# The Usage of Ochre at the Verge of Neolithisation from the Near East to the Carpathian Basin

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# Contents

# List of Figures

# List of Tables

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# 1.

# Introduction

The topic of the Neolithisation process has been popular in scientific debates since the appearance of the term itself in 1865 (Przybyła 2014: 14; Verhoeven 2011: 76). The discussion on that cultural phenomenon was later taken to another level by the thesis, written by Childe, that the Neolithic cultures had their beginning in one place, from where they were later disseminated over vast terrains. Thereby the process of Neolithisation was classified as revolutionary (Bogucki 1996: 242; Childe 1936: 42; Verhoeven 2011: 76).

In terms of trials to describe the Neolithisation processes and the Neolithic period more accurately, many factors have been taken into consideration. Mainly, the emphasis was placed on the economic transition of societies – from foraging to the Neolithic – which was connected to productive strategies (Bar-Yosef 1998; Belfer-Cohen, Goring-Morris 2011; Grosman *et al*. 2008; Marchand 2011; Weinstein-Evron *et al.* 2012).

These focused studies discussed not only the circumstances leading to the emergence of the idea, but also the accompanying artifacts. A specific term, 'Neolithic package', was even created – this was supposed to enable scientists to track the rise of the Neolithic with ease. Yet it seemed, that such concepts should be perceived as inaccurate or lacking a definition accepted by the whole scientific community. Many cultural characteristics were adjoined, connected to the types of popularly found artifacts, cultivation and domesticated fauna from a vast terrain from the Levant to the South-Eastern Europe (eg. Çiringiroğlu 2005; Raczky *et al.* 2010: 152; Yakar 2005). Although such items and traces of accompanying ideas are frequently found at archaeological sites, a point should be underlined: they could be tracked back to the preceding cultures. As such, their usage cannot be considered as exceptional (Çiringiroğlu 2005: 8; Verhoeven 2011: 78-83). On the other hand, their appearance in greater quantities at a particular site could be an indication of such phenomena as the Neolithic period or its influence (Çiringiroğlu 2005: 4).

There appeared also a proposition to create a term of an 'agricultural package', which would contain: 'emmer wheat, einkorn wheat, hulled barley, lentil, chick pea, bitter vetch, flax' (Çiringiroğlu 2005: 3). The idea was backed with thorough analyses of finds of seeds. Those proved that the crops discovered in archaeological layers in European terrain had a mutual origin with those discovered in the Near East (Covard *et al.* 2008; Raczky *et al.* 2010: 151). Although it might seem appealing, some problems were apparent. The plants, even though they were cultivated in a similar way, could have varied across the discussed territories – such as for example in the Bulgarian Neolithic. On the other hand, the cultivation system itself could have changed and did not match to the same crop types, as for instance happened in the LBK horizon (Covard *et al.* 2008; Raczky *et al.* 2010: 160).

The term 'Neolithic' itself gained detailed meaning, embracing 'technological, economic, social and ideological aspects as a whole' (Çiringiroğlu 2005: 1). Moreover, when it came to the question of climate contribution, it was argued that both processes were parallel. Climate change towards greater humidity without harsh temperature drops coincided with the developing Neolithic way of life (Yakar 2005). Yet, some of the alterations in local climate might have a special impact on cultural dynamism by fostering its acceleration (Bar-Yosef 2015; Sümegi 2004; Sümegi 2005).

One good climate indicator could be traced around the present day Dead Sea. Its range has visibly changed due to the sharp climate alterations. Until around 15,000 BP that terrain was occupied by a large lake, Lisan, that started to diminish towards its present relict shape (Macumber, Head 1991; Smith 2010: 9). Before that, from around 27,000 BP, it persisted at its high water level, reaching around 165m below sea level (Begin *et al.* 2004; Torfstein *et al.* 2013). At 14,000 BP this had diminished to 280m b.s.l., clearly indicating climate change (Begin *et al.* 2004). A similar situation could be tracked on the coasts of the Black Sea. Its level during the 8th and 7th millennia BC was at least 11 metres lower than that observed nowadays. This also implied the low number of discovered archaeological sites, which at that time were located at the seaside and are now below the surface of the water (Peev 2009: 88).

When it came to the dramatic climate changes, at least two such events may be determined during the discussed time lapse. These could be addressed twofold: Rapid Climate Change (RCC) (Bar-Yosef 2015; Weninger *et al.* 2014) or Ice Rafted Debris Events (IRD) (Gronenborn 2009). The second term was directly connected to the phenomena causing the alterations. In the case of the biggest such event, the ice sheets separating glacial lakes in North America melted, leading to an influx of fresh water into the Labrador Sea. That in turn influenced the balance of Atlantic Ocean by affecting the surface densities and hindering the circulation based on salty waters. That situation caused modifications in the level of average precipitation (Düring 2013; Nikolova 2007: 95; Weninger *et al.* 2006; Weninger *et al.* 2014).

Moreover, the Early Holocene Event should be distinguished, also called the '9.2 ka event', connected to climate cooling. For the terrains of Europe it coincided with the end of the Early Mesolithic (Crombe 2017: 1; Gronenborn 2009). The second period of RCC was connected to the '8.2 ka event' (Bar-Yosef 2015; Crombe 2017: 1; Düring 2013; Gronenborn 2009; Weninger *et al.* 2006), which also could be counted to IRD 5a. Such events were quite ephemeral, lasting 100 to 150 years and connected to a cooling of average temperature by 1-2°C (Crombe 2017: 1; Roffet-Salque *et al.* 2018). To that climatic pressure there might be assigned a socio-cultural reaction: intensified migration (Düring 2013; Gronenborn 2009). That view could be supported by archaeological data, portraying a cultural shift during the PPNB towards more mobile pastoral groups and abandonment of many settlements (Bar-Yosef 2015; Düring 2013), as for example happened in Çatalhöyük (Bar-Yosef 2015), after a trial of adaptation (Roffet-Salque *et al.* 2018). The event was also contemporaneous with the appearance of early Neolithic groups in south-eastern Europe, connected to the transmission of painted pottery from the terrains of Anatolia (Düring 2013; Weninger *et al.* 2006).

As the Holocene climatic optimum lasted during the 7th and 6th millennia BC, cultures flourished (Raczky *et al.* 2010: 151; Rosenstock 2005). Mean temperatures were around 3°C above the present day ones (Rosenstock 2005). Yet, a rapid change in climate can be seen at the end of the 7th millennium BC, with temperatures dropping (Düring 2013; Todorova 1995; Weninger *et al.* 2014). During that period the cultures in the northern part of Bulgaria were in recession due to adverse conditions. Further influx of farming societies to that region can be noted again from the 6th millennium BC, in connection with a reversion to the climatic optimum and demographic growth (Todorova 1995).

