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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 area of mineral pigments are rare in archaeological discourse. The main aim of this paper is to portray the state of knowledge on this 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 are proposed: the first assumes direct quarrying, while the second includes potential intra-group contacts. For this reason, two roughly established areas of interest, within 50 and 150 kilometres in diameter, were proposed. Those hypothetical circles would contribute to the understanding of general mobility patterns pertaining to the discussed communities.

KEYWORDS

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

I. INTRODUCTION

Provenance studies are nowadays gaining popularity in archaeological circles. Trials have already been conducted to identify outcrops of various raw materials such as 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). These groups were further categorised to include materials locally-quarried, regionally-acquired and those of non-local origin (e.g. Cieśla 2018). In the case of ochre, the situation is more complicated. In many instances, its outcrops are presented in geological literature, without further assessment in archaeological works. Yet, the mineral pigments in general should be well described and discussed, underlining their broad patterns of use as well as their associated cultural significance.

Ochre is usually attributed with a set of specific features. This material ranges in colour from yellow, orange, to red, brownish and purple (Eastaugh *et al.* 2004; Popelka-Filcoff *et al.* 2007; Rifkin 2015). Iron oxides and iron oxide-hydroxides are the main colouring agents (Popelka-Filcoff *et al.* 2007; Trąbska 2012; Ahlrichs 2015; Rifkin 2015). The most common colour-bearing minerals creating ochre are hematite with a red streak (Eastaugh *et al.* 2004; Popelka-Filcoff *et al.* 2007; Ahlrichs 2015), 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, as 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), which suggest varied mobility patterns for raw material acquisition, (2) limited sample of sites with ochre traces (see Fig. 1) and (3) quite well-studied paths of transportation for other materials (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) and lasting approximately until about 5300 BC (Blagojević 2023) should be understood as the first wave of Neolithic occupation (Biagi, Spataro 2005; Klindžić *et al.* 2018) across a territory extending from Moldavia, Romania, Hungary, to Croatia, Serbia, and Bosnia (Biagi, Spataro 2005). For the purposes of this study, the analysis is focused exclusively on the geographical area encompassing the Carpathian Basin. The aforementioned communities

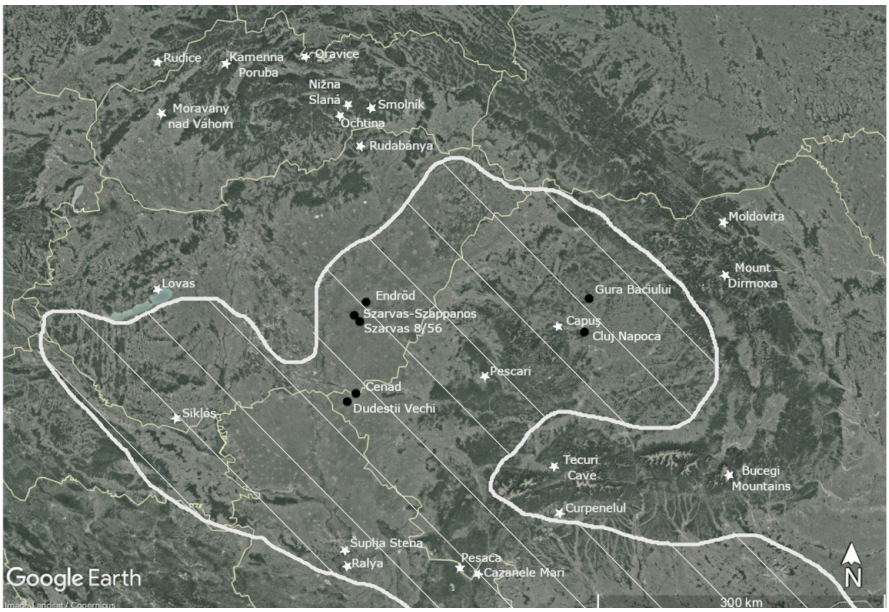

FIG. 1. Sites with ochre traces, discussed in the text (black dots), locations of pigment outcrops (white stars) (map: Google Earth, markings: author); the simplified territorial extent of the Starčevo-Körös-Criș cultural horizon (after: Bánffy 2012)

inhabited predominantly in proximity to watercourses and established relatively short-lived settlements. The economy was based on herding and farming, with hunting and gathering activities supplementing these to varying degrees of intensity (Blagojević 2023).

