 10, 1963, 40-50.

Doboș 2008.
A Doboș, The Lower Paleolithic of Romania: a critical review. *PaleoAnthropology* (2008), 218–233.

Doboș 2017
A. Doboș, The Middle Paleolithic research in Romania. Past and current issues. *MCA* 13 (2017), 5-14.

Doboș *et alii* 2009
A. Doboș, A. Soficaru, A. Popescu, E. Trinkaus, Radiocarbon dating and faunal stable isotopes for the Galeria Principala, Peștera Muierii, Baia de Fier, Gorj County, Romania. *MCA* 5 (2009), 15–20.

Doboș *et alii* 2010
A. Doboș, A. Soficaru, E. Trinkaus, *The prehistory and paleontology of the Peștera Muierii (Romania)*. Liège (2010).

Dobrescu 2008
R. Dobrescu, *Aurignacianul din Transilvania.* București (2008).

Dogandžić – McPherron 2013
T. Dogandžić, S. McPherron, Demography and the demise of Neandertals: A comment on 'Tenfold population increase in Western Europe at the Neandertal-to-modern human transition. *Journal of Human Evolution* 64 (2013), 4, 311–313.

Fu *et alii* 2015
Q. Fu, M. Hajdinjak, O. Moldovan, S. Constantin, S. Mallick, P. Skoglund, N. Patterson, : Rohland, I. Lazaridis, B. Nickel, B. Viola, K. Prüfer, M. Meyer, J. Kelso, D. Reich, S. Pääbo, An early modern human from Romania with a recent Neanderthal ancestor. *Nature* 524 (2015), 7564, 216–219.

Ghemiș *et alii* 2011
C. Ghemiș, J. Clottes, B. Gély, F. Prud'Homme, An exceptional archaeological discovery - the 'art gallery' in Coliboaia Cave, Apuseni Mountains, Romania. *ActaArchCarp* 46 (2011), 5–18.

Gladilin 1989
V. Gladilin, The Korolevo Palaeolithic site: research methods, stratigraphy. *The Korolevo Palaeolithic site : Research methods, stratigraphy* 27 (1989), 2–3, 93–103.

Gladilin – Demidenko 1989
V. Gladilin, Y. Demidenko, Upper Palaeolithic stone tool complexes from Korolevo. *Anthropologie* 27 (1989), 2–3, 143–178.

Hahn 1988
J. Hahn, *Die Geißenklösterle-Höhle im Achtal bei Blaubeuren I: Fundhorizontbildung und Besiedlung im Mittelpaläolithikum und im Aurignacien*. Stuttgart (1988) – PhD Thesis.

Harvati *et alii* 2007
K. Harvati, P. Gunz, D. Grigorescu, Cioclovina (Romania): Affinities of an early modern European. *Journal of Human Evolution* 53 (2007), 732–746.

Hublin *et alii* 2020
J. J. Hublin, N. Sirakov, V. Aldeias, S. Bailey, E. Bard, V. Delvigne, E. Endarova, Y. Fagault, H. Fewlass, M. Hajdinjak, B. Kromer, I. Krumov, J. Marreiros, N. Martisius, L. Paskulin, V. Sinet-Mathiot, M. Meyer, S. Pääbo, V. Popov, Z. Rezek, S. Sirakova, M. Skinner, G. Smith, R. Spasov, S. Talamo, T. Tuna, L. Wacker, F. Welker, A. Wilcke, N. Zahariev, S. McPherron, T. Tsanova, Initial Upper Palaeolithic Homo sapiens from Bacho Kiro Cave, Bulgaria. *Nature* 581 (2020), 299-302.

Iovita *et alii* 2014
R. Iovita, A. Doboș, K. Fitzsimmons, M. Probst, U. Hambach, M. Robu, M. Vlaicu, A. Petculescu, Geoarchaeological prospection in the loess steppe: Preliminary

results from the Lower Danube survey for Paleolithic sites (LoDanS). *Quaternary International* 351 (2014), 98–114.

Jámbor 2012
Á. Jámbor, Quaternary Evolution. (J. Haas), *Geology of Hungary*, Heildelberg (2012), 201–213.

Jungbert 1979
B. Jungbert, Repertoriul localităţilor cu descoperiri paleolitice din Transilvania (II). *ActaMN* 16 (1979), 389-410.

