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The Upper Palaeolithic rock art in the Tagus Valley Rock Art Complex (context, style and chronology)

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Dissertação de Mestrado

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RESUMO

Esta dissertação apresenta um quadro metodológico de estudo das gravuras rupestres do Vale do Ocreza, que pertence ao Complexo de Arte Rupestre do Tejo de Portugal. Actualmente é a única área em todo o complexo com representações paleolíticas de animais confirmadas. Tenta-se uma aproximação cronológica de um painel recentemente descoberto, ao mesmo tempo que se faz uma revisão de um outro painel com uma única figura, previamente encontrada na mesma área, a fim de averiguar possíveis relações entre os dois painéis. Como resultado da ausência de datações diretass, o método de datação que é usado inevitavelmente é o da comparação estilística. Foram procurados paralelos estilísticos nos principais locais com arte rupestre do Paleolítica Superior da Península Ibérica, com foco no seu setor ocidental. Em paralelo, é discutido o caso da sincronia entre as figuras. Dados preliminares apontam a favor de uma cronologia paleolítica (Gravetense-Solutreinse). Com exceção das questões de datação, outra questão parece ser a identificação da espécie. Relativamente ao novo painel, na ausência de características para a identificação das espécies, é realizada uma análise morfológica para informar sobre os possíveis animais representados. Finalmente, o contexto cultural dos grupos culturais associados ao Paleolítico Superior do ocidente da Península Ibérica e a utilização de rochas metamórficas para a criação de arte rupestre são brevemente examinados para compreender melhor o contexto geral e o comportamento dos artistas pré-históricos.

Palavras-chave: Arte rupestre, Gravuras, Paleolítico Superior, Rio Tejo.

ABSTRACT

The following dissertation presents a methodological framework of studying rock art engravings from the Ocreza Valley, which belongs to the Tagus Rock art Complex of Portugal. Currently it is the sole area in the whole complex with confirmed Palaeolithic animal representations. An attempt is made to chronologically frame a newly discovered panel, while there is also a review of a panel with a single figure previously found at the same area, in order to investigate possible relations among them. As a result of the absence of Palaeolithic dates the dating method that is used inevitably is that of stylistic comparison. Stylistic parallels were searched in major sites with upper palaeolithic rock art from the Iberia, with a focus in the Western part of the peninsula. Additionally, the case of synchroneity between the figures is discussed. Preliminary indications argued in favour of a palaeolithic chronology (Gravettian-Solutrean). Except the chronological questions, another issue appears to be the identification of the species. Regarding the new panel, in absence of characteristic features for the species identification, a morphological analysis is conducted to inform about the possible represented animals. Finally, the prehistory of cultural groups associated with Upper Palaeolithic Western Iberia and the use of metamorphic rocks for the creation of rock art are briefly examined to understand further the general context and the behaviour of the prehistoric artists.

Keywords: Rock art, Engravings, Upper Palaeolithic, River Tagus.

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1. Introduction

1.1. Problem, objectives, and structure of the dissertation

In 2021, a new panel with engravings (OCR20) was unearthed during the excavation fieldwork in the Ocreza Valley, Portugal. This panel belongs to an open-air area rich in rock art, the Tagus Valley Rock Art Complex, whose proposed stylistically dates cover an extend period of time from the Upper Palaeolithic to the Bronze Age (Garcês, 2017). During the campaign were recognized at least three zoomorphic figures together with other pecking marks. Their settings, canvas and complexity equal those of the Côa Valley.

Nevertheless, open air rock art is largely exposed to various natural and anthropic weathering conditions, that make its preservation through documentation an urgent need after its discovery (for more Darvill and Fernandes, 2014). Major problems for this panel are, so far, 1) the absence of associated archaeological artefacts on the stratigraphic layers, 2) a historical radiocarbon date from a hearth found in stratigraphy, 3) the impossibility of applying OSL dating methods and 4) the vague picture of the engravings, resulting of weathering processes, the natural texture of the metamorphic support and artistic choices applied. All these conditions created a demand for further study as none could be treated before the proper documentation of the rock art. Therefore, this dissertation is the first approach this panel and its related problems. The first step after the excavation was the rock art documentation by means of high-resolution photography, tracing of the engravings and the discrimination of the graphic units, by morphological analyses.

The primary objective of the dissertation is the chronological attribution of the figures. In absence of associated radiometric dates and of diagnostic archaeological artefacts securely associated to the engravings, the use of stylistic comparisons is the only available tool at this point to access chronology. For this, parallels were searched in Western Iberia. Due to the diagnosis from S. Garcês, H. Collado Giraldo, and G. Nash that the figures were made during Pleistocene, was decided that this study would incorporate a review of the Ocreza's Horse panel. The Ocreza Horse is a small panel with a partial individual figure located just a few meters from the new panel, and the only Palaeolithic rock art find from the Tagus Valley Rock Art Complex until the find of the new panel (Baptista, 2009; Garcês, 2017). The review was directly linked with the dating question, asking as well for the possible synchroneity of the figures.

The secondary objective is to investigate the setting of the panel so as to understand the use of schist outcrops for artistic purposes and contextualize the regional cultural practises. The exploitation of schist surfaces for rock art has been repeatedly reported in the geological setting of Western Iberia (Baptista, 2009; 2012; Jordá Pardo, 2012; Garate Maidagan et al., 2016; Balbín Behrmann and Alcolea González, 2021; Reis, 2021; Vázquez Marcos, 2021). The reasons behind this tendency will be examined as well taking into consideration the importance of various previously suggested factors, the geological nature of the rocks (morphology, disposition, schistosity, and granularity), preservation reasons (natural and anthropogenic "weathering") and anthropic artistic intervention (selection and creativity) (Garate Maidagan et al., 2016; Fernandes et al., 2017; Balbín Behrmann and Alcolea González, 2021).