Unfortunately, the Mesolithic societies that lived on the terrains under study have only been partly described (Eichmann 2004). Consequently, there is a paucity of information regarding the likely existence of exchange routes and preferred raw material outcrops. Nevertheless, the contacts with incoming Early Neolithic populations cannot be excluded (Klindžić *et al.* 2018), and thus should be perceived as a potential factor in the ways of materials transportation.

In general, ochre could have been acquired in proximity to the settlement, or brought from more remote places. Alternatively, work could have been performed off-site to obtain other raw materials (Brantingham 2003). In that case, ochre could have been found and collected by chance. That in turn would hinder studies on its sourcing, making it almost impossible to create more generic theories. Another possibility would be that excursions

were organised with the sole aim of acquiring ochre. Evidence supporting these propositions may be found in ethnographic records. Firstly, some instances of pigments being acquired from nearby outcrops may be presented. One such example is the use of red ferruginous materials in paints. Natural mineral paints based on pigments from the Falu Mine were traditionally used to paint buildings in Sweden (Koark *et al*. 1986). These paints are still available for purchase today[1]. Another example would present the habits of the Walbiri people, inhabiting Central Australia, who obtained and quarried ochre from locally-lying outcrops. They extracted their pigments from the Karrku mine (Smith *et al.* 1998). On the other hand, various instances of ochre quarrying from remote sources might be mentioned here, such as: (1) the Hopi people in North America, who obtained ochre from a location at a distance of about 175 kilometres (Ball 1941: 41) or (2) the Maori people in New Zealand, who acquired pigments from a barely accessible site located in the mountains (Walsh 1903: 7). Then, ochre could have been perceived differently, with additional cultural meaning attached, especially if it was obtained from a culturally-enriched landscape. Moreover, if the process of acquisition was costly, the general value of the material obtained could have been 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 vital for understanding its social and/or economic role.

This article focuses on ochre quarrying and use 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 are presented 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 locations of ochre deposits would be no longer accessible for examination (see e.g. Roper 1979; Kościuk-Załupka 2023). Moreover, some outcrops

1 https://falurodfarg.com/en/paint/falu-rodfarg-original/, access 28.01.2025.

could have been used by the prehistoric societies both directly, by quarrying, and indirectly, as the material could have been transported by varied natural forces, such as water flows (Çamurcuoğlu 2015). This, in turn, would hinder any assessment of the time and effort required (see e.g. Bailey, Davidson 1983; Brantingham 2003; Herzog 2010) for ochre acquisition. Nevertheless, analyses of the ochre outcrop would be vital for understanding of the general dynamics of the discussed human populations.

Throughout the Carpathian Basin, at least 21 ochre outcrops have been documented (Fig. 1). Unfortunately, some were described too generally and so are impossible to reexamine. Moreover, only twelve of them were checked by means of laboratory techniques (Tab. 1). In some cases the outcomes were

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	-

published partially or without any description of the methods applied – 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 tests that might match the natural samples with archaeologically acquired specimens.

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

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 have been documented (Fig. 1). Pigment occurrences were mostly connected to the burial rites, thereby forming a clearly coherent pattern. 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 certain 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, sprinkled over it or applied in the form of paint (Makkay 2007). 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 adornments 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 Szarvas 8/56 hosted 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 human mobility as well as potential sources of ochre acquisition, two models may be proposed. The first would assume that ochre was collected without much effort and by individuals from the community within a moderate timespan. In this case, a general distance of 50 kilometres was thought to be appropriate for this first model. This proposition is dictated by observations already made for the mobility patterns of the Starčevo-Körös-Criş groups (see e.g. Klindžić *et al*. 2018) and their use of raw materials within a range of around at least 40 kilometres, referred to as the 'local' habitat (Biagi *et al*. 2007).

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

These proposed distances and radii are definitely just hypothetical, aimed at attempting to understand the potential paths of ochre acquisition. Those models do not consider additional features, such as the topography of the terrain or factors connected to the time and energy needed to cover the proposed distances, as already suggested elsewhere for other models too (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.