Kajetz – Heffter 2020
I. Kajtez, E. Heffter, Palaeolithic artefact scatter visibility in the changing landscapes of the western Morava and Resava river valleys (Serbia). (I. Miloglav) *Recent developments in archaeometry and archaeological methodology in South-Eastern Europe,* Newcastle upon Tyne (2020), 1-20.

Kozłowski 2004
J. Kozłowski, Early Upper Paleolithic Levallois-derived industries in the Balkans and in the Middle Danube Basin. *Anthropologie* 42 (2004), 3, 263–280.

Kozłowski – Ginter 1982
J. Kozłowski, B. Ginter, *Excavation in the Bacho Kiro cave (Bulgaria): final report*. Warsaw (1982)

Kozłowski *et alii* 1992
J. Kozłowski, H. Laville, B. Ginter, *Temnata Cave: excavations in Karlukovo karst area, Bulgaria*. Warsaw (1992)

Kuhn 2003
S. Kuhn, In what sense is the Levantine initial Upper Paleolithic a "transitional" industry. (J. Zilhão, Fr.d'Errico) *The Chronology of the Aurignacian and of the transitional technocomplexes. Dating, stratigraphies, cultural implications*. Lisboa (2003), 61–70.

Larson *et alii* 2007
G. Larson, G., U. Albarella, K. Dobney, P. Rowley-Conwy, J. Schibler, A. Tresset, J.-D. Vigne, et alii 2007, Ancient DNA, pig domestication, and the spread of the Neolithic into Europe. *Proceedings of the National Academy of Sciences* 104 (2007), 39, 15276–15281.

Lazarovici *et alii* 2018
C. Lazarovici, G. Lazarovici, G. Trnka, Flint sources in the Middle Prut area. (C. Lazarovici, A. Berzovan), *Studia in honorem professoris Vasile Chirica*, Bucureşti (2018), 177-198.

Lengyel 2018
G. Lengyel, The Paleolithic in Hungary. (C. Smith) *Encyclopedia of global archaeology*.

Lindal 2020
J. Lindal, P. Radović, D. Mihailović, M. Roksandic, Postcranial hominine remains from the Late Pleistocene of Pešturina Cave (Serbia). *Quaternary International* 542 (2020), 9-14.

Marín-Arroyo – Mihailović 2017
A. Marín-Arroyo, B. Mihailović, The chronometric dating and subsistence of late Neanderthals and early anatomically modern humans in the central Balkans: insights from Šalitrena Pećina (Mionica, Serbia). *JAR* 73 (2017), 3, 413–447.

McCormick 2001
M. McCormick, *Origins of the European economy: communications and commerce AD 300-900*. Cambridge (2001).

Mellars – French 2011
P. Mellars, J. French, Tenfold population increase in Western Europe at the Neandertal–to–modern human transition. *Science* 333 (2011), 6042, 623–627.

Mellars – French 2013
P. Mellars, J. French, Population changes across the Neanderthal-to-modern-human transition in western France: A reply to Dogandžić and McPherron (2013). *Journal of Human Evolution* 65, (2013), 3, 330–333.

Mester 2013
Z. Mester (ed.), *The lithic raw material sources and interregional human contacts in the northern Carpathian regions*. Kraków (2013).

Mester 2018
Z. Mester, The problems of the Szeletian as seen from Hungary. *Recherches Archéologique Nouvelle Serie* 9 (2018), 19–48.

Mihailović 2014
D. Mihailović, *Palaeolithic and Mesolithic research in the Central Balkans*. Belgrade (2014)

Mihailović in press
D. Mihailović, Push-and-pull factors of the Middle to Upper Paleolithic transition in the Balkans." *Quaternary International* doi:10.1016/j.quaint.2019.10.010

Mogoşanu 1978
F. Mogoşanu, *Paleoliticul din Banat*. Bucureşti (1978).

Moreau *et alii* 2019
L. Moreau, A. Ciornei, E. Gjesfjeld, P. Filzmoser, S.A. Gibson, J. Day, P.R. Nigst, *et alli,* First geochemical 'fingerprinting' of Balkan and Prut flint from Paleolithic Romania: Potentials, limitations and future directions. *Archaeometry* 61, (2019), 3, 1–18.

