

Adorning the Dead

A Bio-Archaeological Analysis of Ochre Application to Gravettian Burials

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Introduction

A burial can be a simple or complex affair, include elaborate decorations and grave goods or contain only a skeleton. It may involve cremation, exposure, interment or a combination of these funerary measures. While different societies bury their dead in numerous unique and culturally specific manners, the very act of burial is incredibly human. Prehistoric burials provide both academics and the larger public an intimate connection with our early ancestors. The burials of the Upper Paleolithic in Europe, specifically during the Gravettian era, are examples of early ritual mortuary activity and have captivated archaeologists since the birth of the field. This period marks the first appearance of modern *Homo sapiens* in Europe and the European development of cave art, figurines, lithic technologies, and ritual behavior. Burial and mortuary activities have been used to understand cognition, symbol use, modernity and are central to debates attempting to decipher what makes humans human (Bar Yosef 2002).

Although our understanding of Upper Paleolithic culture is increasing, more research is still required to further unravel the lives of Europe's oldest modern human ancestors. As the dead are buried by the living, graves reflect the intentions, beliefs and activities of the larger community (Parker Pearson, 1999). As such, burials can provide in-depth information regarding the ritual behaviour of past cultures. The Gravettian, as previously mentioned, is a time period within the Upper Paleolithic dating between 28,000 and 21,000 years ago. The earliest evidence for elaborate ritual burial of modern humans in Europe can be dated to this time. The inclusion of numerous grave goods, and jewellery, as well as the presence of red ochre in the burial is characteristic of these burials.

The Gravettian culture, rather uniquely, extended across Europe. Archaeologically, clusters of sites have been found in modern day Italy and the Czech Republic. While the Gravettian was a pan-European culture, regional Gravettian variants are well established (Pettitt, 2011; Zilhao and Trinkaus 2002; Soffer 1985; Moreau 2010).

How burials, which are culturally defined rituals, correspond and engage with regional variation is unknown. This essay will examine the use of ochre in funerary contexts, specifically the location of ochre staining and the interpreted method of application, to identify regional trends in mortuary ritual behaviour. Where was the ochre applied on the body and what was the method of application? Do these behaviours display regional variation and to what extent does this variation correspond to established geographical sub-groups? If ochre application to burials displays regional variation, this will further support the presence of Gravettian cultural variants. Regional variation will be considered present if specific methods of application occur only or predominately in a geographic area. If multiple methods are used in a single region or a method is used across regions this would indicate cultural continuity and ochre use would not be related to Gravettian subgroups. The amount of regionalization will allow for discussion of community networks, knowledge transmission and communication within this time period. Additionally the examination of ochre application will allow for an enhanced reconstruction of ritual behaviour and the activities of Gravettian cultures.

Theoretical Orientation

The social theory paradigm approaches burials as a social practice, where the grave is formed from a combination of factors inherent to the individual and the society. As previously discussed and stated by Parker Pearson (1999; 3) “the dead don’t bury themselves”. This commonly used quote, explains in a simple and direct manner that while, features of a burial may represent the dead individual, what elements are displayed are chosen by the community. As such a burial can be utilized to infer information about the larger society rather than solely the individual who was buried. This paradigm provides the theoretical rationale that allows the analysis of mortuary activities to apply to the identification of larger cultural and regional trends.

In addition to the aforementioned approach, the archaeological assumption of Soffer (1985) will be incorporated. This supposition views the “archaeological record as material remains of past human behavior and therefore an entrée into past cultural systems” (Soffer, 1985; 15). This also makes the assumption that culture is at least partially uniform throughout time and space in a region. While this is problematic and needs to be acknowledged, it is also common across archaeological research and does not invalidate this study. Both Riel-Salvatore and Clark (2001) and Pettitt (2011) have examined features of Gravettian burials to understand variation in traditions, while utilizing this assumption. Riel-Salvatore and Clark examined cultural continuity between Middle and Upper Paleolithic cultures through the similarities and differences of burial position and grave goods, while Pettitt identified both regional and demographic trends in the Gravettian mortuary tradition, as will be further discussed below. This paper combines their

methodology, the interpretation of numerous burials and sites by archaeologists and the social theory paradigm to identify regional cultural traditions.

Literature Review

History of Ochre Use:

Ochre is one of the most commonly found pigments in archaeology (Mortimore et al. 2004) It is a type of stone coloured by the presence of iron oxides (Sajo et al. 2015). The colour can range from brown and yellow to a vibrant red or deep purple (Mortimore et al. 2004). Ochre has a long history of use by both modern humans and earlier hominins. The first evidence for scraped ochre was found at the Pinnacle Point site in South Africa (D'Errico 2008). It was dated using associated organic remains to approximately 164,000 years before present. The use of red ochre has been tied to the development of symbolic behaviour and the debate over the emergence of modern human behaviour within scholarly communities (Duarte 2014).

During the Gravettian, ochre was applied to burials and used as a pigment to create cave art. Due to these applications, it has historically been associated with symbolic use in the field of archaeology. While symbolic ochre use has been well documented ethnographically and is commonly used for ritual purposes or body decoration, it remains hypothetical, although likely, when discussed in Paleolithic contexts (Sajo et al. 2015). Ethnographic evidence has also demonstrated ochre used as medicines, dyes and preservatives (Ronchitelli et al. 2015). Indeed Duarte (2014) suggests that ochre may have

increased an individual's genetic fitness as the handling of ochre would result in the ingestion of iron and therefore provide health benefits.

Gravettian Burials and the Archaeology Record:

To understand the use of ochre within Gravettian graves, it is necessary to situate ochre in its larger mortuary context. Gravettian burials have been researched since the late nineteenth century (Formicola et al. 2004). Since then 45 separate burials have been identified consisting of a minimum of 78 individuals (Pettitt 2011). Burials including two or three individuals frequently appear in the archaeological record. These multiple burials have represented all possible combinations of the male-female and adult-child dichotomies. In addition to the double burials, two triple burials; Barma Grande in Italy and Dolni Vestonice in Moravia, have been found. Finally two instances of large group burials have been unearthed. The first at the Abri Pataud site in France contained the remains of a minimum of six individuals. The second at the unique site of Predimosti in the Czech Republic likely consisted of a social unit of 20 individuals (Svoboda 2008). Evidence from some of the double burials, such as Grotte des Enfants, suggests that a burial may be reopened to inter additional individuals after the primary interment. This differs from the Sunghir double burial that clearly demonstrates that the burials occurred concurrently, based on the location of the individuals and artifacts in the grave (Formicola 2007).