In connection to the climate, we should also note the 'Central European-Balkanic Agroecological Barrier', abbreviated as CEB AEB. This concept was created to refer to the specific spread of the Neolithic into the Carpathian Basin, whereby it was noted that the earliest Neolithic groups did not settle further north into the Carpathian Basin, perhaps dictated by unfavourable environmental conditions for the establishment of communities based on agriculture. That barrier was successfully crossed in a later period through adaptations of farming societies to the new habitat (Kertész 2002: 290-291; Sümegi 2004).

The means by which the ideas assigned as purely Neolithic were spread have been widely discussed among scientists. In particular, two hypotheses have been distinguished for the popularisation of agricultural knowledge. The first theory proposed is so-called 'demic diffusion'. According to its assumptions, the spread of an idea was firmly combined with a physical spread of humans. On that basis, for the appearance of the Neolithic in Europe mobile groups were needed who already had knowledge about agriculture (Fernández *et al.* 2014; Hervella *et al.* 2015; Siddiq 2016; Yakar 2005). That hypothesis was especially supported by development of the idea of a 'wave of advance', proposed by scientists Ammerman and Cavalli-Sforza (1984; Anthony 1990; Fort, Pujol, Cavalli-Sforza 2004). That model presupposed a stable spread of Neolithic ideas, assessing its constant yearly velocity at around one kilometre per year (Ammermann, Cavalli-Sforza 1984; Fort, Pujol, Cavalli-Sforza 2004: 58; Yakar 2005). The proposition seemed especially well-matched to Western Anatolia, where Mesolithic traces were scarce, contrary to the known Neolithic sites (Çiringiroğlu 2005: 8-9). A similar situation was also described for the northern range of the Carpathian Basin (Raczky *et al.* 2010: 159).

In discussing the modality of the Neolithic migration, three models were created, accurate for the Bulgaria, yet seemingly applicable to the Balkans in general. The first route proposed was from the Adriatic Sea side towards the east, with the Danube River as the main determinant. Another hypothesis showed the opposite situation, with migration originating from the Black Sea coasts, heading westward. The last idea proposed movement from south to north through the Bosphorus. Yet, those propositions were not exclusive, leaving the possibility of multidirectional options (Dzhanfezova, Doherty, Elenski 2014). Especially so, when return migrations are also taken into account (Anthony 1990).

Another hypothesis was based on the cultural diffusion. Its main proposition excluded movements of human groups and assumed the transition of ideas over vast terrains, mostly based on cultural exchange between human societies (Fernández *et al.* 2014; Hervella *et al.* 2015; Siddiq 2016; Yakar 2005). In trials to reconcile both hypotheses, some of scientists proposed the range of demic diffusion up to the Balkans area, with the further spread of ideas to the north by means of cultural diffusion (Hevrella *et al.* 2015). Neolithic knowledge might have also attracted local societies living in the vicinity of agrarian settlements, thereby contributing also to a form of cultural diffusion (Dequilloux *et al.* 2012; Gronenborn 1998). That could be connected to a model of so-called 'leapfrog colonization', which does not require that the inflowing migrants eradicate locally existing societies (Dequilloux *et al.* 2012; Horejs *et al.* 2015: 292). Yet, voices may also be encountered arguing that:

> '(...) contact with Neolithic groups certainly did not introduce new aspects of social organization and ideology. It could only accelerate and intensify processes of increasing social complexity and ideological integration already present within European Mesolithic groups (...)' (Radovanović 1996: 315).

With this in mind, there should not be made any strong hypothesis, that did not include the pre-existing impact of the Mesolithic societies, together with their long social and cultural development, preceding the arrival of new Neolithic ideas.

Trying to confront both hypotheses – demic diffusion and cultural diffusion – innovative analyses were introduced, based on DNA comparisons. After juxtaposition of data from present day living populations with archaeological outcomes, more accurate conclusions could be drawn. For further discussion, distinctions among two types of DNA were necessary: maternal and paternal lineages. The first is easier to examine, as it appears in every human genome and is especially easily traceable in mitochondria. The other can be found only in males' DNA, transmitted by the Y chromosome among masculine descendants (Montazer Zohouri, Niknami 2011: 1008-1009).

Based on maternal DNA, eight major haplogroups could be determined, which include most of the present day European populations. For the discussion on demic diffusion, four groups are of particular importance. Haplogroup H is even nowadays one of the most popular both in Europe (where it stands at around 50%) and in the Near East (around 30%). It was stated to appear in Europe most probably around the time of the Middle Upper Palaeolithic, together with haplogroup V. By contrast genes connected to the Neolithic expansion were identified with two other groups: J and T1 (Budja 2005; Hevrella *et al.* 2015), which constitute between 12% and 23% among current European populations (Budja 2005).

When it comes to paternal DNA, two distinctive gene flows can also be identified. The first, marked with haplogroup Eu7, migrated to Europe from the Near East during Gravettian times. The second flow is connected to the initial stages of Neolithisation. Here such haplogroups as Eu4, Eu9, Eu10, Eu11, could be recognised, also originating in the Near East (Budja 2005).

Thus, based on DNA analysis, it could be stated that, at least in part, the spread of the Neolithic ideas was connected to demic diffusion. Yet a combination of percentage data for both maternal and paternal DNA participation in the mentioned haplogroups indicates that in present day European populations only 20% of genes could be connected to the direct impact of the Neolithic diffusion, while 80% should be connected to indigenous, Palaeolithic societies (Budja 2005). This led to a conclusion of the coexistence of both separate genetic groups for a long time in the European ecosystem, without full gene replacement (Dinu, Soficaru, Miritoiu 2007; Fernández *et al.* 2014). Interestingly, the DNA analyses indicated the populations of the Pre-Pottery Neolithic B period as the most expansive. The currently living closest relatives of the mentioned societies are both Druzes and Ashkenazi Jews (Fernández *et al.* 2014).

Based on those premises, it would be interesting to trace the circumstances of the appearance and spread of Neolithic ideas. As was previously mentioned, such trials were based on the construction of the 'Neolithic package' (Çiringiroğlu 2005; Yakar 2005). Yet it seems appealing as well to include the cultural component, not taken into consideration before. This work provides such a trial, starting the discussion on the usage of the mineral pigment ochre. That cultural element may be studied with ease and in many ways. Its usage can be detected in archaeological layers due to its chemical stability (Ahrlichs 2015: 8; Dayet *et al.* 2013; de Faria, Lopes 2007; Olivares *et al.* 2013; Weinstein-Evron, Ilani 1994). Thus it might be used as a catalyst for further research. Also the contexts of discoveries are varied, disclosing their differing cultural meanings. The application of ochre was connected both to profane and ritual use. Hypotheses based on archaeological contexts could be tested also by means of ethnographical comparisons, as tribal societies worldwide still apply ochre in different ways nowadays (eg. Mészáros, Vértes 1954: 27; Rifkin 2015a; Rifkin 2015b; Taçon 2004).