Mourre 1997
V. Mourre, Industries en quartz: précisions terminologiques dans les domaines de la pétrographie et de la technologie. *Préhistoires Méditerranéennes* 6, (1997), 201-210.

Nicolăescu-Plopşor 1954
C. S. Nicolăescu-Plopşor, Introducere în problemele

paleoliticului din RPR. *Probleme de Antropologie* 1 (1954), 59-71.

Nicolăescu-Plopșor 1956
C. S. Nicolăescu-Plopșor, Rezultatele principale ale cercetărilor paleolitice în ultimii patru ani în RPR. *SCIV* 7, (1956), 1-2, 7–39.

Nicolăescu-Plopșor 1957
C. S. Nicolăescu-Plopșor, Le paléolithique dans la RPR à la lumiere des dernieres recherches. *Dacia NS* 1 (1957), 41–60.

Nicolăescu-Plopșor 1965
C. S. Nicolăescu-Plopșor, *Oamenii din vârsta veche a pietrei*, București (1965).

Nicolăescu-Plopșor – Zaharia 1959
C. S. Nicolăescu-Plopșor, N. Zaharia, Raport preliminar asupra cercetărilor paleolitice din anul 1956 (Mitoc). *MCA* 5 (1959), 15–22.

Nicolăescu-Plopșor *et alii* 1957a
C. S. Nicolăescu-Plopșor, E. Comșa, D. Nicolăescu-Plopșor, A. Bolomey, Șantierul arheologic Baia de Fier. *MCA* 3 (1957), 34-38.

Nicolăescu-Plopșor *et alii* 1957b
C. S. Nicolăescu-Plopșor, A. Păunescu, A. Bolomey, Șantierul arheologic Nandru, *MCA* 3, (1957), 29–40.

Nicolăescu-Plopșor *et alii* 1957c
C. S. Nicolăescu-Plopșor, N. Haas, A. Păunescu, A. Bolomey, Șantierul arheologic Ohaba Ponor. *MCA* 3 (1957), 41–49.

Nicolăescu-Plopșor *et alii* 1961
C. S. Nicolăescu-Plopșor, D. Teodoru, S. Teodor, A. Păunescu, F. Mogoșanu, M. Bitiri, A. Paul-Bolomey, M. Florescu, N. Berlescu, Șantierul arheologic Bicaz. *MCA* 7 (1961), 37–47.

Onac – Goran 2019
B. Onac, C. Goran, Karst and caves of Romania: A brief overview. (G. Ponta, B. Onac), *Cave and karst systems of Romania*, Cham (2019), 21–36.

Otte *et alii* 2007
M. Otte, V. Chirica, P. Haesaerts, (eds), *L' Aurignacien et le gravettien de Mitoc-Malu Galben (Moldavie roumaine)*. Liège (2007).

Păunescu 1965
A. Păunescu, Sur la succession des habitats paléolithiques et postpaléolithiques de Ripiceni-Izvor. *Dacia NS* 9, (1965), 5–31

Păunescu 1989
A. Păunescu, Le Paléolithique et le Mésolithique de Roumanie (un bref aperçu). *L'Anthropologie* 93, (1989), 1, 123–158.

Păunescu 1999
A. Păunescu, *Paleoliticul si mezoliticul de pe teritoriul Moldovei cuprins între Siret si Prut*, București (1999).

Păunescu 2000
A. Păunescu, *Paleoliticul și mezoliticul din spațiul cuprins între Carpați și Dunăre*. București (2000).

Păunescu 2001
A. Păunescu, *Paleoliticul și mezoliticul din spațiul transilvan*. București (2001)

Ponta – Onac 2019
G. Ponta, B. Onac (eds.), *Cave and karst systems of Romania*. Cham (2019).

Povară 2019
I. Povară, 'Emil Racovită' Institute of Speleology: World's first research unit dedicated to karst and cave studies. (Ponta, Onac) *Cave and karst systems of Romania*. Cham (2019), 5-8

Pradel 1955
L. Pradel, Périgordien et Aurignacien. Constatations, possibilités et apparences. *Bulletin de la Societe Prehistorique Française* 52, (1955), 9-10, 604-607.

Pradel 1966
L. Pradel, Transition from Mousterian to Perigordian: Skeletal and industrial [and comments and replies]. *Current Anthropology* 7, (1966), 1, 33-50.