It is also necessary to acknowledge that the individuals included in the sample of known Gravettian burials are not representative of the larger population (Pettitt 2011). For currently unknown reasons, the burial record includes more adolescent and adult males. Children and women are underrepresented, although when they are identified, they

are more commonly found in communal graves (Pettitt 2011). However ochre was applied to the bodies of adult males and females and of children. This is valuable as it increases the sample size available for analysis and in doing so supports the selection of ochre as the method of analysis.

Of the known Gravettian burials, a minimum of thirty-one of them incorporate red ochre. Figure 1 shows the location of burials with definitive or possible ochre use present. There are an additional two sites in Russia, Sunghir and Kostenki, not included on the map due to their distance in order to increase the clarity of the other European sites.

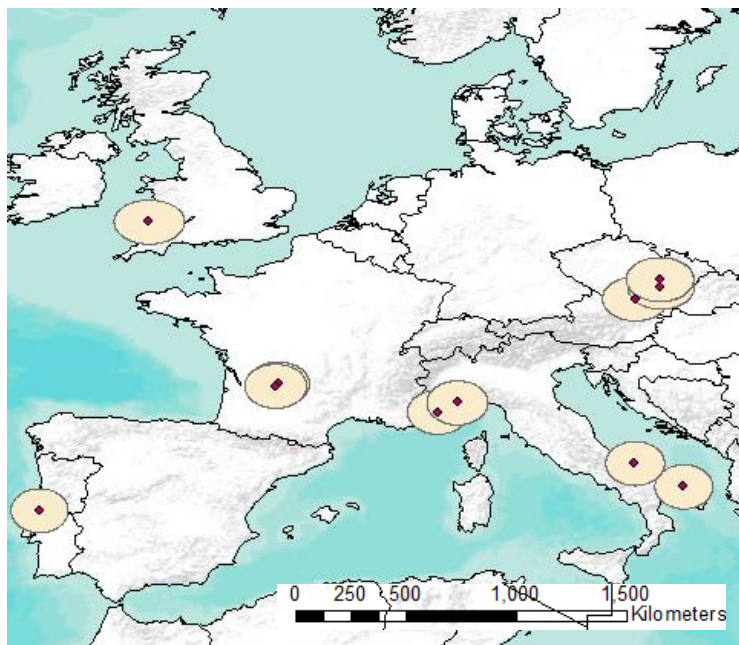


Fig. 1 Location of Gravettian burials with definite or possible ochre use

It is important to note that in these burials, red ochre was almost

exclusively used. The burial of Arena Candide also known as Il Principe, is the only burial known to utilize another shade. In addition to the red ochre lying underneath the skeleton, the Prince was found with yellow ochre applied to a wound in his jaw (Pettitt 2011). Thus as in other burials, red ochre was still present and the yellow ochre may have served a separate, non-mortuary purpose. While these consistencies are clear, the appearance of the ochre varies between the burials, which make it an appropriate characteristic to examine and identify regional variation.

Methods of Ochre Application

Recent excavation reports have analyzed the location of ochre within the grave and have interpreted the method of ochre application (Zilhao and Trinkaus, 2002; Simon et al. 2014; Ronchitelli et al. 2015) This analysis will continue the work of these researchers by applying the following interpretations to additional burials to determine the predominance of certain application techniques. It is also necessary to incorporate biological knowledge to arrive at a feasible interpretation. Bones with both anterior and posterior coverage would have been surrounded by ochre whether this was manually applied or transferred from a shroud. Furthermore if ochre were found inside bones or joints, this would indicate the ochre was applied to skeletonized remains, as ochre would not naturally stain these areas of the body. In this paper the method of application will be proposed for each burial. In instances where the method of application was not stated in the site notes or biological skeletal analysis, it was identified using established reasoning from comparable sites and researchers such as the following examples.

The method of ochre application on the Lagar Velho child, from the Lapedo Valley in Portugal, was interpreted using this knowledge of human biology and taphonomic processes. Ochre was found on both the

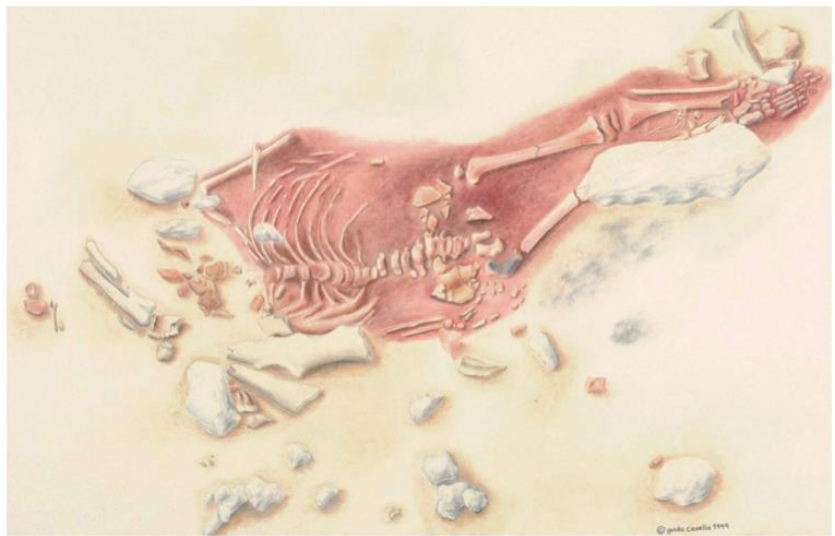


Fig. 2 Drawing of the Lagar Velho child from Zilhao and Trinkaus (2012)

anterior and posterior surfaces of the skeleton (Zilhao and Trinkaus, 2002). In addition, the limbs of the body were tightly spaced in relation to each other and to the body, as can be seen in figure 2. Finally the ochre was displayed a relatively even thickness across the skeleton. These factors allowed Zilhao and Trinkaus (2002) to suggest that the child was wrapped in an ochred dyed shroud. Similarly Simon et al. (2014) conclude that the Krems-Wachtberg 2 burial was buried in an ochre stained shroud. This interpretation is due to three main factors, the presence of a defined boundary of ochre staining quite close to the body, the red staining on all sides of the bones and a small ivory clip above the skull likely used to close the shroud.