This dissertation is divided in the following chapters: Introduction, State-of-the-art, Methods and Materials, Results, Discussion and Conclusion. The first chapter of the Introduction is consisted of three subchapters. The first one presents the Problem, objectives, and structure of the dissertation. The second provides information about the geographic and geomorphological setting of Ocreza. The third informs about the climatic conditions during the Upper Palaeolithic.

The State-of-the-art provides a brief introduction to the Iberian Upper Palaeolithic and its Western sector, information about the Upper Palaeolithic rock art and the Iberian Peninsula, the Tagus Valley Rock Art Complex and the history of the research in the Ocreza Valley.

The third chapter, Methods and Materials, provides information about the methodology that was followed and briefly presents two Upper Palaeolithic panels. The methodology subchapters are divided in Excavation method and Documentation methods. The latter is further subdivided in two categories, the ones used in the field and the ones used in the lab. More particularly are presented the documentation methods of field sheet, digital photography, photogrammetry, direct and indirect tracing. In Materials is presented the context of the site regarding its discovery during the excavation time and the features of the new panel and of the Ocreza Horse panel.

The fourth chapter contains the results of the field and laboratory work. Field results include the retrieved excavation data, and the night photography. The laboratory results concern the analysis of the new panel and figures through the digital photographs, the 3D model and the direct and indirect tracings, with an interpretation of the number and the type of graphic units depicted and the engraving techniques applied for their creation. After the description of the

figures follow some initial results derived from the literature research and the fieldtrip visits for both panels examined.

The fifth chapter discusses the results. First is given an interpretation of the panel and are presented hypotheses for 1) the technical details related to the chaîne opératoire of the panels' creation, 2) the problems brought by superimpositions, 3) the representational aspects of graphic units that are difficult to be distinguished and 4) the possible taxa of the unidentified zoomorphic figures from OCR20. After that, based on the stylistic conventions, it is examined the possible chronological frame and the cultural relation of the figures with others known from Iberia in the wider context of the Western Iberian Upper Palaeolithic artistic tradition. This part investigates possible connections with other clusters of rock art in the Iberian Peninsula, the regular use of schist outcrops as supports for symbolic purposes and a few considerations about the spatial context of the site.

Finally, the last chapter, Conclusions, pinpoints the Tagus in the scope of the Palaeolithic rock artists, establishing its potential when compared with other regions with similar settings, taking the results presented as a starting point for further research.

1.2. Geographic and Geomorphological setting of the Ocreza Valley

Western Iberia is distinguished by three different categories of geomorphological formations: the carbonate Mesozoic formations, the siliciclastic Cenozoic formations, and the metamorphic formations of the Hesperian Massif (Figure 1) (Oosterbeek et al., 2010) (see also Pereira and Benedetti, 2013). The site of Ocreza is located at the Hesperian Massif that presents narrow valleys, like Ocreza, that were shaped by the drainage system incisions at the Palaeozoic bedrock (Martins et al. 2010), but also by regional tectonics (Rosina and Cura, 2010). The geological bedrock of the site corresponds to a complex consisted of schist and greywacke, the so called Beiras group (Romão, 2006). More particularly, the geological unit of the area around the Fratel Dam is characterized by black graphite phyllites, that are occasionally interspersed with grey metagreywackes (Figure 2 and Appendix Figure 192) (Romão, 2006). As a result, the river has exposed numerous schist outcrops of these kind, with some of them used as rock art supports. Ocreza river is a tributary from the right bank of the Tagus. The river is a physical border between the regions of Ribatejo and Beira Baixa. The site administratively belongs to the parish of Envendos, Municipality of Mação, in the district of Santarém. The exact location also bears the name Vale Da Rovinhosa. The river extends 80 km from its source in Serra da Gardunha until it reaches the right margin of the Tagus. The rock art panels are located at the right margin of the river, at a meander on the final part of Ocreza, approximately 1200 meters

before the confluence with the longest river of Iberia. The exact coordinates of the two panels are 39°32.756'N | 07°49.570'W | 53 m a.s.l. for the Horse's panel (OCR15), and 39°32.763'N | 07°49.537'W | 58 m.a.s.l. for the new one (OCR20) (Figure 3, Figure 4). Following the numeric order of the latest corpus (Garcês, 2018) the Ocreza's Horse panel is numbered as panel 15, replacing the previous 21 given by Baptista (2001), while the new one received the number 20. The platform where panel OCR15 is situated has an abrupt edge next to the present rivers' course, following it for some meters on a parallel line (Figure 4, Figure 5). The new panel is vertical, and it is found in a higher position (c. 5m), in an inclined area, around 50 m heading to the northeast.