The involvement of auxiliary methods, associated primarily with the fields of chemistry and geology, facilitated the analysis of the ochre fragments themselves. Thereby, it might be possible to expose additional data, which could lead in turn to the discovery of the connections between the archaeological samples and their natural outcrops. With such connexions, research on the mobility and exchange routes between Neolithic societies could be introduced. The research was twofold, encompassing chemical analyses, supplemented by optical microscopy, in association with crystal measurement.

The study is divided into nine chapters. The first is introductory, with specification of the timespan and terrain under discussion. There are also brief bibliographical and materials reviews. The second chapter is entirely devoted to the subject of ochre itself, and exact definitions are presented. As the term seems to be quite inaccurate, clarifications are proposed, in line with the geological basis. In order to understand all properties of ochre, discussion on the natural occurrence of its mineral components is also introduced. Methods of ochre analysis are presented with discussion concerning their application. Briefly the chapter sets out the reasons for the choice of methods: SEM-EDS, BSE and optical microscopy.

The third chapter concerns the cultural background for the phenomenon of ochre usage. As the timespan is restricted to the initial stage of Neolithisation, only a few archaeological entities are encompassed. By necessity, the preceding cultures of the Epipalaeolithic in the Near East or the Mesolithic in Europe are also briefly discussed.

The next chapter concerns ochre finds in archaeological layers. Contexts are discussed, divided into two sections: sacred and profane. Moreover, in Chapter Five, ethnographic instances of ochre use are presented. These serve to deepen our understanding of the possible role of pigment.

In the succeeding chapter archaeological sites where ochre was found are introduced. They are separated according to four regions: the Levant, Anatolia, the eastern part of the Balkan Peninsula and the Carpathian Basin and described chronologically. In a concise summary, patterns that emerged during the description of the sites are outlined.

Subsequently in Chapter Seven, ochre outcrops in the territories under discussion are presented. In latter part the analyses of ochre samples are discussed and summarised. They are also presented in subsections, according to the countries under study. Possible markers for distinguishing ochre are discussed. The possibility of matching archaeological ochre pieces with natural outcrops is also raised.

Two final chapters are devoted to wider discussion and conclusions. One of the main aims is to present the meaning of ochre among the societies under investigation. It was also interesting to make an ethnographic comparison to present day tribes, especially those living in Africa and America. Experimental works connected to the application of ochre are also worth underlining. It is particularly noteworthy that firing and oxidation could affect the colour of the ochre (Ahlrichs 2015: 95-96; Cornell, Schwertmann 2003; de Faria, Lopes 2007; d'Errico *et al.* 2010; Petru 2006; Salomon *et al.* 2012; Trąbska 2012; Weinstein-Evron, Ilani 1994). In comparison with naturally found minerals, that reference might be indicative of the level of knowledge of prehistoric societies.

**Purpose of the work**

The aims of the work could be divided into several sections. The initial intention was to analyse and categorise the archaeological finds connected to the pigments popularly named as ochre. Especially important was the emphasis that these minerals were used not only in sacred, most popularly considered contexts, but also in everyday, profane aspects. Surely, some archaeological discoveries had characteristics of both types, as will be addressed in the following chapters.

With the aim of comprehensively presenting contexts, catalogues of both ochre samples and archaeological sites at which such minerals were found were created. An additional list was made for natural outcrops, to determine the cultural and natural background for the developing societies. On this basis, the great ubiquity and utility of ochre is clearly visible. Thanks to thorough analysis of the contexts, ochre forms or traces and the accompanying artifacts, more general conclusions can be drawn. The main differences in ochre application can be tracked over the timespan and the area of cultural entities under discussion. For a more accurate assessment of the possible explanations of the archaeological contexts with which ochre is associated, ethnographic comparisons are introduced, as tribal societies using that pigment in varied ways can still be described.

For a more profound discussion, three possible models of the cultural transition of ochre usage are assessed:

1. the usage of ochre was a separate issue from the Neolithisation process and therefore its application should be seen as a continuous matter in singular regions, without traceable changes even due to cultural transitions;
2. the types of ochre usage varied deeply between the Mesolithic and Neolithic societies, yet it will be possible to trace continuity in Mesolithic applications; this could lead to the conclusion that these concepts were imposed upon the Neolithic newcomers;
3. the types of ochre usage varied deeply between the Mesolithic and Neolithic societies, with a lack of continuity in application between the Mesolithic and Neolithic, but with the new patterns moving with the Neolithic communities.

All of the mentioned hypotheses will be tested by confrontation with the archaeological data. It should not be considered that only one of the discussed propositions would be adequate for the whole area under study.

Another research question was the possibility of discovering connections between ochre samples from archaeological layers and their natural outcrops. That question is particularly difficult on the basis of scarce research in the field of chemical analysis and composition comparisons (eg. see discussion in: Popelka-Filcoff *et al.* 2007). As an introduction to geo-chemical analysis of ochre, there would need to be discussion about possible ways of sampling and checking, together with designation of possible destructivity of miscellaneous methods. For this study, scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) with additional detection of back scattered electrons (BSE) were chosen as the main methods. The auxiliary use of an optical microscope was restricted to only a few of the samples, bearing possible traces of usage.

For the purpose of comparison, it was also necessary to search for natural outcrops of discussed minerals. That task was problematic due to different possibilities of formation of ochre deposits, which led also to the problem of the multiplicity of their appearance.[1] Only a restricted number of possible places where the pigments might be acquired have been identified and are discussed in the scientific works. Yet still, the chemical analysis, even without an initial pattern, enables us to compare samples between themselves to retrieve also relationship between singular samples that would lead to statements on the connections between archaeological sites. For that reason, statistical tools were also involved. The main methods applied were Principal Component Analysis and Cluster Analysis. Thanks to the diagrams obtained, the similarities of the samples' chemical composition could be presented and summarised.

**Territorial range**

For the purpose of comparison, quite a vast area was chosen: from the Levant to the Carpathian Basin. Yet, due to many factors the territory was restricted to a strip of land, beginning from Israel, through Turkey, leading along the eastern Balkans to Hungary and Slovakia. Although sampling of Syrian ochres was excluded on account of the unstable political situation in that country,[2] some archaeological sites are mentioned in the work.

The Levant may be defined from different approaches. First of all, it could be understood in a historical manner. The term, steaming from the French word *lever*, was connected to concept of the rising sun, and thus to the countries located towards the east. From that perspective the Levant would be understood as a strip of land on the eastern shores of the Mediterranean Sea.[3] Later, in geographical terms, it would be perceived as a territory, starting from the Sinai Peninsula in the south, spreading northward to the Mountains of Cilicia (El-Sibai *et al.* 2009) and bounded by the Taurus and Zagros mountains (Goring-Morris, Belfer-Cohen 2011), covering an area of around 1300 x 350km (Yakar 1998).