The burial of Arena Candide, also known as Il Principe, was found in Italy and became famous for its rich assemblage of grave goods (Pettitt 2011). The burial included hundreds of beads, four pierced elk batons and a blade made from non-local material. The skeleton uniquely displays two methods of ochre application. The bottom of the Prince was dyed red. Due to the presence of the ochre on only the ground facing side, it was interpreted that the skeleton was placed on a dyed blanket or ground covering. In addition to the blanket, yellow ochre was directly applied to the wound on his jaw. This may indicate the inclusion of ochre application to specified locations or as previously mentioned the yellow ochre may have other possibly medicinal purposes.

It is important to note that the use of cloth has been identified during this time from both Pavlov I and Dolni Vestonice (Soffer 2000). Sections of plant fiber cloth were imprinted onto pieces of clay. These pottery fragments demonstrated that multiple types of weaving were used, that loom-woven cloth had been created and even evidence of stitches.

This indicates that sewing was practiced. Therefore both cloth shrouds and blankets were possibly in use.

The research completed at the Grotta Paglicci site in southern Italy, revealed an additional example of ochre application to specific locations on the body. The



Fig. 3a Photo of the ochre staining on PA III. Fig 3b Clear staining is evident on the cranium along the hairline. Photos from Ronchielli et al. (2015)

individual known as PA III has been identified as a female between the ages of 18-20 based on established bioarchaeological methods (Ronchitelli et al. 2015). She was found with ochre on her head, pelvis and feet. The application of ochre to her head ended rather sharply at approximately the hairline and was accompanied by a series of eight beads. Ronchitelli et al. (2015) believe this indicates the ochre was applied to her hair. Additionally as the eight beads were situated so the pierced roots were pointing toward her face, it was thought that they might have been attached to a headband of sorts that separated the ochred hair from her face.

Established Gravettian Regional Variation:

To hypothesize where regional variation might occur, it is necessary to understand what regional traditions are currently known. Additionally if regional variation is present in mortuary ochre use, an understanding of established zones will allow for comparison to identify whether specific trends correspond to certain regions. Literature discussing the Gravettian continually acknowledges the presence of regional variation (Pettitt, 2011; Zilhao and Trinkaus 2002; Soffer 1985; Moreau 2010). This variation presents as various factions of the larger Gravettian cultural complex. How this variation interacts with burial practices is still largely unknown. Pettitt (2011) did identify regional variation in burial location, with cave burials in the modern day Italy and open-air site burials common in the Moravia region of the Czech Republic. While this may be due to natural geographic features such as caves occurring more commonly in Italy, it still displays the different ways that the Gravettian people engaged with their environment.

The regional boundaries and subgroups are at times unclear. Over the history of Paleolithic research multiple terms have been coined and common words have developed unique meanings. . At times the terms are used to describe cultural variation in the form of time periods within the Gravettian (Svoboda et al. 1996) and occasionally terms such as Gravettian and Pavlovian may be used interchangeably (Soffer 2000; Pavlov & Indreliid 2000) This has led to various pieces of literature describing the same site as being associated with many different subgroups. This is perhaps most evident in the discussion of the Willendorf site. The site has been described as belonging to the general Gravettian (Tomaskova 2003), a unique Willendorfian tradition (Pettitt 2011) and belonging to the

Pavlovian cultural group (Svboda 1996; in Marriros and Bicho 2013). It is further complicated as the site consists of multiple stages of habitation which individually may be attributed to specific groups. While regional variation has been unclear, it is an important context for this analysis.

One method of identifying cultural subgroups is through the analysis of lithic technologies. This technique is used because stone tools tend to survive in the archaeological record but also because ethnoarchaeological evidence shows that hunter-gatherer groups have used different kinds of points to distinguish communities within larger regions (Marreiros and Bicho 2013). This approach was been applied to the Gravettian in multiple regions including the Swabian Jura region of Germany (Moreau 2010) and the Southern Iberian Peninsula (Marreiros and Bicho 2013). Moreau found “strong cultural affinities between the Upper and Middle Danube”, to the degree to suggest that the Willendorf site cannot be labeled as Early Pavlovian but rather as a general Gravettian site (2013; 90). However he did see distinct variation in the assemblages present at other Pavlovian sites and the Russian site of Kostenki. Unfortunately no burials have been identified in the Swabian Jura region. However this study reaffirms the presence of regional subgroups of the Gravettian as well as the use of archeological evidence to identify them.

Burials are present in the Pavlovian and Kostenki regions of the Gravettian. The Kostenki–Sunghir cultural area is located in Russia and, as the name suggests, encompasses the regions around the Kostenki and Sunghir archaeological sites. Sunghir lithic typology

includes tools such as triangular biface points, pointed knives and elongated scrapers (Pavlov and Indrelid, 2000). The Pavlovian is perhaps the most well established Gravettian sub-culture and is located in the Moravia region of the Czech Republic and southern Austria. These settlements occurred in broad river valleys and they had a reliance on imported material and high concentrations of mammoth bones. (Olivia 2000). Furthermore Pavlovian sites tend to lack Kostenki knives and a specific form of stone tool called a microdenticulate.

In addition to the variation in lithic technology, the Pavlovian and the Kostenki groups relied more heavily on large game such as mammoths for their subsistence (Olivia, 2000). This varied from the smaller game commonly hunted in southern Europe. Interestingly however the tools used were relatively similar, with small identifiable variations, regardless of the quite drastic environmental differences between the Mediterranean and Northern Europe. This reinforces the belief that these subgroups were indeed variations of the Gravettian, rather than completely separate cultures.