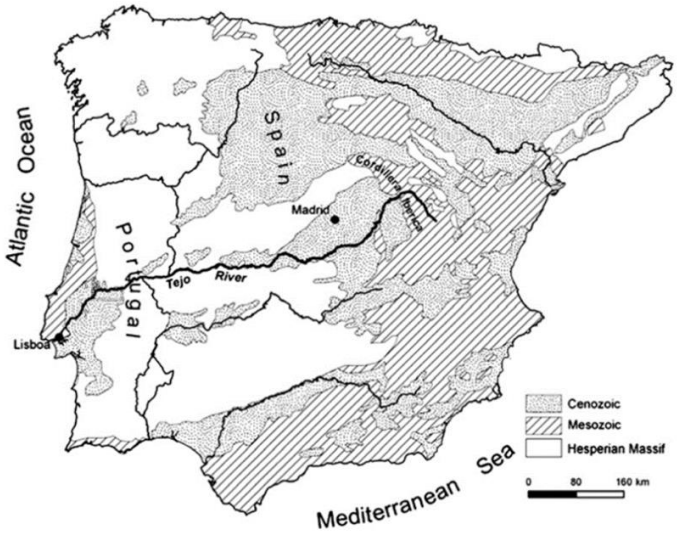

Figure 1: Geological map of Iberia. Ocreza is found on the Hesperian Massif, also known as Iberian/Old Massif, close to the junction with the Cenozoic and Mesozoic basins (Map: Oosterbeek et al., 2010).

Figure 2: Detail from Geological Map of Portugal, Folha 28-A – Mação by J. M. Romão and A. Esperancinha (2000). Explanatory text Romão J. (2006). White star the Ocreza site OQA: Formation of Armorican Quartzite: (***) quartzites, siltstones and conglomerates, (**) Member of Vale de Mua Member: quartzites and siltstones,

(*) Member of Casal Carvalhal: arkose conglomerates, Beiras Group: NCF: Unit of Fratel dam: black graphite phyllites, occasionally interspersed with grey metagreywackes, NCP: Unit of Padrão-Silveira: Coarse metagreywackes interspersed with striped phyllites and conglomerates.

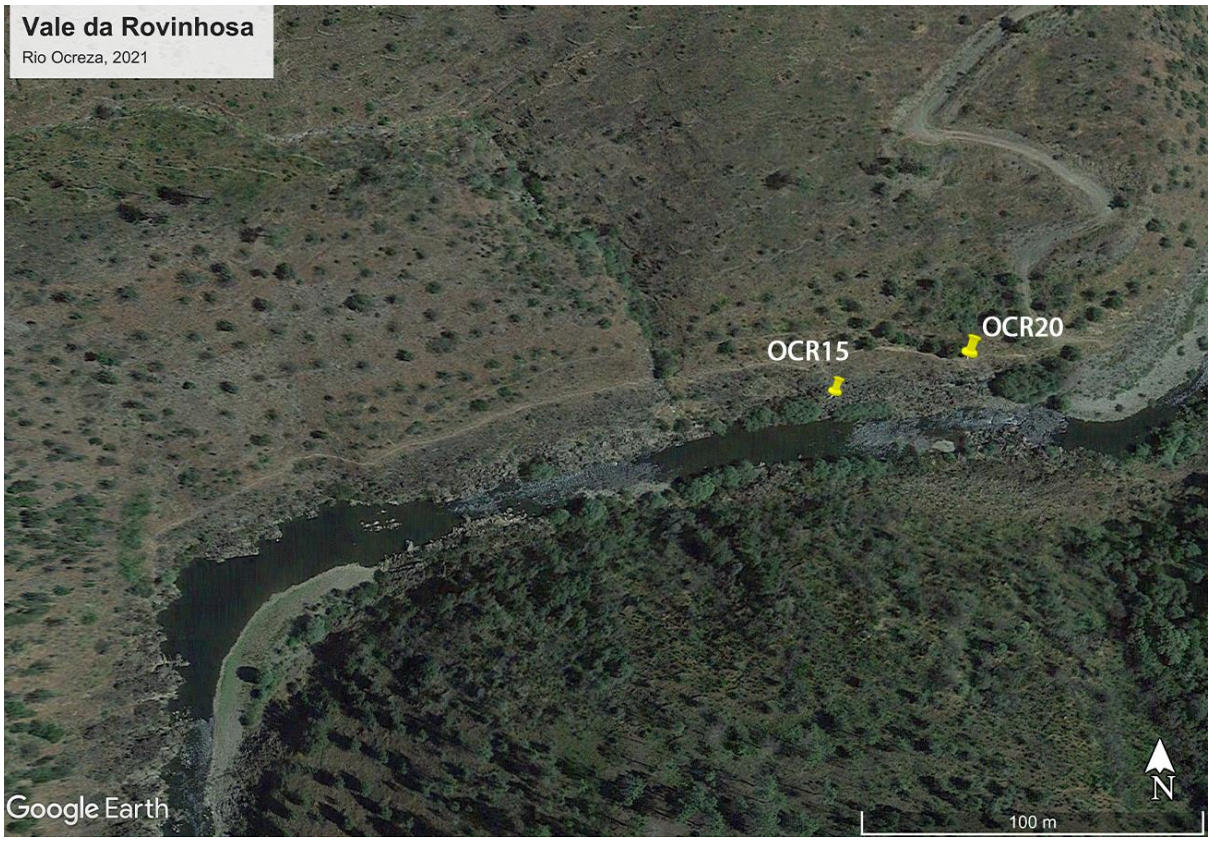

Figure 3: Aerial view of the two panels via Google Earth (Image: S. Garcês and D. Danelatos).