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

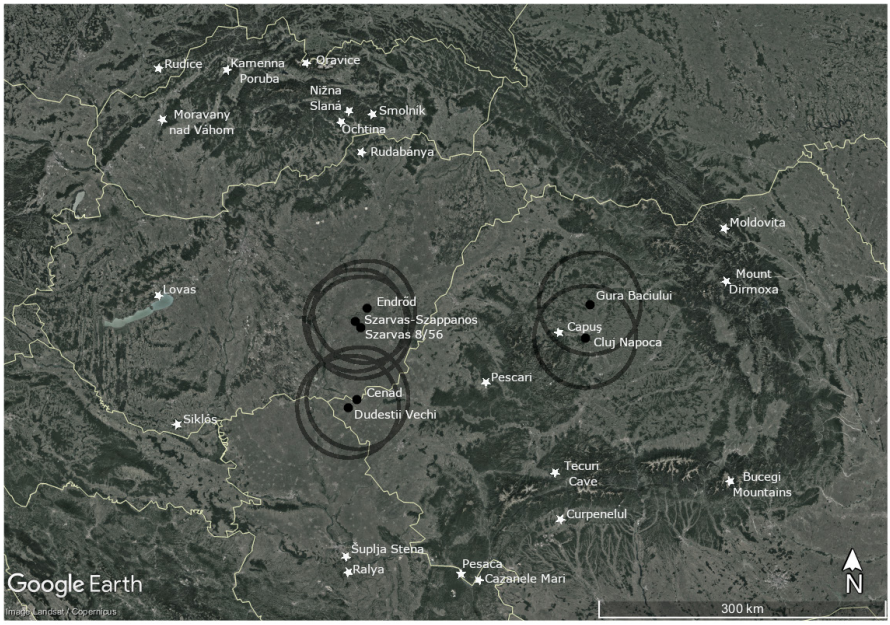

FIG. 2. Discussed sites with marked area within diameter of 50 km (map: Google Earth, markings: author)

The second model assumed a larger area, within a distance of 150 kilometres from the discussed sites (Fig. 3). In this case, more natural outcrops fell within this radius. Interestingly, the Pescari outcrop was located within all of the proposed spheres. Besides, three other places were within 150 kilometres: 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 still make them 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 50 kilometres model revealed that only two of the discussed sites could have had direct and relatively convenient access to the ochre outcrop, located in Capuş. More ochre occurrences may well have fallen within this radius, but they (1) could have

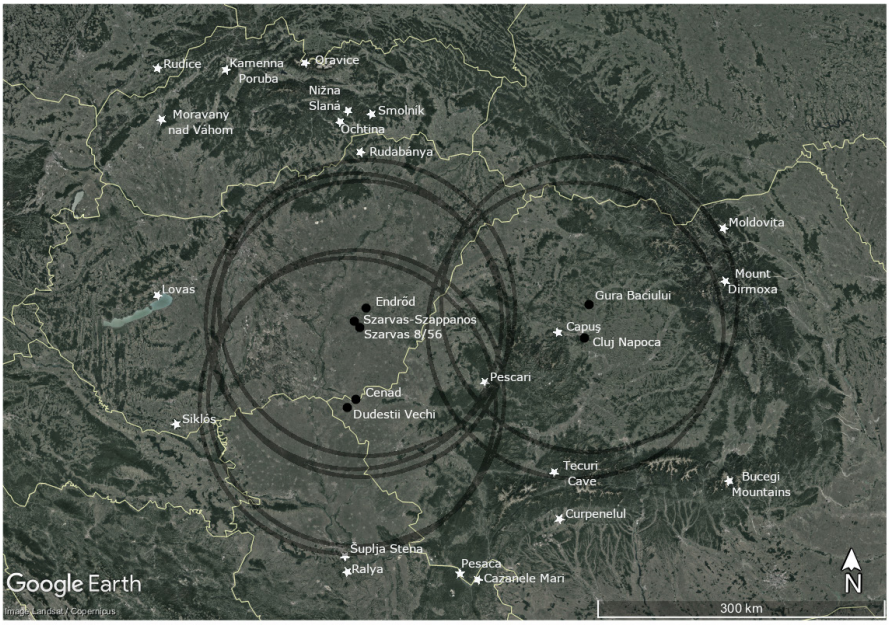

FIG. 3. Discussed sites with marked area within diameter of 150 km (map: Google Earth, markings: author)