Geographically, Anatolia is bordered by the Black Sea to the north, the Taurus Mountains in the south-east, the Mediterranean Sea along its south-western coasts, and finally the Sea of Marmara, in the west. The peninsula is also known as Asia Minor or its Turkish name – Anadolu. Sometimes, some Mediterranean islands are also associated with the region.[4] Anatolia is the Asian part of present day Turkey. A small number of sites located in Thrace, within Turkey's European territory, will be discussed jointly, as they show similarities with inland Anatolia.

The Balkans span over a peninsula. The name itself stems from Turkish term for 'forested mountain' (Reed, Kryštufek, Eastwood 2004: 14). Its scope could be described as encompassing 35-48° N (Reed, Kryštufek, Eastwood 2004: 17). Its eastern, western and southern borders are easy to track along the Black, Aegean, Adriatic and Ionian Seas. The Bosphorus is also taken as a border, which means that the western part of Turkey is considered part of the Balkans as well. Yet, there is no agreement on the northern borders of the region. The main contentions are three: the first assumes the northern border of the Balkans as congruent with present day border of Bulgaria. Another also includes the south-eastern part of Romania, with the delta of the Danube river. The last hypothesis further incorporates the whole territory of present day Romania (Reed, Kryštufek, Eastwood 2004: 9).

The definition of the Carpathian Basin can be understood on several levels. In its broadest sense it can perceived as 'the area bordered by the Alps, the Carpathians, the Dinári mountains' (Hajdú 2004: 5). Yet, other names are also in use for that territory, such as 'Hungarian Basin, Pannon Basin, Central Danubian Basin (...) etc' (Hajdú 2004: 5), tightly connecting it with Hungary as a political entity (Hajdú 2004: 43). On a geographical and hydrological basis, the area remains deeply associated with the River Danube (Hajdú 2004: 6). From that

[1] For discussion and examples see: Ahrlichs 2015; Cornell, Schwertmann 2003; Montalto *et al.* 2012; Popelka-Filcoff *et al.* 2007; Trąbska 2012; Weinstein-Evron, Ilani 1994.

[2] For further discussion see: Cordesman 2018: 56-57; Khan, Khan 2017.

[3] https://www.britannica.com/place/Levant, access: 20.01.2020.

[4] https://www.britannica.com/place/Anatolia/The-Neolithic-Period, access: 20.01.2020.

perspective, archaeological sites will be discussed extending to Slovakia, with the further addition of some geological ochre outcrops located in the Czech Republic. Despite lying outside of the area of interest, they will complete the discussion of pigment quarries, especially as they could have been used by the societies under discussion.

The most important reason behind the selection of this territorial range was also dictated by the cultural background. In that case the Anatolian-Danubian model of Neolithic spread was taken as the main discursive issue, with the omission of the Impresso-Cardial complex (see: Furholt 2021: 485-487, 495, 497).

**Chronological range**

During the discussion on chronology, numerous problems were encountered. One of the difficulties was the lack of possibility or certainty when it came to the comparability of timespans, cited in various articles. To that issue belonged primarily the problem of finding long chronologies. In articles discussing one culture, examples of wider cultural background are often not given nor are previous cultural entities mentioned.

Another obstacle was discussion based only on dates counted from the year 1950 (BP), without mentioning the calibrated outcomes. In other cases, even though the necessary dates were given, the applied calibration curve was not mentioned or the mean errors taken into consideration. This clearly impeded the comparative work. Even the choice of laboratory for radiocarbon analyses is significant, although relevant information was rarely published. Naturally, exceptions may be found, such as the informative article written by Düring (2013).

Even if the dates were published in a similar system, some of the works were rather based on averaged data sets, though differing on the basis of the varying approaches and needs of the discussion. Possibly also in the more recent works there might be dates cited from older articles. Thus it was barely possible to find a single chronological system that would be appreciated by the whole scientific community. On that basis, the dates proposed below should be perceived as general ones, cited after latest researches. They are presented for comparative reasons and for the portrayal of the main trends in the spread of Neolithic ideas.

In general, the chronology presented in this work is intended to reflect the innovatory phenomena, known as Neolithisation and its spread across the vast terrains from the Levant to the Carpathian Basin. Within the general periods named below, more specific cultures are characterised, to be discussed in the section dedicated to the cultural background.

When it comes to the cultural periods discussed in the work, they could be divided according to regions. In the Levantine area four more general units were distinguished, with further division into specific periods. The main division differentiated Late Epipalaeolithic, Pre-Pottery Neolithic A, Pre-Pottery Neolithic B and Pre-Pottery Neolithic C (Abraham 2013; Çiringiroğlu 2005: 4), with a caveat that the last one was not discovered in all areas and could be treated sometimes as the final part of the previous entity (Triss 2001). One of the periodisation propositions was (after Abraham 2013):

| | |
|---|---|
| Late Epipalaeolithic | 12500 – 10000 BC |
| Pre-Pottery Neolithic A | 10000 – 8550 BC |
| Pre-Pottery Neolithic B | 8550 – 6750 BC |
| Pre-Pottery Neolithic C | 6750 – 6300 BC |

Here it should be mentioned that the Late Epipalaeolithic term was introduced instead of the overly narrow term of Natufian culture that was originally proposed (Abraham 2013). The timespan of the Epipalaeolithic was, however, proposed elsewhere as having a different length, encompassing the years between 23000 and 10500 BC, then followed by Neolithic from 10500 to 5600 BC – including both pre-pottery and pottery phases (Verhoeven 2011: 78). The major cultural break was noted abound the year 7000 BC, together with increased pastoral way of life (Verhoeven 2011: 83).

Generally, similar division to that one of Abraham (2013) have been proposed in other articles (eg. Borrell, Štefanisko 2016; Çiringiroğlu 2005: 4), with the major difference only in terms of the duration of Pre-Pottery Neolithic B by the introduction of its partition into Early PPNB from 9000 to 7500 BC and Late PPNB lasting from 7500 to 7000 BC (Çiringiroğlu 2005: 4).

In terms of the chronological division of the periods in Anatolia, obstacles might be encountered. Firstly, the uneven level of exploration of that territory should be mentioned, both by human groups during the Neolithisation process and by archaeologists nowadays. Another issue was the major differences in both the spread of the Neolithic and varied means of its assimilation.

Based on radiocarbon dates from Direkli Cave, specifically from the seventh layer, the southern part of Anatolia was inhabited between 10730 and 8915 BC by societies similar to the Levantine Early Natufian entities (Taşkıran 2016: 48). Later on, the difference in the appearance of Neolithic settlement between southern and northern Anatolia could reach as much as 1000 years (Karul 2011). For instance, for the Cappadocia the beginning of Neolithic could be traced from 8500 BC (Thissen 2002) or 8300 BC (Kılınç *et al.* 2016: 1), while for the north-western parts of Anatolia from the second half of the 7th millennium BC. One such example would be the region around Eskişehir, with the Neolithic period lasting from 6400 to 5400 BC (Karul 2011). For the area under discussion two periods can be distinguished, similar to the Levantine division between Aceramic and Pottery Neolithic horizons, again with dates diversified on a geographical basis (Kılınç *et al.* 2016: 1).