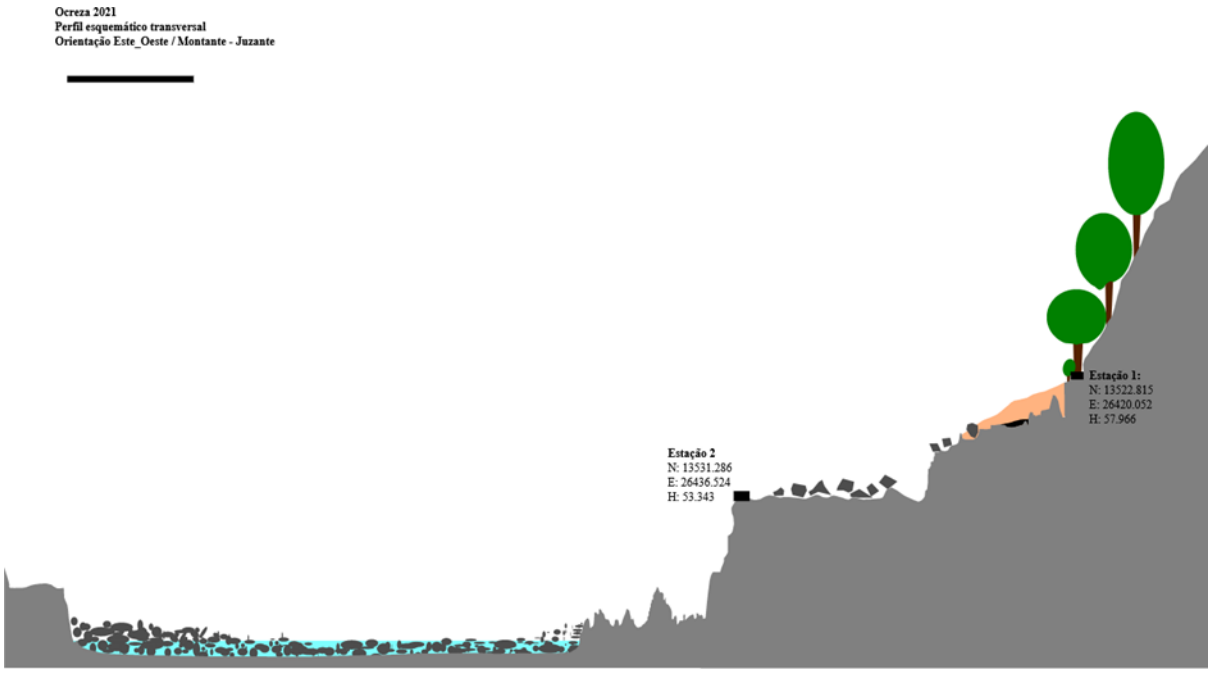

Figure 4: Transversal schematic profile of the Ocreza site. At the right margin the old panel is found in Estação 2, while the new in Estação 1(Digital sketch by T. Pereira).

Figure 5: Drone photo showing the exposed schist outcrops and its vertical formations (Photo: J. Diogo).

1.3. Global paleoclimate and Iberian paleoenvironment during the Upper Palaeolithic

It is beyond any doubt that climatic conditions and changes always affected life on Earth. For hominins in general and for Upper Palaeolithic hunter-gatherers, the significance of temperature fluctuations stands on the abundance or rarity of the biotic components like fauna and flora, but also the accessibility in important abiotic components, like water and lithic raw materials (Zilhão; 2014; Straus, 2018; Lillios, 2019; Pereira et al., 2022). Consequently, subsistence strategies were highly influenced. Crucial innovations and alterations in behaviours related to hunting, gathering, migrations and symbolism tend to reflect the capability of adaptation (González-Morales, 1997 *apud* Bicho et al., 2007; Vanhaeren and d' Errico, 2006; Audouze, F., 2007 *apud* Fuentes et al., 2019; Bicho et al., 2007; Haws, 2012; Bicho et al., 2017; Banks et al., 2019; Haws et al., 2021). To understand further Upper Palaeolithic societies and their representations, it is important to have a brief idea of their paleoclimate and paleoenvironment contexts.

The Pleistocene is distinguished by abrupt climatic changes and colder temperatures compared to the following Holocene (Roberts, 2014). The oscillations of colder and warmer periods were regular during the Pleistocene until the beginning of Holocene at 11,700 ka cal BP (Rasmussen et al. 2014). The warmer phases are called interglacials and the colder ones glacials. Intervals during the glacial periods are called either stadials, in the case that they were cold and interstadials when they were warm (Roberts, 2014). The stadial-interstadial cycles occurred in Greenland, North Atlantic and Europe at the same time, causing alterations in vegetation and the geomorphology with regional differences and timing (Banks et al., 2019). Climatic

fluctuations during Late Pleistocene occurred "at millennial and sub-millenial time scales" (Dansgaard et al., 1993). During the Last Glacial, two types of rapid climate episodes have been documented the warming Dansgaard-Oeschger (D-O) and the cooling Heinrich (HE) events. In Western Europe there are at least six important D-O events (Figure 6) and four HE (Figure 7) that affected the western Iberian Upper Palaeolithic (Figure 8). (Bicho et al., 2017) According to Mix et al. (2001) between the end of HE2 until the HE1 the Planet had the Last Glacial Maximum, a period with a relevant climatic stability associated with full glacial conditions (Bicho et al., 2017). Polar ice sheets reached their maximum extent, and the sea level met an extreme regression. Mix et al. (2001) and Naughton et al. (2009) suggest that during this period the dramatic HE and D-O events did not occur (Bicho et al., 2017).