been completely exploited in the past, or (2) are not described in the scientific literature. Thus, a final assessment is impossible with the data set available. Nevertheless, even these incomplete pieces of information could be useful for the estimation of mobility patters. As it could be seen, the discussed societies used potential unknown ochre sources close to their settlements, or made excursions towards ochre outcrops – at least 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. Again, this could mean that more ochre outcrops were known to lie in the vicinity of these settlements, but are not documented nowadays. On the other hand, this might also be a point in favour of the assumption of an active exchange nets between Early Neolithic settlements, or even potentially with the remnants of Mesolithic groups.

Secondly, in the case of the 150 kilometre model, more ochre outcrops were found within the designated area: Capuş, Mount Dirmoxa, Pescari, Tecuri Cave and Šuplja Stena. Additional four outcrops were just slightly outside

the marked radius. What is worth underlining is that the Pescari outcrop fell inside all of the radii. Accordingly, the discussed sites would have had access to at least one ochre outcrop. But the longer the distance, the less economically viable it would be to travel to obtain the raw material (Roper 1979), especially if other potential, yet to be documented outcrops 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, split into three sections: (1) a distance of up to 150 kilometres one way, requiring at least 8 to 10 days marching, assuming a walking pace of 5 to 6 hours per day (in good weather), (2) quarrying at the outcrop and (3) the return journey, again taking a minimum of 8 to 10 days, or even more, depending on the amount of quarried material to be transported (Bastien *et al.* 2005). Here, two possibilities should be discussed: (1) quarrying conducted by the community that needed the 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. It is the conclusion of this study that, when considered in the context of ethnographical analogies, each of the proposed possibilities appears to be acceptable. Unfortunately, a definite statement is not possible, based on the data available. More chemical analyses and material studies should be conducted to approach this problem more thoroughly.

The last point to emerge from the proposed models is the fact that the established boundaries intersected, indicating potential exchange between the discussed sites. This could potentially eliminate an additional factor in our models, which included the more or less intense activity and exchange with Mesolithic groups. Of particular relevance is the assertion that the Starčevo-Körös-Criș societies were relatively mobile (Depaermentier *et al.* 2020), which might suggest frequent possible encounters between the inhabitants of varied settlements. Furthermore, the proximity of the settlements to each other suggests the existence of enhanced potential for the movement of materials between these communities (see maps in Luca *et al.* 2011). Certainly, accurate dating of the archaeological remains would be necessary to determine the contemporaneity of the settlements and the possibility of such encounters. Nevertheless, this 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 supposition is supported by discoveries

of obsidian artefacts in the lithic assemblage of 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 of even 300 kilometres 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. Therefore, a cluster of potential ochre outcrops north of the discussed sites could be of key importance, located close to the obsidian quarries, such as Rudabánya (Bodor *et al.* 2013) or Ochtina (Liščák, Antalík 2018).

All these estimations aimed at source recognition based on proposed middle-range theory and models (see: Bailey, Davidson 1983) could also be used secondarily to assess the potential cultural role and value of ochre. As discussed above, the main discoveries of pigment traces were connected with graves. Burial rites are usually characterised by various features, underlying their social, religious-philosophical, territorial or ideological components (Carr 1995). So, one cannot rule out that ochre traces occurred specifically in such important, specific contexts, 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 sets of grave goods. This represents an important feature, linked with the cultural perception of ochre, as well as its potential value.

For a more profound understanding of the probable ways in which ochre was acquired, two models were presented, involving distances of 50 or 150 kilometres from the settlements. These are simplified hypotheses, without discussion of 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 the formation of new hypotheses. It was supposed that ochre could have been brought from outcrops lying further 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. At present, one of the primary impediments is the absence of laboratory analyses directed towards the characterisation and provenance of ochre in the specified area. Nevertheless, the pigments could be understood in this case as a mere starting point for some general hypotheses on the dynamics and mobility of the presented societies.

Moreover, more effort is required to properly describe the whole habitat surrounding the archaeological sites, including potential sources of pigments. This would facilitate an evaluation of potential excursions from settlements towards outcrops.

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