Radović *et alii* 2019
P. Radović, J. Lindal, D. Mihailović, M. Roksandic, The first Neanderthal specimen from Serbia: Maxillary first molar from the Late Pleistocene of Pešturina Cave. *Journal of Human Evolution* 131, (2019), 139–151.

Richter *et alii* 2008
D. Richter, G. Tostevin, P. Skrdla, Bohunician technology and thermoluminescence dating of the type locality of Brno-Bohunice (Czech Republic). *Journal of Human Evolution* 55 (2008), 5, 871–885.

Richter *et alii* 2009
D. Richter, G. Tostevin, P. Škrdla, W. Davies, New radiometric ages for the Early Upper Palaeolithic type locality of Brno-Bohunice (Czech Republic): comparison of OSL, IRSL, TL and 14C dating results. *JAS* 36, (2009), 3, 708–720.

Riel-Salvatore *et alii* 2008
J. Riel-Salvatore, G. Popescu, C. Barton, Standing at the gates of Europe: Human behavior and biogeography in the Southern Carpathians during the Late Pleistocene. *JAA* 27, (2008), 399–417.

Roska 1925
M. Roska, Recherches sur le Paléolithique en Transylvanie. *Bulletin de la Société Scientifique de Cluj* 2, (1925), 2, 183–192.

Schmidt *et alii* 2013
C. Schmidt, V. Sitlivy, M. Anghelinu, V. Chabai, H. Kels, T. Uthmeier, T. Hauck, I. Băltean, A. Hilgers, J. Richter, U. Radtke, First chronometric dates (TL and OSL) for the Aurignacian open-air site of Românești-Dumbrăviţa I, Romania. *JAS* 40 (2013), 3740–3753.

Schmidt – Zimmerman 2019
I. Schmidt, A. Zimmermann, Population dynamics and socio-spatial organization of the Aurignacian: Scalable quantitative demographic data for western and central Europe. *PLOS ONE* 14, (2019), 2, e0211562.

Schmidt *et alii* 2020
C. Schmidt, M. Anghelinu, U. Hambach, D. Veres, F. Lehmkuhl, Reassessing the timeframe of Upper Palaeolithic deposits in the Ceahlău Basin (Eastern Carpathians, Romania): Geochronological and archaeological implications. *Quaternary Geochronology* 55 (2020): 101020. doi:https://doi.org/10.1016/j.quageo.2019.101020.

Sirakov *et alii* 2010
N. Sirakov, J.-L. Guadelli, S. Ivanova, S. Sirakova, M. Boudadi-Maligne, I. Dimitrova, F. Ph, C. Ferrier, A. Guadelli, D. Iordanova, 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 (Northwestern Bulgaria). *Quaternary International* 223–224 (2010), 94–106.

Sitlivy *et alii* 2012
V. Sitlivy, V. Chabai, M. Anghelinu, T. Uthmeier, H. Kels, A. Hilgers, C. Schmidt, et alii. 2012. The earliest Aurignacian in Romania: New investigations at the open air site of Românești-Dumbrăviţa I (Banat). *Quartär* 59 (2019), 85–130.

Soficaru *et alii* 2006
A. Soficaru, A. Doboș, E. Trinkaus, Early modern humans from the Peștera Muierii, Baia de Fier, Romania. *Proceedings of the National Academy of Sciences* 103, (2006), 46, 17196–17201.

Soficaru *et alii* 2007
A. Soficaru, C. Petrea, A. Doboș, E. Trinkaus, The human cranium from the Peștera Cioclovina Uscată, Romania. *Current Anthropology* 48, (2007), 4: 611–619.

Sonneville-Bordes 1972
D. de Sonneville-Bordes, Environnement et culture de l'homme du Périgordien ancien dans le sudouest de la France: données récente. (F. Bordes), *The origin of Homo sapiens*. Paris, 1972, 141-146.

Staubwasser *et alii* 2018
M. Staubwasser, V. Drăgușin, B. Onac, S. Assonov, V. Ersek, D. Hoffmann, D. Veres, Impact of climate change on the transition of Neanderthals to modern humans in Europe. *Proceedings of the National Academy of Sciences* 115, (2018), 37, 9116-9121.