Event	Event number[a]	Age/interval (ka cal BP)	Starting age for Greenland interstadials (ka cal BP)
D–O	0 (1)	11.6	11,520 (start of Holocene)
	1 (2)	14.6	14,690 (GI-1e)
	2 (8)	23.4	23,340 (GI-2.2)
	3 (11)	27.8	27,780 (GI-3)
	4 (12)	29.0	28,900 (GI-4)
	5 (14)	32.3	32,500 (GI-5.2)
	6 (15)	33.6	33,740 (GI-6)

Figure 6: Table created by Bicho et al. (2017) presenting the absolute dates of each D-O event according to Rahmstorf (2003) together with the Greenland Interstadial dates proposed by Rasmussen et al. (2014) during the Portuguese Upper Palaeolithic. The numbers in brackets correspond to the c. 1470 cycle number given by Rahmstorf (2003: Figure 1).

Event number	Interval (ka cal BP)
HE1	18.0–15.6
HE2	26.5–24.3
HE3	32.7–31.3

Figure 7: Table created by Bicho et al. (2017) presenting the absolute dates of three of the four HE that occurred during the Portuguese Upper Palaeolithic based on the study of Harrison and Sanchez Goñi (2010).

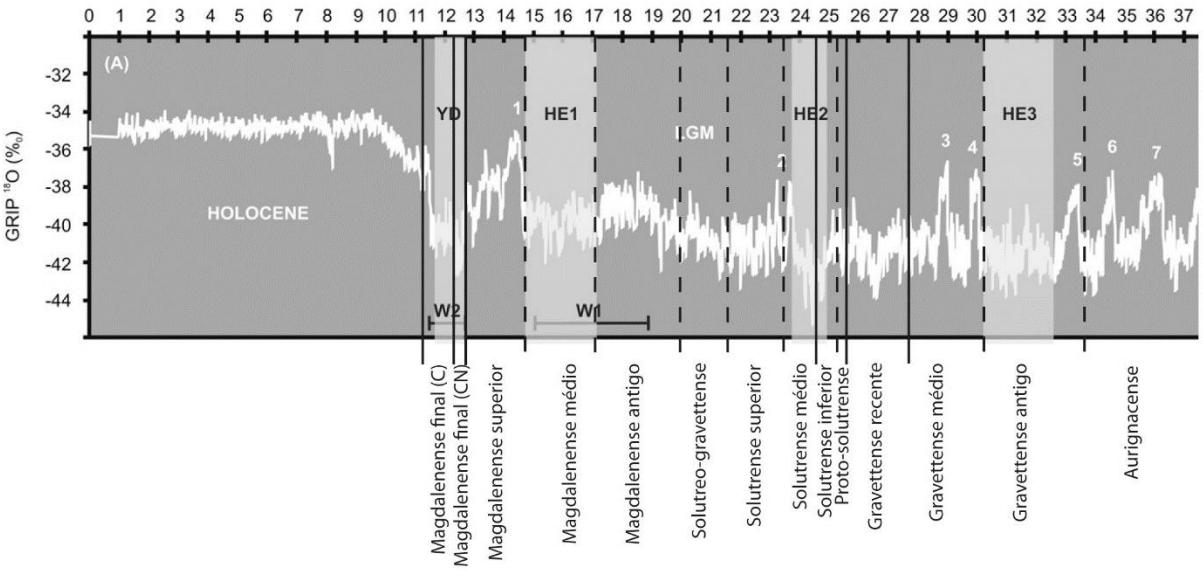

Figure 8: Climatic curve and the sequence of the Portuguese Palaeolithic based on Zilhão, 1997; 2013 and Aubry et al., 2010 (Image: Santos, 2017).

Paleoenvironmental studies for western Iberia indicate for the Last Glacial stage alternations between humid interstadials with an increase of temperate forests and cold and arid stadials with dry grasslands or steppe expansion. During this time, the Iberian Peninsula presented important transformations on the landscape, the fauna and flora, but also variations between coastal and interior areas. For example, the coastal areas were influenced by the sea, while the interior was more arid and colder. During the coldest periods, forests were restricted and usually replaced by open areas, with grasslands like tundra, and dry and cold steppes. The remaining woods presented conifers like taigas, while deciduous or thermophile species were preserved in specific microclimates and increased only by the end of glaciations (Sánchez Goñi et al., 2008; Fletcher et al., 2010 *apud* Benedetti, 2019). Straus (2018) notes that during MIS3 temperature and humidity fluctuations were responsible for regular alterations on the various Iberian landscapes. The mosaic included grasslands and woodlands, but also a more temperate taxa located at the southern parts. In MIS2, at the initial stage there was a decrease in temperatures and humidity, with a fluctuation during Last Glacial Maximum (LGM). The Euro-Siberian zones presented landscapes with open vegetation with scattered pines and junipers, while the Mediterranean ecozone preserved temperate arboreal taxa (Naughton et al., 2007; González-Sampériz et al. 2010; Bicho et al. 2013; Iriarte and Murélaga 2013; Rofes et al. 2015 *apud* Straus, 2018). The aridity was increased at the Last Glacial Maximum together with the expansion of the glaciars and the greatest sea level regression. At that time grasslands and heathlands spread. Only a few small areas of pines, junipers and birches remained. Deciduous trees lasted in southernmost refugia (Naughton et al., 2007; González-Sampériz et