For the Central Balkans, the most general chronological division encompassing the periods of interest can be found in the article written by Cook and scientific team (2009):

| | |
|---|---|
| Early Mesolithic | 9600 – 7200 BC |
| Late Mesolithic | 7200 - 6300 BC |
| Final Mesolithic | 6300 - 6000 BC |
| Early Neolithic | 6000 - 5500 BC |

These cultural changes would also be embraced by the climatic units embedded in the timespan from Late Glacial to the Middle Holocene (Cook *et al.* 2009). Similar dates for the beginning of the Early Mesolithic have also been proposed in other works - from 9500 BC (Borić, Raičević, Stefanović 2009), or more generally from the 10th or even 11th millennium BC (Radovanović 1996: 293). Another caesura was set for the Late Mesolithic, moving its beginning as much as 300 years earlier, and lasting from 7500 to 6200 BC (Borić, Raičević, Stefanović 2009), or from 7300 till 6200 BC (Borić *et al.* 2014).

An interesting proposition, referring only to the Mesolithic period was published by Dinu, Soficaru and Miritoiu (2007):

| | |
|---|---|
| Stage I | 8800 - 8300 BC |
| Stage II | 8300 - 7800 BC |
| Stage III | 7800 - 7300 BC |
| Stage IV | 7300 - 6800 BC |
| Stage V | 6800 - 6300 BC |
| Stage VI | 6300 - 6100 BC |
| Stage VII | 5700 - 4800 BC |

Based on those dates it could be concluded that Mesolithic societies existed in parallel with Neolithic settlements thorough the whole Early Neolithic period (Dinu, Soficaru and Miritoiu 2007). A shorter period was proposed by Roksandić and scientific team (2006), designating 5500 BC as the end of the Mesolithic period, with the introduction of agriculture around 6500 BC. The most general dates were proposed by Radovanović (1996: 293), designating the 6th millennium BC as the final stage of Mesolithic, which would also indicate its duration in parallel with the Early Neolithic.

Some scientists, based on the analysis of settlements with monochrome pottery, have proposed earlier dates for the Early Neolithic stage, starting from 6400 to 6100 BC (Todorova 1995), or from 6300 BC (Borić, Stefanović 2004). Yet those dates should be approached cautiously, including the possibility of the reservoir effect (Cook *et al.* 2009). In other articles, the dates for the initial stage of Neolithic influences vary from 6100 to 6000 BC (Dzhanfezova, Doherty, Elenski 2014; Luca, Suciu, Dumitrescu-Chioar 2011). Thus, the average dates of the transition between the Mesolithic and the Neolithic would sit between 6200 and 5900 BC (Borić *et al.* 2014). The Middle Neolithic, lasting from around 5300 to 4500 BC should also be mentioned (Hevrella *et al.* 2015). The later development of the Neolithic cultures would finish with the appearance of the Eneolithic/Early Chalcolithic period, starting from 5th millennium BC (Bailey *et al.* 1998), or more precisely from around 4500 BC (Hevrella *et al.* 2015).

The lands of the Carpathian Basin were diversified in terms of the chronology of changing cultures. An example could be drawn on the basis of the Upper Tisza region. Archaeological works have not yet confirmed any traces of Mesolithic societies in that area, but the obvious presence of Neolithic activity has been found (Peev 2009: 159; Raczky *et al.* 2010: 159). The appearance of Neolithic ideas in that region could be dated at least from the end of the 7th millennium BC (Bánffy 2013b), or more accurately between 6000 and 5700 BC (Sümegi *et al.* 2013).

In general, for the region under discussion, two separate lines of cultural development have been proposed, based on their location south or north of the Central European-Balkanic Agroecological Barrier (Kertész 2002: 290). Mesolithic entities had been developing from previous cultures in the Carpathian Basin from the beginning of the Holocene (Kertész 2002: 281). However, the barrier mentioned above seemed to mark and divide the environment that was habitable by inflowing Early Neolithic societies from that inhabited solely by the Mesolithic groups. Migration towards southern parts of the Carpathian Basin would be then situated between the dates 6500 and 5500 BC. The colonisation of the region between the rivers Maros and Körös could be placed around 5850 BC (Bánffy 2013), with the approximate finish of northwards migration around 5620 BC (Peev 2009: 159). That was later followed by the development of the Middle Neolithic within a timeframe of 5500 to 5000 BC (Kertész 2002: 291) or 5700 to 5400 BC (Sümegi *et al.* 2013), connected to the spread northwards as the new cultural entities adapted to the new environment (Kertész 2002: 291). These dates may be also identified with the origins of the Linear complexes, dated similarly between 5600 and 5300 BC (Kozłowski *et al.* 2014: 38).

Trials have been conducted to compare the cultural development of the discussed cultures. Based on similarities in cultural transitions, it could be stated, that the Early Chalcolithic of Anatolia could be juxtaposed with the Middle Neolithic in Greece and with the Early Neolithic of the Balkans as chronologically coexisting (Brami, Head 2011).

**Bibliographical review**

The overall literature can be divided into three types. The first is connected to cultural issues, another discusses matters of ochre at archaeological sites, while the last defines that material in chemical and geological terms. The first two are the most abundant, with the third group constituting an auxiliary branch.

Generally, the chosen literature was written in English. It was normally easy to find appropriate articles both in libraries and at the webpages of scientific journals. Bibliography in German and Spanish was also represented, as both are understood by the author. Yet, in some cases there was a deep need to reach works in different languages, especially in the case of local field reports. These are also rarely cited in international articles, with detriment to the development of the field.

During the discussion about the absolute chronology of both cited sites and the cultures, a number of difficulties were encountered. Two have already been addressed above. Another problem with the chronological range was the fact that not all articles contained accurate information on dating. In some cases the chronological span was marked only by associating the finds or phenomena with a single cultural horizon, especially when specialist topics were under consideration. Such an approach could be seen for example in the works of Brami with Heyd (2011) or Pavuk (2016). Although in these articles there are informative and accurate discussions around different cultural spheres, the issue of dating issue is basically omitted. On the other hand, particularly well prepared articles in the matter of chronology were written by Biagi with Shennan and Spataro (2005), Biagi with Spataro (2005) or Luca, Suciu and Dumitrescu-Chioar (2011a).

