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Mountainous cultural crossroads: voyages for ochre quarrying

ABSTRACT

Recent decades have presented increased interest in provenance studies. However, such research in the sphere of mineral pigments are rare in archaeological dispute. The main aim of this paper is to portray the state of knowledge on that issue, followed by a presentation of ochre outcrops in the Carpathian Basin. The discussion is additionally illustrated by examples of 10 archaeological sites with described ochre traces from the Early Neolithic period. Moreover, two models of ochre acquisition were proposed: the first one assuming direct quarrying and the second one including potential intra-group contacts. For that reason, two roughly set areas of interest, within 50 and 150 kilometers in diameter were proposed. Those hypothetical circles would contribute to the understanding of general mobility patterns of the discussed communities.

KEYWORDS

ochre quarrying patterns, ochre outcrops, Carpathian Basin, Early Neolithic

I. INTRODUCTION

Provenance studies are nowadays gaining on popularity in the archaeological dispute. Trials have already been done to recognize outcrops of various raw materials, such as for instance: siliceous rocks (e.g. Valde-Nowak 2013), obsidians (e.g. Kasztovszky *et al.* 2019), ceramic (e.g. Kazakis, Tsirliganis 2015) and shells (e.g. Dimitrijević 2014). Further division has been applied on materials locally-quarried, regionally-acquired and those of non-local origin (e.g. Cieśla 2018). In the case of ochre studies, the situation is more complicated. In many instances, the outcrops of that material are presented in geological literature, without further assessment in archaeological works. Yet, the mineral pigments in general should be well described and discussed, with an underline of their wide array of utilization patterns as well as their attached cultural significance.

Ochre is usually attributed with a set of specific features. That material presents a colour range from yellow, orange, to red, brownish and purple (Eastaugh *et al.* 2004; Popelka-Filcoff *et al.* 2007; Rifkin 2015). The main colouring agents are iron oxides and iron oxide-hydroxides content in the compound (Popelka-Filcoff *et al.* 2007; Trąbska 2012; Ahlrichs 2015; Rifkin 2015). The most common colour-bearing minerals creating ochre are: hematite with red streak (Eastaugh *et al.* 2004; Popelka-Filcoff *et al.* 2007; Ahlrichs 2015), and goethite, lepidocrocite and limonite with yellow to brown hues (Popelka-Filcoff *et al.* 2007; Ahlrichs 2015). Moreover, the compound could be enriched with crystals of calcite, mica, quartz, gypsum or kaolinite, what is dictated by the geological background of the initial formation (Eastaugh *et al.* 2004; Ahlrichs 2015).

Ochre was used by various cultural groups around the globe. For this work, Starčevo-Körös-Criş communities were selected, mainly due to: (1) higher mobility of those groups, compared to later cultural entities (Depaermentier *et al.* 2020), what allowed for propositions of varied mobility patterns for raw material acquisition, (2) limited sample of sites with ochre traces (see Fig. 2) and (3) quite well-studied paths of other materials transportation (e.g. Siklósi 2004; Klindžić *et al.* 2018). The Starčevo-Körös-Criş horizon, commencing at the end of 7th and beginning of the 6th millenium BC (Biagi, Spataro 2005; Bánffy 2013) should be understood as the first wave of Neolithic occupation on these terrains (Biagi, Spataro 2005; Klindžić *et al.* 2018). Even though the Mesolithic societies on those terrain are only partly described (Eichmann 2004), contacts with incoming Neolithic populations cannot be excluded (Klindžić *et al.* 2018).

In general, ochre could have been acquired in proximity to the settlement, or brought from more remote places. The second situation could be dictated by different activities, performed away from the site, aimed at obtaining other raw materials (Brantingham 2003). In that case, ochre could have been encountered and collected by chance. That in turn would hinder the studies on its sourcing, making it almost impossible to create more generic theories. Another possibility would assume excursions, aimed solely at ochre acquisition. The instances, supporting those propositions, could be noted in the ethnographic record. As an example of ochre acquisition from locally-lying outcrops could serve the patterns of quarrying performed by Walbiri people, inhabiting Central Australia. They obtain their pigments from the Karrku mine (Smith *et al.* 1998). On the other hand, various instances of ochre quarrying from remote sources could be mentioned, such as: (1) Hopi people in North America, who obtain ochre from a localization in the distance of about 175 kilometers (Ball 1941: 41) or (2) the Maori people in New Zealand, getting pigments from a hard-to-reach site, located in the mountains (Walsh 1903: 7). Then, ochre could be perceived in different manners, with additional cultural meanings, especially if it was obtained from culturally-enriched landscape. Moreover, if the process of acquisition was costly, the general value of such obtained material could be perceived as more exclusive, or prestigious (Siklósi 2004). Under these circumstances, the assessment of ochre outcrops and their distance to the archaeological sites would be a vital issue for understanding its social and/or economic role.