Steguweit *et alii* 2009
L. Steguweit, M. Cârciumaru, M. Anghelinu, and L. Niță, Reframing the Upper Palaeolithic in the Bistrița valley (northeastern Romania). *Quartär* 56, (2009), 139–157.

Strait *et alii* 2016
D. Strait, C. Orr, J. Hodgkins, N. Spassov, M. Gurova, C. Miller, T. Tzankov, The human fossil Record of Bulgaria and the formulation of biogeographic hypotheses. (K. Harvati, M. Roksancis), *Paleoanthropology of the Balkans and Anatolia: Human evolution and its context*, Dordrecht (2016), 69–78.

Tourloukis 2016
V. Tourloukis, On the spatio-temporal distribution of Mediterranean Lower Paleolithic sites: a geoarchaeological perspective. (K. Harvati, M. Roksandic), *Paleoanthropology of the Balkans and Anatolia: Human evolution and its context*. Dordrecht (2016), 303-323

Trinkaus *et alii* 2012
E. Trinkaus, S. Constantin, J. Zilhão (eds.), *Life and death at the Peștera cu Oase: A setting for modern human emergence in Europe*. New York (2012).

Tuffreau *et alii* 2007
A. Tuffreau, V. Boroneanț, E. Goval, B. Lefevre, A. Boroneanț, A. Doboș, G. Popescu, Le gisement Paléolithique moyen de Zăbrani (department d'Arad). *MCA* 3 (2007), 5-18.

Tuffreau *et alii* 2009
A. Tuffreau, E. Goval, B. Lefevre, V. Boroneanț, A. Boroneanț, A. Doboș, G. Popescu, L'utilisation du quartzite dans l'industrie Mousterienne de Zabrani (Banat, Roumanie). (S. Grimaldi, S. Cura), *Technological Analysis on Quartzite Exploitation*. Lisbon, (2009), 25-32.

Tuffreau *et alii* 2013
Tuffreau, A., R. Dobrescu, A. Petculescu, E. Știucă, S. Balescu, F. Lanoë, M. Wismer, La grotte La Adam: un repaire de carnivores visité par les chasseurs du Paléolithique. (J.-P. Saint Martin), *Recherches croisées en Dobrogea*. București (2013), 75-86.

U.S. Geological Survey 2006
U.S. Geological Survey, FGDCdigital cartographic standard for geologic map symbolization (postscript implementation). *U.S. Geological Survey Techniques and Methods*: 11-A2. http://pubs.usgs.gov/tm/2006/11A02/.

Woods 2011
A. Woods, *The effects of lithic raw material quality on Aurignacian blade production at Abri Cellier*. PhD Thesis, University of Iowa (2011). http://ir.uiowa.edu/etd/1111/.

Table 1. *Excavated caves in Romania with typological attribution, assemblage size, dominant raw material and radiometric dates / Peșteri în care au fost făcute săpături, cu atribuirea culturală, mărimea seriei litice, materia primă predominantă și date radiometrice.*

No.	CAVE/ ROCKSHELTER	EXCAVATED SURFACE/ MAX DEPTH	FIRST AND LAST YEAR OF EXCAVATION	MIDDLE PALEOLITHIC			UPPER PALEOLITHIC (EARLY)			UPPER PALEOLITHIC (LATER)			RADIOMETRIC AGES AMS CONVENTIONAL
				Attribution	Lithic assemblage (N)	Dominant Raw Material	*Attribution*	*Lithic assemblage (N)*	*Dominant Raw Material*	*Attribution*	*Lithic assemblage (N)*	*Dominant Raw Material*	
1	**Baia de Fier – PeşteraMuierii**[1]	>50 m²/1.8 m	1929; 1955	Mousterian	>3000	Quartzite	Aurignacian	60	Flint	-	-	-	**Aurignacian** **29110 ± 190 BP** **29930 ±170 BP** **30150 ± 800 BP** **Mousterian** **30060 ± 280 BP** **40850 ± 450 BP** **40950 ± 450 BP** 42560 ±1310 BP **42700 ± 550 BP** **47500 ± 900 BP**
				Mousterian	59	Flint	-	-	-	-	-	-	
2a	**Băile Herculane – Peştera Hoţilor**[2]	14 m²/2.80m	1954; 1973	Mousterian	155	Quartzite	Aurignacian	19	Flint	Tardigravettian	1064	Flint	**Tardigravettian** 11490 ± 75 BP
2b[3]	**Peştera 24**	1m²	2019	-	-	-	-	-	-	-	-	-	
2c	**Peştera 26**	1m²	2019	-	-	-	-	-	-	-	-	-	