As established by this literature, differences should correspond to these known regions of variation. These include the Pavlovian culture in Moravian region of the Czech Republic and nearby Austria, the Kostenki culture in Russia and the Gravettian complex in Italy. However the archaeological sites are clustered together. Variation should be visible in these inherently regional zones.

Material and Methodology

Burial Database

For my analysis I created a database of 28 Gravettian burials with evidence of ochre application from across Europe that date to between 30,000ya and 20,000ya. The date range has been enlarged from the traditional time range of the Gravettian to allow for variation in calibration methods. When Carbon-14 dates are used they have to be altered to reflect changes in the environment. The methods for this calibration have changed over time. The larger range ensures that older and younger papers with different calibration techniques are incorporated. These burials are from Spain, Austria, Portugal, Russia, Italy, France and the Czech Republic. In addition to the location and type of ochre application, information regarding the context of the grave, presence of grave goods and biological and pathological characteristics was collected.

While it would be valuable to extend this study in the future to include all known Gravettian burials, individuals without the definitive presence of ochre were not included in this analysis. This was done to ensure that the burials examined were intentional ritual mortuary interments. As previously mentioned, burial in the Gravettian period was selective. This means that some human remains that are found are not purposeful interments. These individuals may be the result of other taphonomic processes and were not intentionally buried. To ensure that the appearance of the burial was created by and represents the actions of a cultural subgroup, the burials without the clear presence of ochre were excluded. Burials with possible ochre use such as the Cro-Magnon burials and the Cussac graves in France were also excluded for this reason. Additionally had there been ochre use, the context is disturbed and a clear interpretation of the ochre could not be

made.

The data was gathered from a variety of academic sources. The data sets from pre-existing comparative analyses of Gravettian burials (Pettitt, 2011; Riel-Salvatore and Clark, 2001) were fundamental for the creation of the database for this paper. Bioarchaeological analysis, including the assessment of the Lagar Velho child by Zilhão, J. and Trinkaus (2002), and site publications such as the work of Trinkaus and Svoboda (2006) at Dolni Vestonice and Pavlov, were also used. Where possible to ensure that the data is accurate as well as extensive, multiple sources were used for each individual. Additionally the language and detail of the ochre description varied between sources. The data that I am using is subject to translation error and as demonstrated by Tomaskova (2003), differing methods of categorization. There is degree of subjectivity to terms like covered or imbedded and unfortunately, there are few instances where the explanations are more robust. For the majority of reports a general description of ochre presence, such as “body was covered”, was utilized. However if additional detail was included in the site reports, this language was reflected in the database.

Most importantly a significant amount of the data is from historical excavations. While this does not necessarily mean that the data is flawed, the amount of documentation and analysis is minimal. Often these papers did not provide detailed excavation reports and therefore certain facts may be unclear or in some instances conflicting. This is compounded by the fact that many of the skeletons have either been lost or destroyed. While this is a problem shared by all research in this field and as discussed above does not inhibit the research, it does create difficulties.

For my analysis I utilized the methodologies of Pettitt (2011), Zilhao and Trinkaus (2002) and Riel-Salvatore and Clark (2001). These authors employed a burial dataset to determine trends within a Paleolithic context. Both then attempted to identify general trends within the Gravettian funerary tradition through identifying and observing evident trends. This is a well-established methodological approach within Paleolithic archaeology due to the often small sample available for analysis. Pettitt states that though there is minimal data available “sufficient data exist as to facilitate intuitive observations and generalizations [...] and this is not a weakness” (2011; 3)

GIS Analysis

In addition to the analysis of the database, a geographic information system (GIS) was used to determine special relationships between the various sites and methods of application. When available, site coordinates (latitude and longitude) were taken from the site reports. When these were not accessible, the GPS coordinates were found using Google maps. The locations of these sites were cross-referenced with maps included in published reports to ensure the GPS coordinates were accurate. The coordinates and the database were then imported into the GIS software, ArcGIS. An equidistant base map was used, ensuring that distance was maintained. Distance was determined to be the most important map feature to maintain as proximity was the variable that was examined.

The sites were imported as vector, or point, features into the program. The features were then expanded by the addition of a buffer. A buffer is a polygon that surrounds a feature that is utilized to increase the area for spatial analysis. Circular buffers with a radius of 100 kilometers (km) were created using the buffer wizard feature of ArcGis. A

buffer of 100 km was selected as it represented the immediate and local range of the populations responsible for the burials. While it is possible and likely that the hunter-gatherer groups travelled beyond a 100 km radius, the smaller value was used to provide conservative results.

Each method of application was given a numeric code. Utilizing the attribute selection tool, maps were created for each category of ochre application. In addition through the use of the join tool, maps were created to identify the locations where the method of application overlapped within 100 km. The join tool creates a new feature where the shapes of the selected features, that are included in the analysis, are combined to create a singular larger feature.

Results

Database Results

Table 1: Gravettian Burials with Ochre Present¹

Individual	Country	Date	Age	Sex	Location of Ochre	Ochred Objects	Interpreted Method of Application
Krems-Wachtberg 1-a	Austria	Unknown	Perinatal		Skeleton is covered		Shroud
Krems-Wachtberg 1-b	Austria	Unknown	Perinatal		Skeleton is covered		Shroud
Krems-Wachtberg 2	Austria	Unknown	Infant; 0-3 months		Skeleton is covered		Shroud
DV 3	Czech Republic	~30,000-26,000	Adult	F	Skeleton is covered		Shroud
DV 13	Czech Republic	26,640+/-110; 24,000+/-900; 24,970 +/-920	Adolescent	M	Head and upper torso		Specified locations
DV 14	Czech Republic	26,640+/-110; 24,000+/-900; 24,970 +/-920	Adolescent	Prob F	Head, pubic area, upper torso		Specified locations
DV 15	Czech Republic	26,640+/-110; 24,000+/-900; 24,970	Adolescent	M	Head and upper torso		Specified locations

¹ For additional references please see the citation list at the end of this document and the references cited in Pettitt (2011)