This article focuses on the issue of ochre quarrying and utilisation by the Early Neolithic societies in the Carpathian Basin. The discussion encompasses the presentation of the potential outcrops with further assessment of their usability. Moreover, as a new approach towards provenance studies is needed, some hypotheses would be set for further discussion.

II. OCHRE OUTCROPS

The identification of outcrops used by prehistoric societies could be a difficult or even impossible task. Due to the general changes in the observable habitat, as well as potential complete exploitation of the material, some of the acquisition places would be no longer accessible for examination (see e.g. Roper 1979; Kościuk-Załupka 2023). Moreover, some outcrops could have been used by the prehistoric societies both directly, by acts of quarrying, and indirectly,

as the material could have been transported by varied natural forces, such as for example water flows (Çamurcuoğlu 2015). This in turn would hinder any assessment of the needed time and effort (see e.g. Bailey, Davidson 1983; Brantingham 2003; Herzog 2010), put into ochre acquisition. Nevertheless, the assessment of the ochre outcrop would be vital for understanding of the general dynamics of the analysed human populations.

Throughout the Carpathian Basin, at least 21 ochre outcrops were documented (Fig. 1). Unfortunately, some of them were described too scarcely and thus are impossible to reexamine. Moreover, only twelve of them were checked by means of laboratory techniques (Tab. 1). In some cases the outcomes were published partially or without description of applied methods, as for instance in the case of the Ralya, Oravice (Petránek, van Houten 1997) or Cazanele Mari outcrops (Gãtã, Mateescu 1999-2001). This definitely hinders further comparisons and trials of matching the natural samples with archaeologically acquired specimens.

In general, most of the known outcrops are located within the Carpathian belt, with only some instances, such as Lovas (Dobosi 2006) or Siklós (Török 1999) found in the lowland area (Fig. 1).

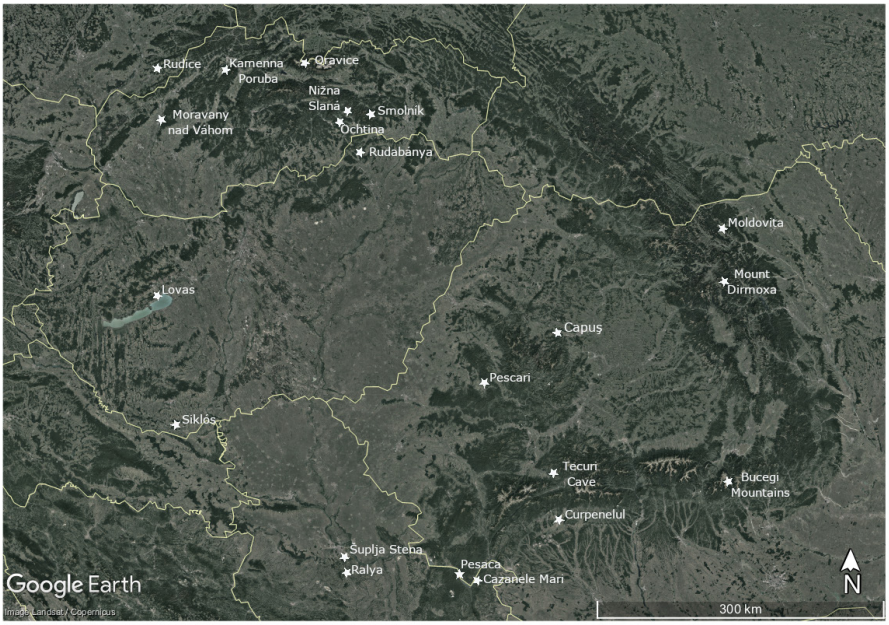

FIG. 1. Map of the known ochre outcrops in the Carpathian Basin and in the mountain range (map: Google Earth, markings: author; after: Kościuk-Załupka 2023)

TABLE 1. The recognized ochre outcrops in the Carpathian Basin and the mountainous ridge (after: Kościuk-Załupka 2023)