No.	CAVE/ ROCKSHELTER	EXCAVATED SURFACE/ MAX DEPTH	FIRST AND LAST YEAR OF EXCAVATION	MIDDLE PALEOLITHIC			UPPER PALEOLITHIC (EARLY)			UPPER PALEOLITHIC (LATER)			RADIOMETRIC AGES AMS CONVENTIONAL
3	**Boroşteni – Peştera Cioarei**[4]	49 m²/4.35 m		C Mousterian	16	Quartzite and other coarse grained rocks	Aurignacian	23	Flint	Gravettian	29	Flint	**Aurignacian** 23570 +/–230 BP **Mousterian** 25330 +/–240 BP 30730 +/–420 BP 37750 +/–950 BP 43000 +1300/–1100 BP 47200 +2900/–2100 BP 48000 +180/–1500 BP 48900 +2100/–1700 BP 49500 +3200/–1100 BP 50900 +4400/–2800 BP 51900 +5300/–3200 BP
				E Mousterian	167	Quartzite and other coarse grained rocks	-	-	-	-	-	-	
				F Mousterian	57	Quartzite and other coarse grained rocks	-	-	-	-	-	-	
				G Mousterian	3	Quartzite and other coarse grained rocks	-	-	-	-	-	-	
				H Mousterian	267	Quartzite and other coarse grained rocks	-	-	-	-	-	-	
				J Mousterian	121	Quartzite and other coarse grained rocks	-	-	-	-	-	-	
				L Mousterian	8	Quartzite and other coarse grained rocks	-	-	-	-	-	-	

No.	CAVE/ ROCKSHELTER	EXCAVATED SURFACE/ MAX DEPTH	FIRST AND LAST YEAR OF EXCAVATION	MIDDLE PALEOLITHIC			UPPER PALEOLITHIC (EARLY)			UPPER PALEOLITHIC (LATER)			RADIOMETRIC AGES AMS CONVENTIONAL
4	**Cheia – Peştera la Izvor**[5]	35 m^2/1m		Mousterian	124	Flint	-	-	-	-	-	-	**Mousterian 36506 +/–772 BP** 36810 +790/–720 BP **37048 +/–823 BP**
5	**Cioclovina – Peştera Uscată**[6]	?/?	1911; 2004	Mousterian	'few'	Quartzite	Aurignacian	'few'	Flint	-	-	-	**Aurignacian 29700 ± 700 BP**
6a	**Nandru – Peştera Curată**[7]			Mousterian	113	Quartzite	-	-	-	-	-	-	
				Mousterian	179	Quartzite	-	-	-	-	-	-	
6b	**Nandru Peştera Spurcată**[8]			Mousterian	29	Quartzite	-	-	-	Gravettian	4	Flint	
7a	**Mereşti – Abris 122**[9]	c. 24 m^2+/3 m	1971; current	Mousterian	>1938	Quartzite	-	-	-	-	-	-	**106–141 ka (OSL) or 99–174 ka (IRSL)**
8	**Râşnov – Peştera Gura Cheii**[10]			Mousterian	7	Quartzite	Aurignacian	Ca. 10	Flint	Gravettian	Ca. 60	Flint	
				Mousterian	39	Quartzite	-	-	-	-	-	-	
9	**Ohaba Ponor – Peştera Bordu Mare**[11]	110m^2/3.40m		I Mousterian	63	Quartzite	Aurignacian	18	Flint	-	-	-	
				II Mousterian	43	Quartzite	-	-	-	-	-	-	
				III Mousterian	1700	Quartzite	-	-	-	-	-	-	
				IV Mousterian	170	Quartzite	-	-	-	-	-	-	
10a	**Peştera – Peştera Liliecilor**[12]	80 m^2/1.5 m		Mousterian	44	Quartzite	Aurignacian	173	Flint	Gravettian	39	Flint	