The cultures, discussed below, were finely described by the scientists. Both works focused on the cultural issues and interim reports from the field seasons have been used. For the Levantine areas especially significant works were written by local specialists. A great impact on the better understanding of multiple processes and changes was made by Bar-Yosef (eg. 1998; Bar-Yosef, Valla 1990; Bar-Yosef, Belfer-Cohen 2010). Further development in the discussed branch of knowledge was also made by Belfer-Cohen, with her works on the Natufian culture (eg. 1988; Belfer-Cohen, Goring-Morris 2011). Moreover, the contribution of Grosman to the same field cannot not be omitted (eg. Grosman, Ashkenazy, Belfer-Cohen 2005; Grosman, Munro, Belfer-Cohen 2008; Grosman *et al.* 2016). It is important to take into consideration an article, written by Al-Nahar and Olszewski (2015), containing discussion on distinctive site functions. For the later period, addressed as PPNA, there are some informative articles by Nadel (eg. 2010; Nadel, Rosenberg 2013). Also worth underlining is a focused work, describing stains on a lithic tool from Gesher, Israel (Shaham, Grosman, Goren-Inbar 2010). A discussion around the usage of ochre accompanied by mastic might also be traced. Two field reports on the site of Khirbet Hammam should also be mentioned, as describing the final part of the period of interest – the PPNB (Peterson 2000; Peterson 2007).

The cultures of Anatolia have been discussed particularly in terms of transition from those terrains towards Europe. Some seminal articles focus on this issue, written for example by Nikolov (1993), Yakar (1998), Lichter (2002) Rosenstock (2005) and Karul (Karul, Bertram 2005; Karul 2011). When it comes to studies dedicated to the cultural development of Anatolia, there are also important works. On the list could be articles written by Thissen (2002), Astouti with Fairbairn (2002), Yakar (2005a) and Özdogan (2016). Further, based on the good state of preservation of archaeological layers in the cave of Ökuzini, a summary has been written, discussing both the history of settlement in that area and the usage of surrounding plant supplies (Berke 1992). Also especially useful were articles on fieldwork with short conclusions, such as about the sites of Hallan Çemi Tepesi (Rosenberg, Davis 1992), Musular (Özbaşaran 2000) or Körtik Tepe (Erdal 2015). In the last case, the description of the site constituted a ground for further discussion about the post-mortem treatments, applied to the bodies (Erdal 2015). However, the information about Çatalhüyük in the first book on the findings (Mellaart 1967) are outdated and not comprehensive.

The Balkan cultures, as was mentioned above, were often juxtaposed with Anatolian developments. Yet there are good works on the Balkan entities as well, to mention only a few, for instance by Manson (1995), Bailey (2000) and Pavuk (1993; 2016). The work of Bailey (2000) should be underlined, as containing developed information about the contexts of ochre discoveries, along with an overview of the sites from different timespans.

A comprehensive book, concerning the development of Mesolithic in the Iron Gates area, was written by Radovanović (1996). Her work discussed the difficulties that could be encountered when talking about that period in the Balkans. Not only was a definition of the Mesolithic proposed, but the internal characteristics of the particular societies were also reconstructed. The catalogue of the discussed sites, attached as an appendix, was of considerable use. The usage of ochre was described as well, making the book one of the most important for both the description of cultures and the contexts of ochre.

The Early Neolithic of Romania was well described in an article written by Luca, Suciu and Dumitrescu-Chioar (2011b). One of the most important articles for the cultural development of the Balkans is that of Todorova (1995), where both the chronology and interconnections between the cultural entities are discussed.

As the cultural situation of the region could be perceived as complex, studies on chosen types of artifacts were needed. An article written by Mester and Rácz (2010) on the connection between the spread of the Körös culture and the possibility for newcomers to obtain raw materials proved especially useful. Work on the jewellery of the Starčevo culture should be mentioned (Vitezović 2012). It seems also that animal symbolism within that culture played a major role, as was briefly portrayed in an article written by Vitezović (2015). While discussing the Starčevo-Çriş entity, the topic of altars cannot be omitted. That issue was accurately described by Maxim (2000). The description of typical pottery from that region completes a cultural overview (eg.: Dzhanfezova, Doherty, Elenski 2014).

For discussion of the cultural situation in the Carpathian Basin not only targeted works but also comparative studies were taken into account (eg. Bánffy 2006; Kozlowski *et al.* 2014). There are highly informative field reports by Faragó, Tutkovics and Kalli (2015) and Kalli with Tutkovics (2017) about the site of Bükkábrány, Hungary. Both these works should be mentioned, due to differences in accessibility based on the language: the first was written in Hungarian, the other in English. The site itself was inside a working mine, meaning that the salvage works had to proceed at a rapid pace. Another archaeological site, Hejöpapi-Szenttelep, Hungary, important in the light of discussion on ochre, was well described in the article written by Domboróczki and scientific team (2017). More general remarks, in connection with the palaeoenvironment, were drawn in a short work by Sümegi and scientific team (2013). A significant explanatory work on the Mesolithic cultures and their transition was produced by Kertész (2002).

Also important for the understanding of social dynamics of the Carpathian Basin are more focused studies. One such was aimed at the description of clay figurines, found numerously at some Hungarian archaeological sites (Csengeri 2013). Another article worth mentioning was that written by Whittle (2004) in which mostly natural outcrops of raw materials are described, vital to the development of the Körös culture. The question of the ways of exchange between human groups was left for further discussion.

When it comes to discussion of ochre, there are noticeably less works than on cultural issues. In many cases, the ochre is only mentioned in the articles, without additional description of the context of the find or its macroscopical characteristics. A book by Ahlrichs (2015), however, was seminal in this regard. It concerned mostly European Palaeolithic samples, with an informative introduction to the basic definition of the ochre itself. Furthermore, the references included in that work could be considered as vital for the development of ochre studies.

Another useful work was an article about the archaeological site es-Skhul, located in Israel (d'Errico *et al.* 2010). It should be valued both for its description of archaeologically discovered ochre pieces, as well as for chemical analyses, conducted by means of TEM/EDX. Conclusions considered the need for a database of ochre samples, required for further research.

For the three Epipalaeolithic archaeological sites significant works are available: Pınarbaşı in Anatolia (Baird *et al.* 2013), `Uyun al-Hammam (Maher *et al.* 2011; Diaz *et al.* 2012) and Wadi Hammeh 27 in Jordan (Edwards 2013). The reports were all prepared thoroughly, with accurate description of archaeological finds, including ochre pieces. The contexts of discovery were specified, with short conclusions on the meanings of artifacts. Additionally in the article of Baird and team (2013) distances were included from the sites to the closest-lying known natural outcrops of non-local raw materials.

Another well-written book details the archaeological finds from Shanidar, Iraq (Solecki, Solecki, Agelarakis 2004). The book is informative, although more attention was dedicated to anthropological studies of the skeletons uncovered at the cemetery. Discussion of numerous examples of other sites that seem to share common features with the Shanidar finds is also of key importance, allowing the unification of the cultural landscape of the Levant.