Outcrop	Country	Ochre colour	Chemical analyses	
Bucegi Mountains	Romania	Red, brown, yellow	Yes	XRD, XRF, SEM-EDS, ICP-MS
Capuş	Romania	Yellow, red	Yes	Not described
Cazanele Mari	Romania	Red	Yes	Not described
Curpenelul	Romania	Red	No	-
Moldovita	Romania	Red	No	-
Mount Dirmoxa	Romania	Brown	No	-
Pescari	Romania	Red	No	-
Tecuri Cave	Romania	Red	Yes	XRD, IR
Pesaca	Serbia	Red	Yes	Not described
Ralya	Serbia	Not described	Yes	Not described
Šuplja Stena	Serbia	Not described	Yes	Not described
Lovas	Hungary	Yellow, red	Yes	SEM-EDS, XRD
Rudabánya	Hungary	Yellow, red	Yes	EDS, BSE, XRD
Siklós	Hungary	Yellow, red	No	-
Kamenná Poruba	Slovakia	Not described	No	-
Moravany nad Váhom	Slovakia	Not described	No	-
Nižná Slaná	Slovakia	Red	Yes	Not described
Ochtiná	Slovakia	Not described	No	-
Oravice	Slovakia	Yellow, red	Yes	Not described
Smolník	Slovakia	Not described	Yes	Not described
Rudice	Czech Republic	Yellow, red	No	-

III. OCHRE USAGE AMONG THE EARLY NEOLITHIC COMMUNITIES

From the terrains under consideration, occupied by the Starčevo-Körös-Criş communities, ten sites with ochre traces were documented (Fig. 2). Pigment occurrences were mostly connected to the burial rites. Single graves with ochre adornment were discovered at eight sites. The pigment was mentioned as one of grave adornments at: Gura Baciului (Lenneis 2007), Endrőd 119 (Makkay 2007; Paluch 2012) and Endrőd-Varnyai-puszta (Makkay 2007). Moreover, at three further sites ochre was deposited in a special way, on restricted parts of the skeletons. At Endrőd 3/119, the deceased was only adorned with ochre in the chest area (Makkay 2007). Next, in one of the graves at Dudeştii Vechi, ochre was formed into a ball and deposited next to the cranium of the buried person (Lazăr *et al.* 2012). Similarly, at Endrőd 3/82 ochre was connected to the head, being sprinkled over it or applied in form of paint (Makkay 2007).

FIG. 2. Sites with ochre traces, discussed in the text (black dots) with marking of pigment outcrops (white stars) (map: Google Earth, markings: author)

Two further sites, Cenad (Lazăr *et al.* 2012) and Cluj Napoca (Lenneis 2007; Lazăr *et al.* 2012), presented burials with more elaborate grave goods. Besides ochre, they were furnished with a blade and pottery fragments respectively.

Moreover, a set of six burials with ochre adornment was documented at Szarvas Szappanos (Makkay 2007; Paluch 2012). Interestingly, one of the mentioned graves, number 10, was prepared for seven individuals of different sexes and age at death. Ochre was deposited between the crania of person number 1 and number 2 (Makkay 2007).

Only from Szarvas 8/56 came a discovery of different type. Ochre was documented there on pottery pieces (Makkay 2007).

IV. POTENTIAL DISTANCES OF OCHRE TRANSPORTATION

For a more profound understanding of both human mobility, as well as potential sources of ochre acquisition, two models could be proposed. The first one would assume ochre collecting as a task that does not need much effort

and could be undertaken by individuals from the community within a moderate timespan. In this case, it was postulated to use the general distance of 50 kilometres for this first model. Such proposition is dictated by observations, already made for the Starčevo-Körös-Criș groups mobility patterns (see e.g. Klindžić *et al*. 2018) and their utilization of raw materials at least within the range of around 40 kilometres, referred to as "local" habitat (Biagi *et al*. 2007).

The second model would assume long-distance ochre transportation — could be by: (1) long-term excursions and quarrying by the stated community members, (2) by exchange network (Bickle 2016) or (3) within general circulation patterns (Leary, Kador 2016), which could also include contacts with remnant Mesolithic societies (Klindžić *et al*. 2018). For this model, a distance of 150 kilometres was determined as reasonable. It was proposed mostly due to the observed distances, over which obsidian was transported among the Starčevo-Körös-Criș communities. Moreover, if we take into consideration the annual distances, covered by the Mesolithic societies, connected with their potential meetings with the Neolithic communities, then the proposed span of 150 kilometers would also be adequate (Biagi *et al*. 2007).

Surely, the proposed distances and circles of such radius are only hypothetical figures, aimed at trials of understanding of the potential ways of ochre acquisition. Those models do not consider additional features, such as the topography of the terrain or the factors connected to the time and energy needed to cover the proposed distances, which were already suggested elsewhere for other models as well (see: Romper 1979; Bailey, Davidson 1983). Nevertheless, such crudely set boundaries would be sufficient for our general debate over the potential mobility patterns of the Early Neolithic communities.

Basing on the obtained simplified view, two main points could be underlined when assessing the marked areas within 50 kilometers from the discussed sites (Fig. 3). The first one is connected with the natural occurrences of ochre. As it could be seen, only the sites of Gura Baciului and Cluj Napoca would have an access to the outcrop, located in Capuș in this case. The second issue is the fact of intersection of the proposed circles with the radius of 50 kilometers between the sites: (1) Gura Baciului and Cluj Napoca and (2) all of the eight remaining sites. That could suggest the possible connections between the communities, inhabiting the sites.