No.	CAVE/ ROCKSHELTER	EXCAVATED SURFACE/ MAX DEPTH	FIRST AND LAST YEAR OF EXCAVATION	MIDDLE PALEOLITHIC			UPPER PALEOLITHIC (EARLY)			UPPER PALEOLITHIC (LATER)			RADIOMETRIC AGES AMS CONVENTIONAL
10b	**Peştera – Peştera Mică**	12 m²/0.8 m		-	-	-	Aurignacian	11	Quartzite	Gravettian	7	Quartzite	
10c	**Peştera – Peştera Valea Coacăzii**	25 m²/1m		Mousterian	29	Quartzite	Aurignacian	5?	Quartzite	Gravettian	10	Quartzite	
11	**Peştere – Peştera Igriţa**[13]	Ca 30m²/4 m	1850; 1960s	Mousterian	'a few' flakes, a biface	quartzite	Aurignacian	a few	flint	-	-	-	
12	**Lorău – Peştera Boiului**[14]	Ca 20m²/-.65 m	1924;1930	Mousterian	A few flakes	Quartzite	-	-	-	-	-	-	
7b	**Mereşti – Peştera Calului**[15]	10 m²/1m	1911; 1969?	Mousterian	>9	Siliceous sandstone	Aurignacian	>15	Siliceous sandstone	-	-	-	
13a	**Crăciuneşti – Peştera Balogu**	> 10 m²/1.30 m	1924;2019	Mousterian	Few flakes	Hard limestone	-	-	-	-	-	-	
13b	**Crăciuneşti – Peştera Groapa Lupului**[16]	> 15 m²/1.9 m	1924; 1999	Mousterian	Few flakes	quartzite	Aurignacian	Few flakes	Flint	-	-	-	**Mousterian** 34500 +/- 500 BP **Aurignacian** 26200 +/- 230 BP, 26010 +/- 300 BP, 26380 +/- 430 BP
13c	**Crăciuneşti – Peştera Zidul de Sus**[17]	1m²/0.80	2019	-	-	-	-	-	-	-	-	-	
13d	**Crăciunesti – Peştera Şura de Jos**[18]	?/0.80	1924	-	-	-	Aurignacian	1 flake	Jasper	-	-	-	
14a	**Federi – Peştera 1 din Coasta Vacii**[19]	8m²/1.80 m	1924–1925	-	-	-	Aurignacian	Few flakes	Hard limestone	-	-	-	

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14b	**Federi – Peşterile 2 & 3 din Coasta Vacii**[20]	$3m^2$/?	1924–1925	Mousterian	Few flakes	Hard limestone	-	-	-	-	-	-	
15	**Pescari – Peştera Livadiţa**	$32m^2$/1.5m	1972;1975	Mousterian	> 18	Flint	-	-	-	-	-	-	
16	**Someşul Rece – Pestera Oaselor**[21]	?/?	1891;1924	-	-	-	-	-	-	Gravettian	-	-	
17	**Târguşor – Peştera La Adam**[22]	Ca. $20m^2$/ca. 6 m	1950s; 2009	Mousterian	Ca. 20	Flint	Aurignacian?	8	Flint	Gravettian?	Few	Flint	-

1 Păunescu 2000; Soficaru et alii 2006; Doboş et alii 2009.
2 Mogoşanu 1978; Păunescu 2001.
3 Peştera 24 and Peştera 26 do not formally belong to the city of Băile Herculane; we decided to display them together with Peştera Hoţilor because of their proximity.
4 Cârciumaru et alii 2000.
5 Păunescu 1999.
6 Păunescu 2001.
7 Nicolăescu-Plopşor et alii 1957a.
8 Nicolăescu-Plopşor et alii 1957a.
9 Cosac et alii 2018.
10 Cârciumaru et alii 2008.
11 Nicolăescu-Plopşor et alii 1957b.
12 Păunescu 2001.
13 Breuil 1925; Păunescu 2001.
14 Breuil 1925; Păunescu 2001.
15 Păunescu 2001.
16 Breuil 1925; Păunescu 2001.
17 Breuil 1925; Păunescu 2001.
18 Breuil 1925; Păunescu 2001.
19 Breuil 1925; Păunescu 2001.
20 Breuil 1925; Păunescu 2001.
21 Păunescu 2001.
22 Păunescu 1999; Tuffreau et alii 2013.