		+/-920					
DV 16	Czech Republic	25,570 +/- 280; 25,740 +/- 210; 26,390 +/- 270	Adult	M	Ground staining		Blanket or ground covering
Brno 2	Czech Republic	23,680 +/- 200	Adult	M	Stained skull, medial left clavicle, right humerus side unknown, lamellar surface of anterior right femur limbs and ribs	Animal bones	Shroud
Brno 3	Czech Republic	No date	Adult	F	Skeleton covered		Shroud
Balzo della Torre / Baouso da Torre 1	Italy	No date	Adult 25-30	M		Ochre cover, ochred split bear canine	Only ochred objects
Balzo della Torre / Baouso da Torre 2	Italy	No date	Adult 16-30	M		Ochred flint pebble	Only ochred objects
Grotta del Caviglione	Italy	No Date	Adult	M	Ground staining	~ 50 pierced Fish vertebrae and ~8,000 small shells under body	Blanket or ground covering
Barma Grande 2	Italy	~24,000-25,000	Adult	M	Ground staining		Blanket or ground covering
Barma Grande 3	Italy	~24,000-25,000	Adolescent1 2-13	Prob F	Ground staining		Blanket or ground

							covering
Barma Grande 4	Italy	~24,000-25,000	Adolescent 14-15	Prob M	Ground staining		Blanket or ground covering
Grotta dei Fanciulli 1/4	Italy	26,000 - 22,000	Young Adult, 17	M	Thick on skull		Specified locations
Grotta dei Fanciulli 2/5	Italy	26,000 - 22,000	Older Adult, ~40	F		Ochred bracelets	Only ochred objects
Arene Candide	Italy	23,440 +/- 190	Adolescent 14-15	M	Red ochre ground staining, yellow to wound on jaw		Blanket or ground covering & Specified Locations
Ostuni 1	Italy	24,410 +/- 320	~20	F	Ground Staining		Blanket or ground covering
PA 2	Italy	29,750-27,872	Adolescent 12 - 13	M	Abundant on skull, could have covered whole body,	Grave goods ochre soaked	Possibly Shroud or Specified Locations
PA 3	Italy	28,431-27,071	18 -20	F	Head, pelvis and feet		Specified locations
Lagar Velho 1	Portugal	25,000 -24,500	Child 4-5		Covered anteriorly and posteriorly		Shroud
Kostenki 14	Russia	>28,000	Adult	M	Skeleton is thickly covered		Shroud
Sungir 1	Russia	~23,000-27,000	Adult	M	Staining on surface of the burial	Skull place on ochre, on surface of the burial	Inclusion of additional ochred human remains
Sungir 2	Russia	~23,000-27,000	Adolescent		Skeleton covered	Ochred filled human	Shroud & Inclusion of

						femur associated	additional ochred human remains
Sunghir 3	Russia	~23,000-27,000	Adolescent 11-13	Prob M	Skeleton covered	Ochred filled human femur associated	Shroud & Inclusion of additional ochred human remains
Paviland 1	UK	28,870 +/- 180 - 29,490 +/- 210	Young Adult	M	Skeleton covered		Shroud

Using the established methods of evaluating the method of ochre application, five common categories were identified. These included the use of a shroud, the use of a blanket or other ground covering, the application of ochre to specified locations such as the head, pelvis or feet, the inclusion of only ochred objects and the inclusion of additional ochred human remains. The presence of ochred objects with shrouds, blankets, or specified locations was not included as a separate category as it is possible the ochre was transferred to the objects by the decomposition of the dyed material or other site formation processes. In these instances it would be difficult to establish whether the object was intentionally coloured or not. This is not the case when the only instance of ochre in a burial is on specific objects. For that reason if ochred objects were present but the grave displayed another method of application it was categorized under the direct method of application to the body.

Table 2: Prevalence of Ochre Application Methods

Interpretation of Ochre Application	Number of Burials	Burials with Multiple Traits	Total Burials	Percent
Shroud	10	3	13	42%
Blanket or ground covering	6	1	7	23%
Specified locations	5	1	6	19%
Only ochred objects	2	0	3	6%
Inclusion of additional ochred human remains	1	2	3	10%

As shown in Table 2, the most frequent method of ochre application was the use of a shroud; this was followed by the use of a blanket and then the presence of ochre in only specific locations. The presence of only ochred objects and the inclusion of additional human remains were the least common and occurred in only six and ten percent of the burials respectively. Certain individuals, such as Il Principe, were included in multiple categories due

to the nature of the ochre found at the site. For this reason the total number of burials used to calculate the percentage that each method was used, was higher than the 28 burials included in the database.

GIS Results

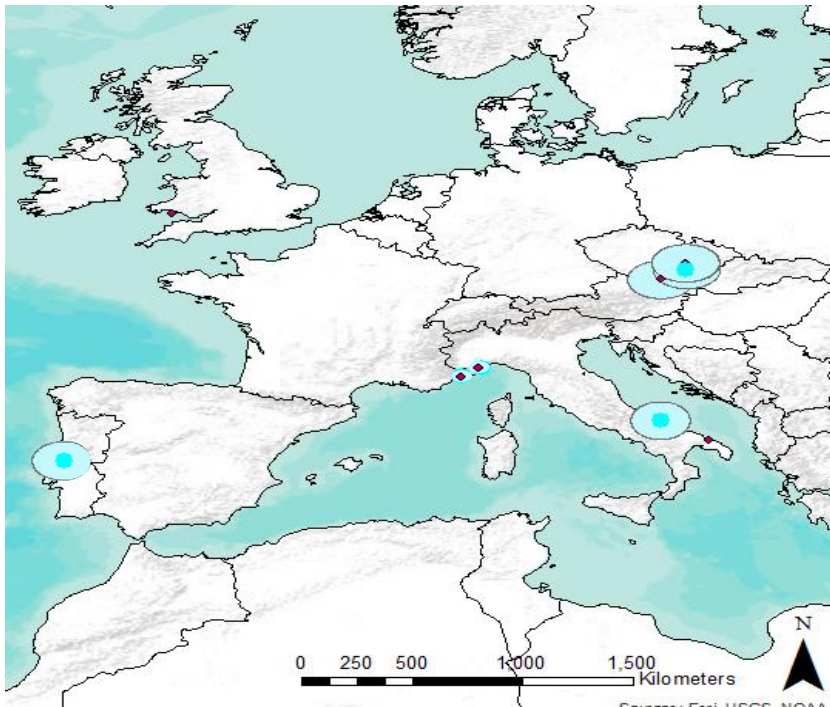


Fig. 4 Location of Gravettian burials with full ochre coverage indicating shroud use.