The second model assumed larger area, within distances of 150 kilometers from the discussed sites (Fig. 4). In this case, more natural outcrops were within the terrain, appointed by the stated limits. Interestingly, the Pescari outcrop was located within all of the proposed spheres. Besides, three other

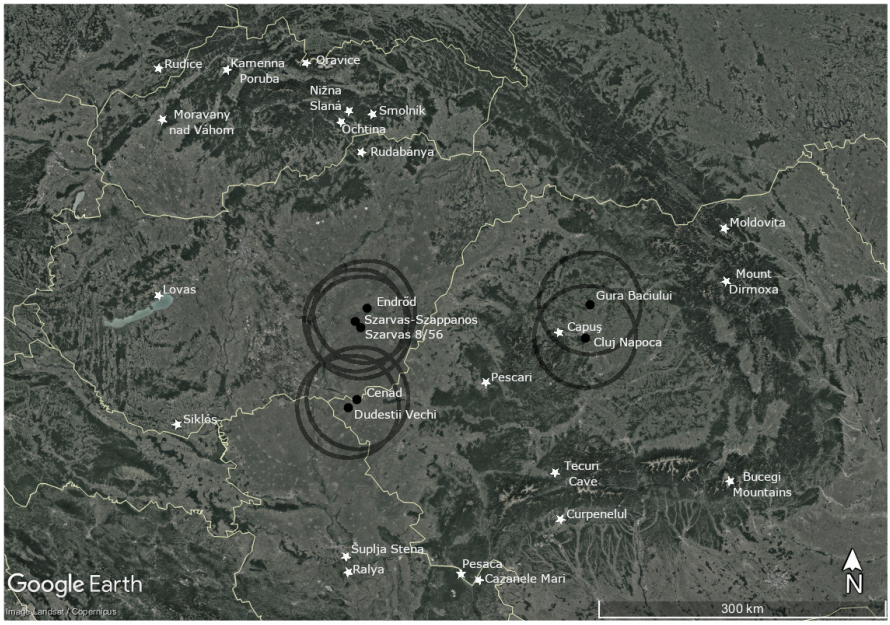

FIG. 3. Discussed sites with marked area within diameter of 50 km (map: Google Earth, markings: author)

places were within the reach of 150 kilometers: Mount Dirmoxa from Gura Baciului, Tecuri Cave from Cluj Napoca and Šuplja Stena from Dudestii Vechi. Moreover, Moldovita, Ralya, Siklós and Rudabánya were some kilometres outside of the crudely set boundaries, what would make them still accessible. In this model, all of the proposed spheres intersected.

V. DISCUSSION

Considering the mobility patterns of the Early Neolithic communities, three main points could be formulated. First of all, the model of 50 kilometres revealed, that only two of the discussed sites could have had direct and relatively convenient access to the ochre outcrop, localized in this case at Capuş. Surely, more ochre occurrences might be within that range, but they: (1) could have been completely exploited in the past, or (2) are not described in the scientific literature. Thus, the final assessment is impossible with the accessible set of data. Nevertheless, even these incomplete pieces of information could be useful for

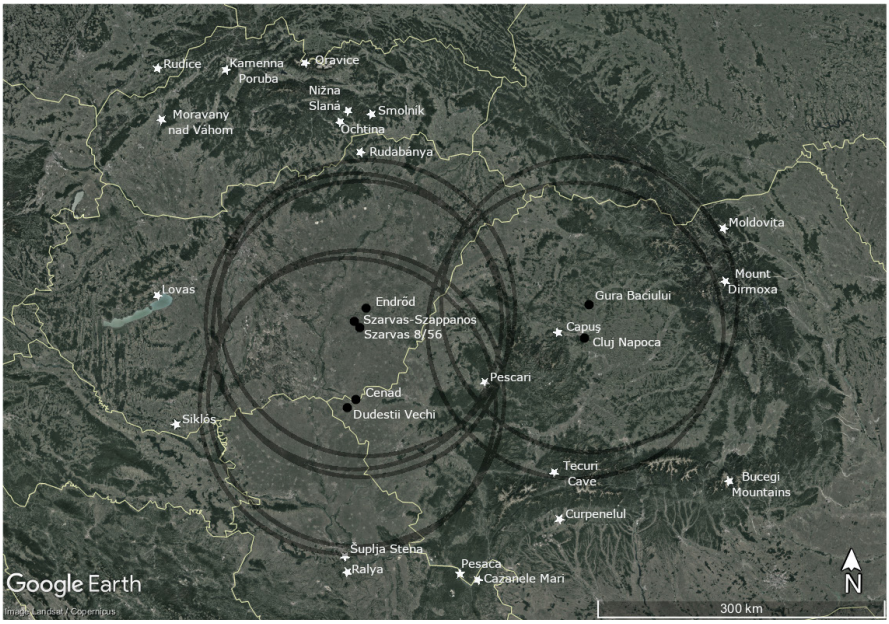

FIG. 4. Discussed sites with marked area within diameter of 150 km (map: Google Earth, markings: author)

the estimation of mobility patters. As it could be seen, the discussed societies were using potential unknown ochre sources close to their settlements, or were making excursions towards ochre outcrops, those were at least in a distance of 23 kilometres from Cluj Napoca, or 40 kilometres from Gura Baciului.