For the disputes on the transition between the Epipalaeolithic and the Neolithic in the Levantine area an important site is Abu Hureyra, located in northern Syria. The site unfortunately cannot be re-excavated due to the construction of the Tabaqa dam and the inundation of a vast area with the waters of a newly-created lake. Yet, the material collected from that location is vital for further analyses (Düring 2003; Connelly 2012; Erdem 2006; Molleson *et al.* 1992; Molleson, Rosas 2012). Also, in articles concerning that site, an important problem, encountered during the ochre studies can be traced. For the red pigment, found in two excavated graves, the term 'ochre' was used. After chemical analysis it appeared, however, that the main minerals forming the sample should be identified as cinnabar (Molleson *et al*. 1992).

A similar problem occurs in works concerning Çatalhöyük in south-central Turkey. In the first book dedicated to that site, the terms ochre and cinnabar are both used (Mellaart 1967), suggesting a massive problem with the description of that material. Yet, in 2004 accurate chemical analyses were conducted. The samples were even contrasted with outcomes for the pieces from Clearwell caves in Great Britain (Mortimore *et al*. 2004). The introduction of such parallels was interesting, yet did not bring further contribution into the discussed field.

The discussion on the ochre from Jericho was also complicated. It appeared mostly only as traces on artifacts, and was not under examination separately. Such residues of paints were traced for example on the elaborate modelled human skulls (Fletcher *et al.* 2008; Goren *et al.* 2001; Strouhal 1973). Yet, the articles on that topic were mostly focused on anthropological issues, concerning sex or age at death of the crania (eg.: Fletcher *et al*. 2008; Strouhal 1973). Other finds from the site, are covered in separate studies, especially on the tool assemblage and architecture (eg. Twiss 2001).

The issue of ochre, as utilised by societies in the Balkans was undertaken by a rather narrow group of scientists. Among those, there should be mentioned the well-written papers of Bailey (2000), Bonsall and scientific team (2016), Radovanović (1996), Boroneanţ (2013) and Živaljević (2012). In addition, an article by Gãtã and Mateescu (1999-2001) appears difficult to evaluate. On the one hand, it is packed with seemingly useful data that, on the other hand, appears to be inaccurate or difficult to find elsewhere.

The Carpathian ochre discoveries were discussed thoroughly in a set of articles, written by Oross and Bánffy (2009), Kalicz and Koós (2014), and Bickle and Whittle (2016). Moreover, information on pigment usage, found in specific contexts and at certain archaeological sites has been described well by Oravecz (1998-1999) and Csengeri (2013).

In terms of discussion around the topic of ochre, Rifkin's articles (2011; 2015a; 2015b) and with scientific team (*et al.* 2015) should also be mentioned. Those comprised mostly in depth studies on the current use of ochre among indigenous peoples living in Africa. Thanks to such accurate ethnographic observations, comparisons can be made with the archaeological material, helping to prove some of the hypotheses.

Experimental archaeology should also form part of the discussion. Significant observations by Trąbska (*et al.* 2007; 2012) exposed differences in the application of yellow and red ochre. Another issue was the impact of high temperature on the ochre samples. The conclusions were all built on experiments that cast new light on that problem. Previous works in that direction were mostly based on the chemical properties of ochre (eg. Weinstein-Evron, Ilani 1994).

The works discussing geological or chemical composition of ochre and its possible outcrops are most compact ones. One of the most informative, by Cornell and Schwertmann (2003), proceeds systematically, with descriptions of every known iron compound. It also discusses the impact and effects of exposure of lumps of ochre to high temperatures. What is more, the discussion includes the division between natural and anthropogenic pigments in current use.

An article written by Popelka-Filcoff and scientific team (2007) discusses the topic of ochre, based on results obtained from samples from Missouri, USA. It evaluates the definition of that mineral, enlisting possible techniques of chemical analyses. Truly important was the statement, that ochre could be sourced, but deepened comparison of the content of trace elements would be necessary. The importance of applying multivariate statistics was also stated.

For discussion of the types of chemical analyses that could be applied to ochre samples, a set of focused articles was chosen. Under consideration were mostly non-destructive methods, with strong underlining of that characteristic, as for example in the article of Chavin, Menu and Vignaud (2003). Raman spectroscopy is covered well in the work of Froment., Tournié and Colomban (2008), while an article by Helwig (1998) is mostly dedicated to infrared spectroscopy. There were also trials to show the main differences between ochre and cinnabar compounds, which are often confused and used as interchangeable terms in archaeological works. One such article was written by Mioč and scientific team (2004), based on the outcomes from PIXE analyses.

Unfortunately, in most articles that present archaeological topics, the methods of analyses are only mentioned, without description of their advantages. That could be seen for instance in the works of Beck and team (2011) or Domingo, García-Borja and Roldán (2012). Another group of articles are based mostly on the publishing of test results, without their consideration, as in that of Gajić-Kvaščev and scientific team (2012). The work of Levato (2016), even though accurate in archaeological terms, cites the results of geochemical analyses without explaining the conditions of the tests. That information would be useful to assess both the accuracy of the data obtained and possibility of further comparisons with other samples. Although the distribution of outcomes is vital for science, constructive discussion is of much greater importance.

In conclusion on the general assembly of the bibliography, the topic of ochre, especially of its analyses, has not been widely undertaken by scientists. The data is scattered and in some cases also defective, as it was presented above.

**Review of the material sources**

In general, the accessibility of ochre samples for both description and further analyses appeared to be of various levels, depending on the excavation and heritage protection policy in the chosen countries. Moreover, some of areas, although within the sphere of the study, were excluded due to the unstable political situation and thus impossibility of borrowing ochre samples (eg. Syria: Cordesman 2018: 56-57; Khan, Khan 2017).

In the case of Israel, ochre samples discovered during archaeological excavations are kept in the scientific institutions, such as universities. Those specimens, as with all movable items derived from archaeological excavation, constitute the state property. The samples could be borrowed, after making an agreement with the excavation leader, as well as obtaining approval from the Director of the Department of Antiquities.[5] Thanks to such regulations, it was possible to borrow ochre samples from the sites Ein Gev II and Tel Tsaf for further examination. Moreover, there appeared a possibility to view also other, older samples, discovered at the sites of El Wad and Raqefet Cave.

Ochre pieces, as with all movable antiquities collected during excavations in Turkey, are usually kept in assigned scientific units and are state property. The supervisor of the excavations also possesses some rights, connected in the most part to publishing the results of the conducted works. Moreover, both archaeological and natural specimens can be brought abroad only under special conditions and after appropriate permits are granted.[6] Thus, ochre pieces deriving from archaeological and geological contexts cannot be taken freely, but must first undergo documentation and then await permits. They also must be returned to the country of their origin after the examination is completed. Under such circumstances and with all appropriate documents, there appeared a chance to borrow samples from the archaeological sites of Aşıklı Höyük and Musular, and geological specimens from the vicinity of Aksaray.

Next, some heritage elements in Bulgaria can be private as well as constituting state property. Nevertheless, all excavated items derived from legally-led works, should be transferred to the museums for storage. The export of cultural elements is possible, after obtaining the necessary license.[7] Ochre is also a subject of these regulations. Nevertheless, none of the archaeological specimens were borrowed, due to communication problems (eg. the Varna ochre) or the fact that some such samples were lost a long time ago (eg. Rakitovo artifacts, courtesy K. Băčvarov, pers. comm.).