The results of the GIS analysis display the burial locations for each method of ochre application. Figure 4 displays the geographic spread of burials determined to utilize a shroud. This method was found in modern day Portugal, Italy, Austria, Russia (not pictured in the map) and the Czech Republic. Due to this

widespread nature, it does not fulfill the requirements discussed above to be considered a regional burial variant. In fact it is common in almost every geographic region in Europe and suggests a common practice among the Gravettian subgroups. This was similar for the other categories of ochre application with the exception of the inclusion of only ochred objects and additional human remains. These last groups only occurred in northern Italy and the Sunghir site in Russia respectively.

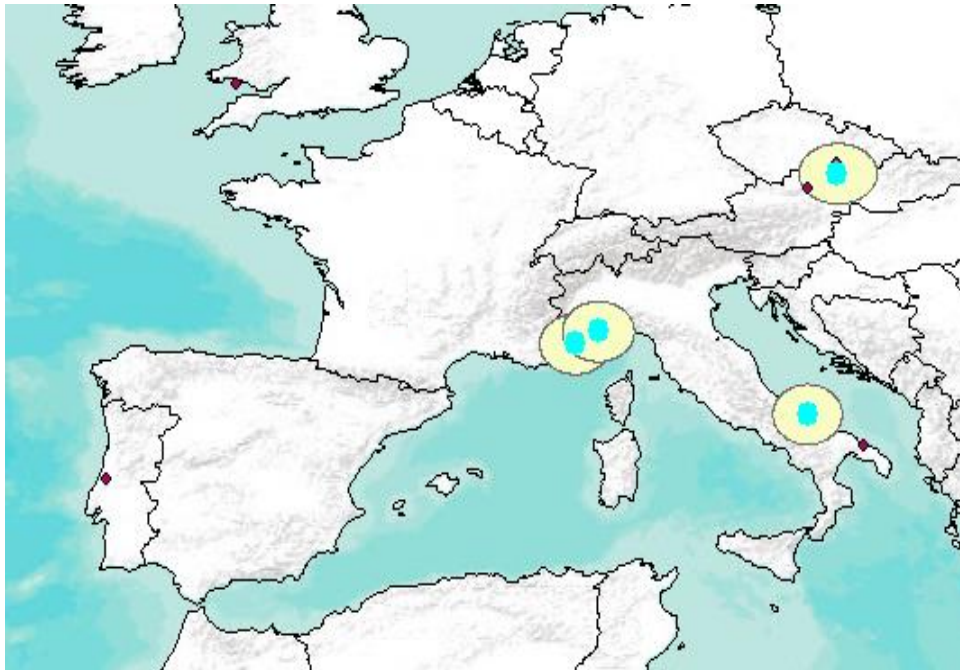


Fig. 5 Location of Gravettian burials with ochre in specified locations.

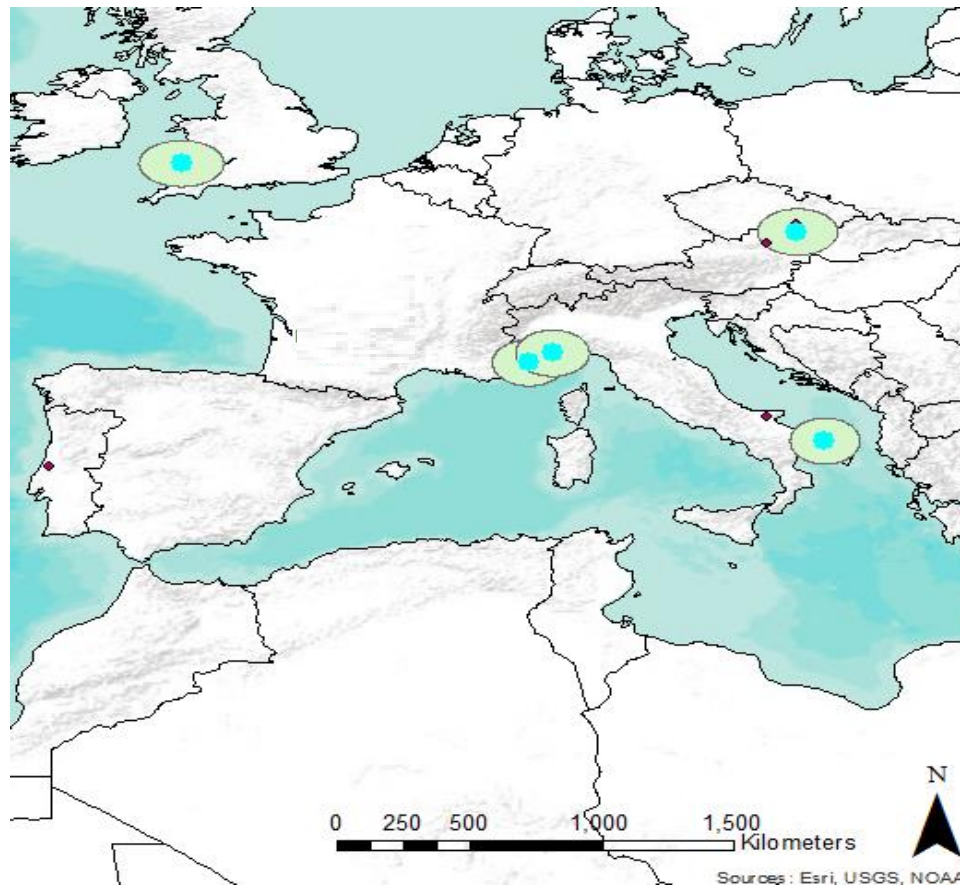


Fig. 6 Location of Gravettian burials with ochre underneath the skeleton indication a blanket or ground covering.