Although the other eight discussed sites did not have access to ochre outcrops within a range of 50 kilometres, pigment traces were documented in the archaeological layers. This could mean again, that more ochre outcrops were known in the proximity of these settlements, but are not documented nowadays. On the other hand, this might also be a point in favour of the assumption of active exchange nets between the Early Neolithic settlements, or even potentially with the remnant Mesolithic groups.

Secondly, in the case of the model with the set boundaries within the distance of 150 kilometres from the sites, more ochre outcrops were found within the designated area: Capuș, Mount Dirmoxa, Pescari, Tecuri Cave and Šuplja Stena. Additional four outcrops were slightly outside of the marked circles. Worth underlining is a fact that Pescari outcrop was caught inside all of the marked circles. According to that model, the discussed sites would have had

access to at least one ochre outcrop. But as the distance increases, it would be less economic to travel there to obtain the raw material (Roper 1979), especially if other potential, yet not documented mineralizations were closer to the settlements. In this case, due to the unevenness of the terrain, the traveling group would have probably advanced at a pace between 2.8 km/h and 3.6 km/h (Gast *et al.* 2019; Ventura, Hodges 2023). The whole trip would have taken at least a month, or two to accomplish, as three parts should be taken into consideration: (1) the distance of up to 150 kilometres one way, requiring at least 8 to 10 days marching, assuming a walking time 5 to 6 hours per day (in good weather), (2) quarrying activities at the outcrop and (3) the return way, again taking a minimum of 8 to 10 days, or even more, depending on the amount of quarred material to be transported (Bastien *et al.* 2005). In that case, two possibilities should be discussed: (1) quarrying conducted by the community, that needed ochre, bearing the costs of long-distance travel and quarrying or (2) acquisition made by other groups, with later transportation and exchange with the discussed communities. Unfortunately, a definite statement is not possible, based on the accessible data. More chemical analyses and material studies should be done to approach this problem more thoroughly.

The last point to emerge from the proposed models is the fact, that the set boundaries were intersecting, indicating potential exchange between the discussed sites. That would allow to resign from an additional factor in our models, which included the more or less intense activity and exchange with Mesolithic groups. Especially vital is the statement, that the Starčevo-Körös-Criş societies were relatively mobile (Depaermentier *et al.* 2020), what would allow for approximation of frequent encounters between the inhabitants of varied settlements. Certainly, the accurate dating of the archaeological remains would be needed in order to determine both the contemporaneity of the settlements and potentiality of such encounters. Nevertheless, such hypothesis should be considered when thinking about mobility patterns.

An additional remark should be made, considering potential ochre acquisition during excursions and searching for other raw materials, or far-reaching exchange practices. This point is supported by discoveries of obsidian artifacts in the lithic assemblage at least at three of the discussed sites: Dudeşti Vechii, Gura Baciului (Biagi *et al.* 2007) and Endrőd 119 (Stranini 1995-1996). As obsidian quarries occur at the distance reaching even 300 kilometers from the discussed settlements (Biagi *et al.* 2007), close to the present-day borders of Hungary, Slovakia and Ukraine (see: fig. 2 in Kasztovszky *et al.* 2014), this direction should also be considered relevant for ochre acquisition.

Then especially important is the observation of a cluster of potential ochre outcrops towards the north from the discussed sites, localized close to the obsidian quarries, such as Rudabánya (Bodor *et al.* 2013) or Ochtina (Liščák, Antalík 2018).

All of these approximations aimed at source recognition based on proposed middle-range theory and models (see: Bailey, Davidson 1983) could also be used secondarily for assessment of the potential cultural role and value of ochre. As it was discussed above, the main type of discovery of pigment traces were connected with the graves. Burial rites are usually characterized by means of various features, with underline of their social, religious-philosophical, territorial or ideological components (Carr 1995). It cannot be omitted then, that ochre traces occurred specifically in such important, specific contexts. Their appearance could be connected to its symbolic meaning (e.g. Kościuk-Załupka 2023). Nevertheless, together with the verification of its potential long-distance transportation, its general value could be seen as precious and specially important for the discussed communities.