al., 2010 *apud* Straus, 2018). It has been proposed that Western Iberia has shown a relatively increased temperature against the extreme colder conditions found in European areas of higher latitudes (Roucoux et al., 2005; Naughton et al., 2007 *apud* Haws, 2012). At the beginning of MIS2, sea level regression lowered the levels of streams, and the vegetation cover was reduced due to the climate changes, exposing the land, and intensifying the erosional episodes which were also evident through the LGM (Angelucci, 2002 *apud* Haws et al., 2021). The range of LGM is disputed (Straus, 2018). The long version includes Oldest Dryas, while the shorter covers the Greenland Stadials 2c and 2b. According to Straus (2018) LGM ended gradually. The climatic conditions ameliorated slightly between 21,000 cal BP and deteriorated again around 17,500 cal BP with Oldest Dryas. After that, the first major warming episode of MIS2 was the Bølling (Greenland Interstadial 1e) around 15,000 cal BP. Greenland Stadial 2 ended by the Late Glacial Interstadial (Meiendorf+Bølling+Allerød 1 and 2 = Greenland Interstadial 1). The climate became warmer with an expansion of pines, junipers, birches, and thermophilus trees. Parklands replaced the previous steppes, being the last cold and dry episode the Younger Dryas (12,900 - 11,700 cal BP) (Straus, 2018).

Despite climatic oscillations, the existence of a habitat mosaic, and the latitudinal variability in the forest covering related to the succession of D-O events and modulations caused by orbital parameters (Sánchez Goñi et al., 2008), during MIS3 and MIS2 evidence suggest the existence of two main persistent ecological zones in the Iberian Peninsula. These were the Euro-Siberian zone, which extended from the Pyrenees and the Basque corridor, the Cantabrian stripe to Gallica and north of Portugal, and the Mediterranean zone covering the rest of Iberia (Figure 9) (Rivas-Martínez, 1987 *apud* Ripoll López and Municio González, 1999; Straus, 2018).

The two most representative sites from Central Portugal with high resolution paleoenvironmental studies are the karstic environments of Lapa do Picareiro (Benedetti et al., 2018) and Gruta do Caldeirão (Zilhão et al., 2021). The data from the two sites agree about the climatic conditions represented in their sedimentary depositions (Zilhão et al.,2021; Benedetti et al., 2018).

The changes of the glacial-interglacial cycles during Pleistocene caused repeated alterations to the geographic distribution of species (fauna and flora), and to geomorphological processes regarding soils and lands. Living organisms faced cases of "fragmentation, and reconstitution" of ranges, movements related to the poles and the mountains regarding localities presenting favourable climatic conditions, often covering extreme large distances (Bennett, 1997 *apud*

Roberts, 2014). The impact of the environmental variability and stress during Pleistocene was evident on the repeated natural deforestation, the extinction of several species and the adaptability of others (Roberts, 2014), including *Homo*. It is generally accepted that the cultural variability seen across the Upper Palaeolithic is a reflex of the regional adaptations to these climatic shifts.

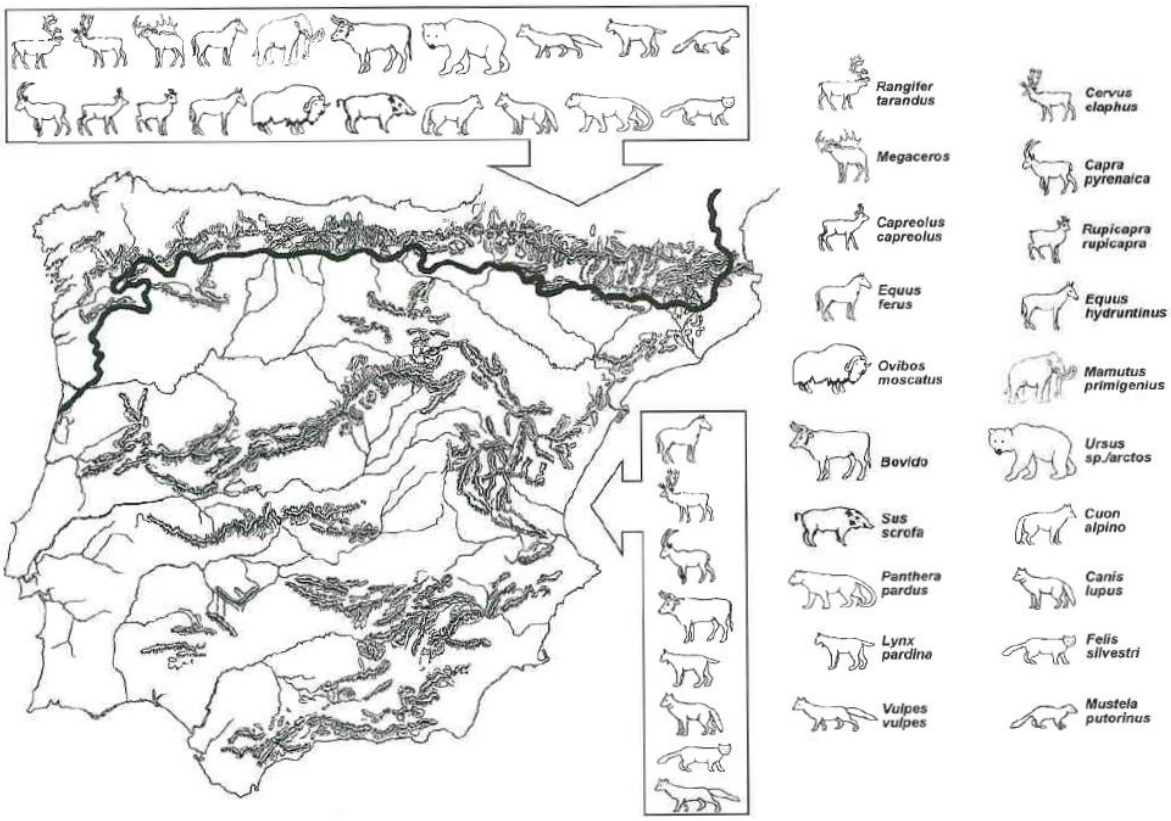

Figure 9: The two main bioclimatic zones of Iberia, with the indicative animal species. (Map: L.E.P., in Ripoll López and Municio González, 1999).