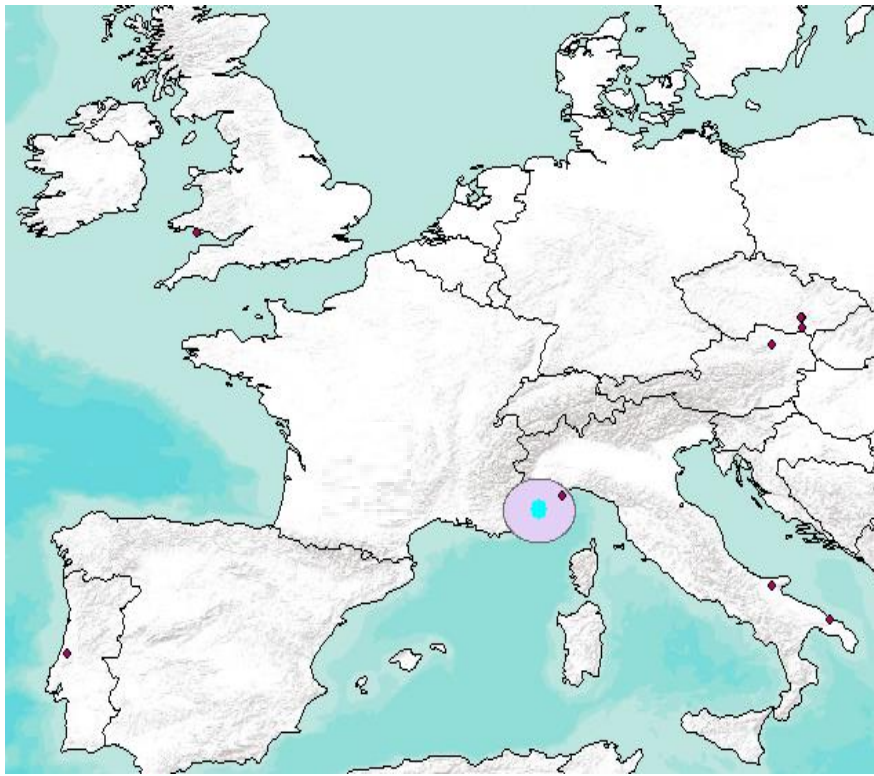


Fig. 7 Location of Gravettian burials with the inclusion of only ochred objects.

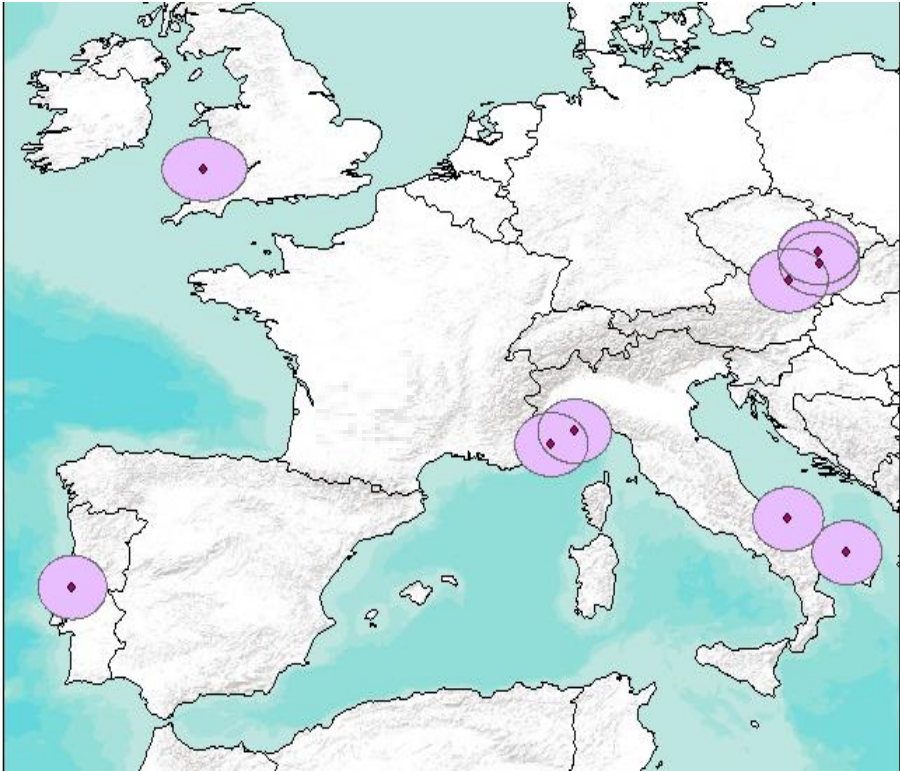


Fig. 8 Location of Gravettian burials that utilize either a shroud or blanket as the method of ochre application.

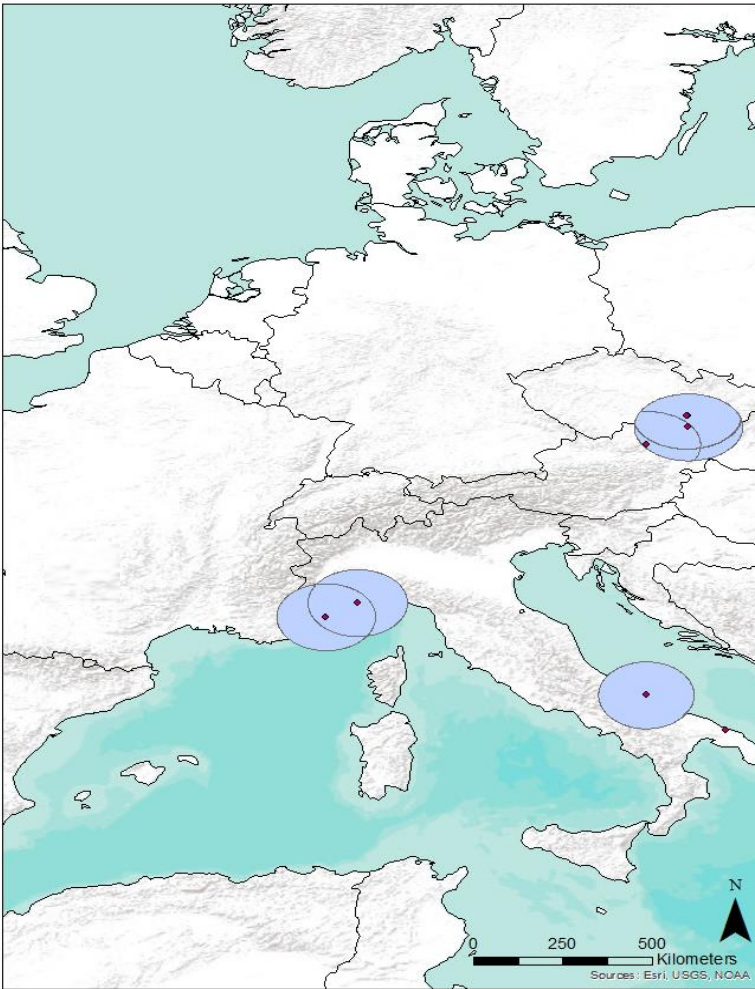


Fig. 9 Locations where multiple methods of ochre application intersect within 100kms.