VI. CONCLUSIONS

In conclusion, a set of 21 documented ochre outcrops in the Carpathian area and ten archaeological sites with pigment traces dated to the Starčevo-Körös-Criş horizon were discussed. Interestingly, pigment finds were connected mostly with burial rituals, constituting one of a set, or even exclusive grave good. This constitutes an important feature, connected to the cultural perception of ochre, also bound to its potential value.

For a more profound understanding of the probable ochre acquisition ways, two models were presented, with distances of 50 and 150 kilometers from the settlements. These are simplified hypotheses with marked even interest circles, without discussion concerning the energy expenditure connected to landform (see e.g. Roper 1979) or other factors. Nevertheless, even such crudely set boundaries presented points for further discussion and formation of new hypotheses. It was supposed, that ochre could have been brought from outcrops lying in larger distances from the settlements, with the omission of yet unknown potential closer-lying quarries.

The presented assumptions are preliminary and should be checked by means of various accessible methods aimed at source recognition, followed by a more accurate description of the discovered ochre traces from the

archaeological layers. The pigments could be understood in this case just as the starting point for general hypothesizing on the dynamics and mobility of the presented societies.

Moreover, more attention should be paid to a proper description of the whole habitat, surrounding the archaeological sites, including potential sources of pigments. This would facilitate an evaluation of potential excursions from settlements towards outcrops.

REFERENCES

Ahlrichs J. J. 2015. *Ocker im Paläolithikum*, Universitätsforschungen zur prähistorischen Archäologie, Band 265, Bonn.

Bailey D. W. 2000. *Balkan prehistory: exclusion, incorporation and identity*, London – New York.

Bailey G. N., Davidson I. 1983. *Site exploitation territories and topography: two case studies from Palaeolithic Spain*, Journal of Archaeological Science 10, 87–115.

Ball S. H. 1941. *The mining of gems and ornamental stones by American Indians*, Smithsonian Institution, Bureau of American Ethnology, Bulletin no. 128, Anthropological Papers, no. 13.

Bánffy E. 2013. *The northern and western frontier of the Körös culture in the Danube-Tisza interfluve*, [in:] *The Early Neolithic in the Danube-Tisza interfluve,* E. Bánffy (ed.), BAR International Series 2584, chapter 3, 15–22.

Bastien G. J., Willems P. A., Schepens B., Heglund N. C. 2005. *Effect of load and speed on the energetic cost of human walking*, European Journal of Applied Physiology 94(1-2), 76–83.

Biagi P., Gratuze B., Boucetta S. 2007. *New data on the archaeological obsidians from the Banat and Transylvania (Romania)*, [in:] *A short walk through the Balkans: the First Farmers of the Carpathian Basin and Adjacent Regions*, M. Spataro, P. Biagi (eds.), Societa Preisotoria Protostoria Friuli-V.G., Trieste, Quaderno 12, 129–148.

Biagi P., Spataro M. 2005. *New observations on the radiocarbon chronology of the Starčevo-Criș and Körös cultures*, [in:] *Prehistoric Archaeology and Anthropological Theory and Education*, L. Nikolova, J. Fritz, J. Higgins (eds.), RPRP 6-7, 35–40.

Bickle P. 2016. *Varied mobility in the Neolithic: the Linearbandkeramik on the move*, [in:] *Moving on in Neolithic studies*, J. Leary, T. Kador (eds.), Oxford, 14–27.

Bickle P., Whittle A. (eds.) 2016. *The first farmers of central Europe, diversity in LBK life ways*, Cardiff Studies in Archaeology.

Biró K. 2014. *Mezőkövesd-Mocsolyás: a kőanyang értékelése*, [in:] *Mezőkövesd-Mocsolyás, A neolithikus Szatmár-csoport (AVK I) települése és temetője a Kr. e. 6 évezred második feléből*, N. Kalicz, J. Koós (eds.), Nemzeti Kulturális Alap Igazgatósága, Miskolc, 205–259.

Bodor S., Földessy J., Kristály F., Zajzon N. 2013. *Diagenesis and ore forming processes in the Bódvaszilas sandstone of the Rudabánya ore deposit, NE Hungary*, Carpathian Journal of Earth and Environmental Sciences 8(4), 147–153.

Bonsall C. 2007. *When was the Neolithic Transition in the Iron Gates?*, [in:] *A short walk through the Balkans: the first farmers of the Carpathian Basin and adjacent regions*, M. Spataro, P. Biagi (eds.), Proceedings of the Conference held at the Institute of Archaeology UCL, Triest, 53–66.

Brantingham P. J. 2003. *A neutral model of stone raw material procurement*, American Antiquity 68(3), 487–509.