2. State-of-the-art

2.1. Upper Palaeolithic Iberia and the Western Sector

Upper Palaeolithic in Europe covers the period from the arrival of the Anatomical Modern Humans until initiation of the Holocene. Its chronological framework is constructed primarily based on the lithic technocomplexes (Lillios, 2019) (Table 1, Figure 11). In wide terms this period is characterized by the production of blades and bladelets and composite tools, and an artistic explosion with the spread of modern human behaviour (McBrearty and Brooks, 2000), including portable and parietal art. The Iberian Peninsula presents a mosaic of geographic regions with differences in raw materials availability and cases of tool forms "variation" (Lillios, 2019). Here, the Upper Palaeolithic starts during the late MIS3 with the transition from the Mousterian to the Châtelperronian and Early Aurignacian technocomplexes around c. 45,000 - 35,000 cal BP (Straus, 2018). The technological transition from Mousterian to Aurignacian, the exact dates of a possible coexistence and replacement of Neanderthals by Anatomical Modern Humans bare a lot of question that need further data. Issues that complicate the studies are the absence of direct association between the initial Upper Palaeolithic technocomplexes and human fossils, but also the late survival of middle Palaeolithic industries in the Iberian Peninsula (Zilhão, 2006; 2009; 2013a; Zilhão et al., 2017; Lillios, 2019; Straus, 2018).

Cultures	**Periods**	**References**
Châtelperronian	c. 43,850 – 40,950 cal BP	(Rios-Garaizar et al., 2022)
Aurignacian	c. 43,300 – 33,500 cal BP	(Haws et al., 2020; Aura Tortosa, 2012)
Gravettian	c. 33,000 – 26,000 cal BP	(Lillios, 2019)
Solutrean	c. 25,000 – 19,000 cal BP	(Cascalheira and Bicho, 2015)
Magdalenian	c. 23,000 – 11,000 cal BP	(Lillios, 2019)

Table 1: Upper Palaeolithic cultures in Iberia and their approximate temporal span with references.

The Châtelperronian (c. 43,850 – 40,950 cal BP) which currently seems to be attributed to Neanderthals (Rios-Garaizar et al., 2022) is regionally found only at the Northeastern part of the Iberian Peninsula and is absent from Western Iberia (Straus, 2018). The defining industries include points, endscrapers, burins, and backed blades and some osseous tools (Lillios, 2019). The Aurignacian, started around c. 43,300 – 40,500 cal BP (Haws et al., 2020) and probably lasted until 33,500 cal BP (Aura Tortosa, 2012). It is associated with the arrival of Anatomical Modern Humans, particularly due to the absence of bladelets technology from Neanderthal

sites (Haws et al., 2020; Rios-Garaizar et al., 2022). The oldest phase of the Aurignacian three subphases (Proto -Early -Evolved) is dated around c. 42,000 cal BP (Lillios, 2019) or 43,000 – 42,000 cal BP *apud* Rios-Garaizar et al. (2022). According to Zilhão (1997) the most characteristic lithic tools are the so called Dufour bladelets, microliths and burins for composite tools (Lillios, 2019). Bone tools can be often found in the assemblages as well. In Western Iberia, the presence and the arrival of this industries has been a subject of debates (Straus, 2018). Initially, Zilhão suggested that Modern Humans expanded at these lands only after c. 37.500 cal BP with the "Ebro Frontier" hypothesis and an "Evolved Aurignacian" between 37,100 and 36,500 cal BP (Zilhão et al., 2021; Zilhão, 2021). On the other hand, Haws et al. (2020) argued that Early Aurignacian existed in Lapa do Picareiro around 41,100 – 38,100 cal BP based on small bladelets and carinated endscrapers, but their results are debated (for further discussion: Zilhão, 2021; 2022; Zilhão et al., 2020; 2021; Haws et al., 2021) and Picareiro is, for now, an isolated case as it can been seen in the map of Alcaraz-Castaño et al. (2021) (Figure 10).

The Gravettian (c. 33,000 – 26,000 cal BP) (Lillios, 2019) started to spread during the beginning of MIS2 (Straus, 2018). Characteristic features of these technocomplexes became backed points and burins (Lillios, 2019). There is evident variability in lithic typology and raw materials use (Lillios, 2019). For Bicho et al. (2017) the Gravettian on the Portuguese territory started c. 33,500 BP, or according to a study with Bayesian modelling around c. 34,500-32,000 cal BP and ended c. 27,400 – 26,300 cal BP (Bicho et al., 2015). In western Iberia according to Haws et al. (2021) clusters of sites can be found in Estremadura, the Côa Valley, Alentejo, and Algarve. Some of the sites that present sequences of artifacts from the Gravettian period are Olga Grande, Cardina, Lapa do Picareiro, Lagar Velho, Vale Boi (Straus, 2018). The Portuguese toolkits of the early Gravettian were distinguished by bipointed, bilaterally backed bladelets, while the late phase showed characteristic Gravette and microgravette points (Bicho et al., 2017; Straus, 2018).