Movable heritage from Romania is the subject of a separate legal document. It could be either private or state property, depending on the worth of the object and the circumstances of its discovery. Items kept in public scientific institutions can be borrowed based on the agreement. On the other hand, private property requires delivery-receipt protocols and permission from the owner. To bring such items abroad, they must be equipped with appropriate certificates.[8] Ochre would also fall within the scope of the discussed laws. Nevertheless, no archaeological samples were brought for further examination due to the fact, that: (1) they are kept in regional museums (courtesy G. Bodi, pers. comm.), from which borrowing was hindered, or (2) they were not kept after the archaeological excavations (courtesy A. Boroneanţ, pers. comm.).

In the case of artifacts discovered in Serbia, the situation is slightly complex. All such items belong to the state. However, the regulations for borrowing single specimens for further analyses are not directly specified.[9] Nevertheless, a chance appeared to borrow three samples from the site of Vlasac, based on an agreement with their keeper, professor S. Stefanović, together with a statement of the necessary rules for handling the specimens.

Artifacts discovered in Hungarian territory during archaeological excavations belong to the state. They can be exported, with various restrictions, depending on their general value. In most cases, the borrowed items need to be granted an appropriate license for export, unless of minor cultural value.[10] Ochre pieces fall into the latter category, and thus their export procedure is greatly simplified. Nevertheless, all such specimens

[5] http://www.antiquities.org.il/Article_eng.aspx?sec_id=42&subj_id=228&id=450, The Antiquities Law 1987, articles: 2, 22; access: 30.11.2021.

[6] https://en.unesco.org/sites/default/files/turkey_lawconservationculturalnaturalproperty_1_entof, Law on Conservation of Cultural and Natural Property no 2863, 1983, articles: 23, 24, 32, 43; access: 30.11.2021.

[7] https://en.unesco.org/sites/default/files/bulgaria_culturalheritageact_2009_entof.pdf, Cultural Heritage Act, 2009, articles: 53, 54, 97, 128, 158; access: 30.11.2021.

[8] https://en.unesco.org/sites/default/files/rom_law_182_engtof.pdf, Law no 182 of 25th of October 2000 regarding the protection of the movable national heritage, articles: 3, 5, 16, 24, 37, 45, 51; access: 30.11.2021.

[9] https://en.unesco.org/sites/default/files/serbia_law1994_engtof.pdf, Law on cultural property, 1994, articles: 12, 13, 15, 31, 63; access: 30.11.2021.

[10] https://en.unesco.org/sites/default/files/hu_actlxiv_01_updt16_entof; Act 64 of 2001 on the protection of cultural heritage; articles: 8, 54, 55, 56, 57; access: 30.11.2021.

must be returned to their original research unit upon the conclusion of their examination abroad. Thanks to the courtesy of Piroska Csengeri, Alexandra Anders and Andras Kalli, it was possible to borrow samples for geochemical analyses from the sites: Hejőpapi, Novajidrány-elkerűlő úf, Mezokővesd-Mocsdyas, Szentistuánbaksa-Anyagnyerő, Bükkábrány-Bánya VII, Polgár-Ferenci-hát and Polgár-Csőszhalom-dűlő.

Lastly, the movable heritage of Slovakia falls under the stipulations of two codifications: Act no 238/2014 on the protection of monuments and historic sites; and Act no 207/2009 on conditions for the export and importation of objects of cultural significance. The first indicates that artifacts, derived from archaeological excavations constitute state property and are usually administered by the Institute of Archaeology, appointed museum or Monuments Board.[11] The second act introduced the possibility of temporary or permanent export of archaeological items. In the case of a desire to take artifacts abroad, the appropriate export license must be obtained from the Ministry of Culture.[12] Thanks to such regulations, some artifacts with pigment stains, as well as ochre pieces, discovered at Moravany were kept in the Jagiellonian University. They were also the subject of further analyses, provided in this volume.

All geological samples were collected in the field, respecting the general laws concerning the landscape and protection of designated areas, such as national parks.

**Methodological framework**

For the thorough verification of the initial theses, a unified set of scientific methods was applied, both theoretical and practical in character.

Initially, a holistic approach to the topic of ochre was taken, together with its accurate definition. That point appeared to be necessary due to the lack of unambiguous assignment of ochre-specific features. On that basis it was possible to create a second level of the discussion, constituting of the general problematic of appearance of the material in archaeological contexts. Moreover, the topic would be discussed in the frames of specific chronological units. In that manner, the continuities and discontinuities of the cultural elements would be underlined, to later allow the deepened analysis of the possibilities of linked transition of ideas connected to ochre utilisation. In turn, thanks to the comparative and statistical approach, patterns would be noticed in the usage of ochre, together with continuities and changes in its application throughout the periods of the Epipalaeolithic/Mesolithic and Neolithic. Moreover, the observable ochre applications could be grouped according to their connotations with the sacred or profane spheres of the societies' lives – this would constitute the major axis of the debate. Although those applications might not always be easily distinguished among the proposed types (eg. Eliade 2008: 8; Gilman 2017: 95; Hodder 2011; Levato 2016; Popelka-Filcoff *et al.* 2007;), there would be the possibility to determine general trends and portray changes caused by contact between different cultural traditions.

The third level included the practical methods. Those were chosen based on a set of features such as accessibility (both ease of use and the cost of tests), comparability of outcomes and non-destructivity. In the next chapter, varied laboratory methods are discussed together with an outline of the reasons for choosing SEM, EDS, BSE and optical microscopy. For the analyses, different ochre samples from archaeological and geological layers were provided. The natural specimens were chosen based on their general potential to be acquired and later used by human groups as ochres – that means that they should be accessible at ground level and at a reasonable distance from the archaeological site. The samples selected were intended to be more or less representative, covering a vast range both in spatial and chronological terms. The results of the wide ranging examinations were later subject of both statistical juxtaposition, as well as comparative studies. That processual approach allowed for more complete accumulation and arraying of data. That later served in turn as a starting point for the formation of different theses and postulates, moving from the initial approach towards post-processual prospects (see eg. Marciniak 2012: 39-45). Certainly, the final conclusions will always stay in the sphere of hypotheses, yet thanks to the proposed set of methods, the results acquired would be highly plausible and comparable with the outcomes from other laboratories.

[11] https://en.unesco.org/sites/default/files/sv_actptccltmonuments14_entof; Act no 238/2014 on the protection of monuments and historic sites, article 40, point 6; access: 30.11.2021.
[12] https://en.unesco.org/sites/default/files/sk_act207_2009_entno.pdf; Act no 207/2009 on conditions for the export and importation of objects of cultural significance, articles: 2, 3; access 30.11.2021.