Çamurcuoğlu D. S. 2015. *The wall paintings of Çatalhöyük (Turkey): materials, technologies and artists*, Thesis submitted to University College London for the Degree of Doctor of Philosophy, Institute of Archaeology, University College London.

Carr C. 1995. *Mortuary practices: their social, philosophical-religious, circumstantial, and physical determinants,* Journal of Archaeological Method and Theory 2(2), 105–200.

Cieśla M. 2018. *How far did they go? Exotic stone raw materials occurrence at the Middle Palaeolithic sites. Case studies of sites from Western Carpathian Mts.*, Acta Archaeologica Carpathica 53, 7–28.

Depaermentier M. L. C., Kempf M., Banffy E., Alt K. W. 2020. *Tracing mobility patterns through the 6th-5th millennia BC in the Carpathian Basin with strontium and oxygen stable isotope analyses*, PLOS ONE 15(12): e0242745.

Dimitrijević V. 2014. *The provenance and use of fossil scaphopod's shells at the Late Neolithic/Eneolithic site Vinča - Belo Brdo*, [in:] *Archaeomalacology: shells in the archaeological record*, K. Szabó, C. Dupont, V. Dimitrijević, L. G. Gastelum, N. Serrand (eds.), BAR International Series 2666, 33–42.

Dobosi V. T. 2006. *Lovas (Hungary) ochre mine reconsidered*, [in:] *Stone Age - Mining Age*, G. Körlin, G. Weisgerber (eds.), Bohum, 29–36.

Eastaugh N., Walsh V., Chaplin T., Siddall R. 2004. *The pigment compendium - a dictionary of historical pigments*, Amsterdam.

Eichmann W. J. 2004. *Mesolithic Hunter-Gatherers in the Carpathian Basin and the spread of agriculture in Europe*, [in:] *Fullbright Student Conference Papers, Hungarian-American Commission for Educational Exchange*, J. Huszar (ed.), Budapest, 161–202.

Gast K., Kram R., Riemer R. 2019. *Preferred walking speed on rough terrains: is it all about energetics?*, Journal of Experimental Biology 222(9): 10.1242/jeb.185447.

Gãtã G., Mateescu C. 1999-2001. *The use of ochre for pottery decoration in the middle Neolithic at Vãdastra*, DACIA, vol. 43-45, 183–195.

Herzog I. 2010. *Theory and practice of cost functions*, [in:] *CAA Fusion of cultures, Proceedings of the 38th Conference on Computer Applications and Quantitative Methods in Archaeology*, F. Contreras, F. J. Melero (eds.), Granada, Spain, 1–8.

Kalicz N., Koós J. 2014. *Mezőkövesd-Mocsolyás, A neolithikus Szatmár-csoport (AVK I) települése és temetője a Kr. e. 6 évezred második feléből*, Nemzeti Kulturális Alap Igazgatósága, Miskolc.

Kasztovszky Z., Biró K. T., Kis Z. 2014. *Prompt Gamma Activation Analysis of the Nyírlugos obsidian core depot find*, Journal of Lithic Studies 1(1), 151–163.

Kasztovszky Z., Biró K. T., Nagy-Korodi I., Sztancsuj S. J., Hágó A., Szilágyi V., Maróti B., Constantinescu B., Berecki S., Mirea P. 2019. *Provenance study on prehistoric obsidian objects found in Romania (Eastern Carpathian Basin and its neighbouring regions) using Prompt Gamma Activation Analysis*, Quaternary International 510, 76–87.

Kazakis N. A., Tsirliganis N. C. 2015. *Provenance of ceramics: methods and practices*, [in:] *Best Practices of Geoinformatic Technologies for the Mapping of Archaeolandscapes*, A. Sarris (ed.), Oxford, 239–250.

Klindžić R. Š., Kaczanowska M., Kozłowski J. K., Karavanić I. 2018. *The neolithization of Eastern Croatia and Southern Transdanubia – lithic perspective*, Folia Quaternaria 86, 159–189.

Kościuk-Załupka J. 2023. *The usage of ochre at the verge of Neolithisation from the Near East to the Carpathian Basin*, Oxford.

Lazăr C., Florea M., Astaloș C., Voicu M., Ignat T., Opriș V. (eds.) 2012. *The catalogue of the Neolithic and Eneolithic funerary findings from Romania*, National History Museum of Romania Monographic Series no VII.

Leary J., Kador T. 2016. *Movement and mobility in the Neolithic*, [in:] *Moving on in Neolithic studies*, J. Leary, T. Kador (eds.), Oxford, 1–13.

Lenneis E. 2007. *Mesolithic heritage in early Neolithic burial rituals and personal adornments*, Documenta Praehistorica, vol. XXXIV, 129–137.