in Portugal and the United Kingdom were excluded, as no additional sites were located within 100 km.

Discussion

From the analysis of the archaeological data, regional variation is not a determining factor in ochre application. This was confirmed by the GIS analysis. As displayed in Figure 9

Two additional methods of special analysis were completed. The first examined the dispersal of shroud and blanket sites and can be seen in Figure 8. The use of shrouds and blankets is found in every region of the Gravettian and at almost every individual site. The second analysis examined the intersection of different methods of application. For this analysis the sites

the use of multiple methods of application within 100 km was common. This can be clearly seen at the site of Dolni Vestonice, which included individuals with selectively applied ochre as well as shrouds. Had there been evidence for regional variation these complexes would likely present more uniformly. Furthermore the predominant context for ochre is either ground staining or complete coverage of the body. This was found in every region of Gravettian Europe and therefore represents a shared and pan-European approach to ochre application. While the lack of regional trends cannot guarantee widespread communication across Gravettian Europe, it would support it. If similar methods of burial, which the use of ochre indicates, were used throughout the larger European area, it is likely that ideas and beliefs were being shared between the regional groups. This is consistent with the evidence that suggests the Gravettian period corresponded with an increase in community aggregation, increased mobility and trade (Soffer 1985; Svoboda et al. 2013). Archaeological evidence at Moravian sites suggests that smaller hunter-gatherer groups would assemble at larger sites such as Dolni Vestonice. This would have promoted contact between groups within regional areas. In addition the presence of non-local artifacts, primarily raw material for making stone tools and decorative materials such as shells, indicates increased mobility across Europe.

However two methods of application did display some evidence that they may have been a unique local trend. The first of these is the inclusion of only ochred objects. The individuals, Balzo della Torre 2 and Grotta dei Faniculli 2 were buried with an ochre pebble and ochred bracelets respectively. This practice only occurs in northern Italy, however within this region many other methods of ochre application are used. This would suggest

that this practice might be a local custom in addition to the mortuary ochre procedures that occur throughout the European Gravettian.

The second local trend is the inclusion of ochre stained skeletonized human remains in addition to the main burials in the single site in Sungir, Russia. While this cannot necessarily be interpreted as regional as it does not appear at the nearby site of Kostenki, it does raise interesting questions about the meaning of this specific location. The Sungir site includes one single and one double burial, both of which include elaborate grave goods. The burials have been directly radiocarbon dated to between ~26 and 29 ka BP (Dobrovolskaya et al. 2012). In addition both are associated with additional ochred human remains. The double burial includes a femur of an adult that has been filled with red ochre (Dobrovolskaya et al. 2012). As the bone had been filled with ochre, it is evident that the remains were skeletonized at the time of interment. The single burial was deliberately associated with the cranium of a female placed on an ochred region directly on top of the burial (Pettitt 2011). These additional remains are interpreted as ritual deposits within the graves.

The prevalence of shroud and blanket burials does raise questions regarding whether ochre was intentionally deposited or was a possible byproduct of the decomposition of coloured shrouds. An analysis of ochre use in Mesolithic burials discussed this issue and suggests that the addition of the ochre may have been due to the presence of dyed skins (Petersen et al. 2015). In agreement with Paleolithic researchers, they argue that the presence of ochre on all surfaces of the bone indicates the use of a wrap

or shroud. It is suggested that the inclusion of ochre indirectly occurred prior to the burial rather than as a post-mortem. Due the presence of burials that indicate direct application to specific areas of the body, such as the hairline of PA III it would appear that ochre was intentionally applied in certain instances. This suggests that the ochre was a deliberate addition however further research is required.

To fully comprehend the presence of ochre within a grave, it is necessary to consider the site formation processes that may have altered the location of ochre. Site formation processes are the cultural and natural processes that alter and form an archaeological site (Banning, 2000). Each individual burial will have been uniquely affected by variety of factors including mineral leaching, water damage, animal action or human involvement and understanding these processes is crucial to understanding the burials and the placement of ochre within them. Unfortunately there has not been significant research to allow for an accurate understanding of how this would affect the ochre location in a burial. In addition to the aforementioned process, scholarship is needed to identify how ochre would be deposited as dyed cloth and hides decompose. These studies would provide tested conclusions regarding the potential accident inclusion of ochre.

Conclusion

Gravettian burials provide insight into the lives and activities of Europe's oldest modern human ancestors. To ascertain whether mortuary activity was determined by cultural sub-groups of the Gravettian, GIS and data analysis was completed on ochre in graves. This study discovered that regional cultural traditions are not the deciding factor

for the variation in ochre application. It would appear that the method for ochre application is determined from other, as yet unknown, factors. The study also revealed that the use of dyed shrouds or blankets was predominant during this time. This raises questions regarding the deliberate inclusion of ochre in graves. In order to answer these questions, further research is required to better understand the site formation processes that affect ochre deposition. The inclusion of ochre only on objects was limited to northern Italy. Additionally the burials at Sunghir included supplementary skeletonized human remains, a method unique to that site. While their presence at one location in Russia and not at the nearby site of Kostenki, indicates that it was likely not a regional tradition it does propose new research avenues regarding the use and curation of human remains at this site. In conclusion, the lack of extreme regional variation supports the theory of an overarching pan-European Gravettian tradition and of long distance communication and social networks between peoples during this period.

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