Liščák P., Antalik M. 2018. *Information system of important geosites in the Slovak Republic*, Important Geological and Montanistic sites of Slovakia, State Geological Institute of Dionýz Štúr, Bratislava, 5–68.

Makkay J. 2007. *The excavations of the early Neolithic sites of the Körös culture in the Körös valley, Hungary: the final report, vol. I: the excavations: stratigraphy, structures and graves*, Societa de la preistoria e protoistoria della region Friuli-Venezia Giulia, Quaderno 11, Trieste.

Oross K., Bánffy E. 2009. *Three successive waves of Neolithisation: LBK development in Transdanubia*, Documenta Praehistorica 36, 175–189.

Oross K., Simmer L., Straub P. 2019. *Regionality in fluidity: the Linearbandkeramik site at Keszthely-Lendl Adolf út in western Hungary and its hitherland*, [in:] *Prehistoric research in south-western Hungary (5500-500 BC)*, E. Bánffy, J. P. Borna (eds.), Castellum Pannonicum Pelsonense, Budapest - Leipzig - Keszthely - Frankfurt M. - Radhen Westf. 7, 9–72.

Paluch T. 2012. *Graves in the Körös culture distribution area in Hungary*, [in:] *The first Neolithic sites in Central/South-East European transect, vol. 3, The Körös culture in Eastern Hungary*, A. Anders, Z. Siklósi (eds.), BAR International Series, vol. 2334, 179–185.

Petercsák T. (ed.) 1999. *The site of Kompolt, Kistér, Neolithic settlement and graves, part of a Bronze Age cemetery, Sarmatian and Avar settlements, summary*, [in:] *Kompolt-Kistér: a Neolithic, Bronze Age, Sarmatian and Avar site, rescue excavation at the M3 motorway*, T. Petercsák (ed.), Dobó István Vármúzeum, Eger, 351–368.

Petránek J., van Houten F. B. 1997. *Phanerozoic ooidal ironstones: contribution to the International Geological Correlation Programme: project 277- Phanerooci Ooidal Ironstones*, Czech Geological Survey, Práce Českého Geologického Ústavu 7.

Popelka-Filcoff R. S., Robertson J. D., Glascock M. D., Descantes C. 2007. *Trace element characterization of ochre from geological sources*, Journal of Radioanalytical and Nuclear Chemistry 72(1), 17–27.

Radovanović I. 1996. *The Iron Gates Mesolithic*, International Monographs in Prehistory, Archaeological Series 11, Michigan.

Rifkin R. F. 2015. *Ethnographic insight into the prehistoric significance of red ochre*, The digging stick, 32(2), 7–10.

Roper D. 1979. *A method and theory of site catchment analysis: a review,* Advances in Archaeological Method and Theory, vol. 2, 119–140.

Siklósi Z. 2004. *Prestige goods in the Neolithic of the Carpathian Basin. Material manifestations of social differentiation*, Acta Archaeologica Academiae Scientiarum Hungaricae 55, 1–62.

Smith M. A., Fankhauser B., Jercher M. 1998. *The changing provenance of red ochre at Puritjarra Rock Shelter, Central Australia: Late Pleistocene to present*, Proceedings of the Prehistoric Society 64, 275–292.

Stranini E. 1995-1996. *Aspects of the Kőrős culture lithic industry: the assemblage from Endrőd 119 (Hungary): a preliminary report*, Acta Musei Devensis. Volum dedicat împlinirii a 115 ani de la înființarea muzeului și a 60 de ani de la apariția revistei „Sargetia", 79–90.

Török A. 1999. *Petrophysical and sedimentobiological analyses of Siklós ornamental limestones, S-Hungary*, Periodica Polytechnica Ser.Civ.Eng. 43(2), 187–205.

Trąbska J. 2012. *Ferruginous red micro-artefacts as a source of archaeological information: a study of selected palaeolithic sites and experimental research*, Sprawozdania archeologiczne 64, 17–62.

Valde-Nowak P. 2013. *The North-Carpathians province of silica rocks during Stone Age*, [in:] *The Lithic Raw Material Sources and Interregional Human Contacts in the Northern Carpathian Regions*, Z. Mester (ed.), Oficyna Wydawniczo-Drukarska „Secesja", Kraków - Budapest, 87–98.

Veit U. 1992. *Burials within settlements of the Linienbandkeramik and Stichbandkeramik cultures of Central Europe. On the social construction of death in early-neolithic society*, Journal of European Archaeology 1, 107–140.

Ventura J. D., Hodges B. H. 2023. *Carrying children, groceries, and water across varying terrain: changes in gait and comfortable walking speed,* Gait and Posture 103, 140–145.

Walsh P. 1903. *On the Maori method of preparing and using Kokowai*, Transactions and proceedings of the Royal Society of New Zealand, vol. 36, 4–10.

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