The Solutrean (c. 25,000 – 19,000 cal BP) almost coincides with whole range of the Last Glacial Maximum (Cascalheira and Bicho, 2015; Straus, 2018). The diagnostic tools for Proto-Solutrean (on the apparently absence of a Lower Solutrean) are the Vale Comprido Points and the bifacial and tanged points for the Solutrean (Bicho et al., 2017). Straus (2018) notes that the last Solutrean sequences were found in Central and South Iberia until c. 21,400 – 20,000 cal BP. According to Lillios (2019) the tool assemblages are distinguished by leaf-shaped points. They present concave bases, shaped shoulders, barbed and tanged, backed and

shouldered points that were used for projectiles and knives (Zilhão, 2013b). Regional differences in technocomplexes can be largely clustered between the northern Atlantic region of the Iberian Peninsula and the Mediterranean coast. Stylistic differences are evident among the various types of points (Schmidt, 2015). During the Solutrean major sites from the western part of the peninsula have been Olga Grande and Cardina, Caldeirão, Escoural, and Vale Boi (Straus, 2018).

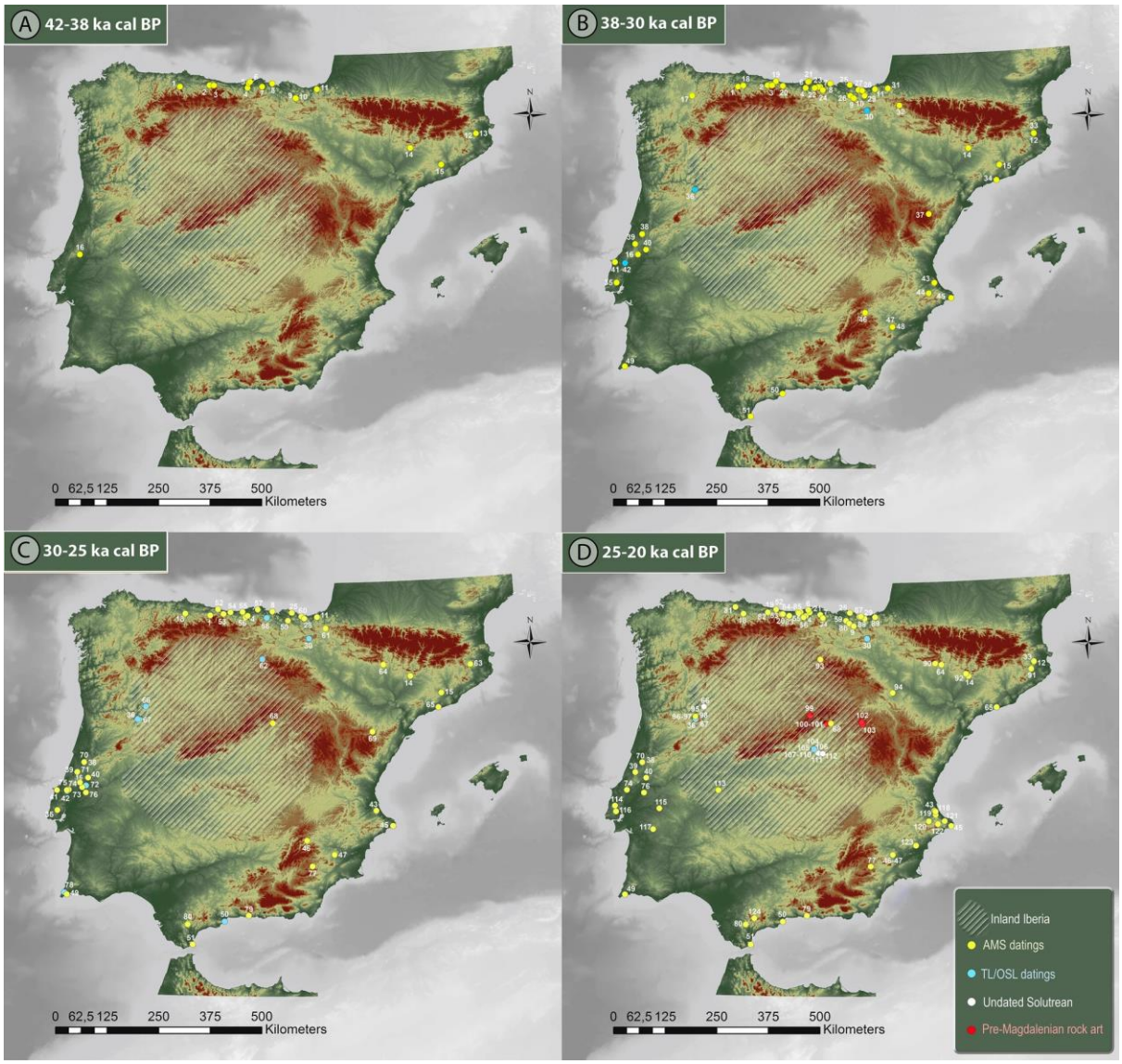

Figure 10: Process of modern humans' expansion in the Iberian Peninsula during the Upper Palaeolithic. Picareiro is number 16. A: 42 – 38 cal BP, B: 38 – 30 cal BP, C: 30–25 cal BP, D: 25–20 cal BP (Map: Alcaraz-Castaño et al., 2021).

The Magdalenian (c.23,000-11,000 cal BP) presents a more evident regional diversification. Blades and bladelets are the most typical lithic tools (Lillios, 2019). Bone tools and portable art start to be common but remain relatively absent in Portugal, with exceptions of Côa and Foz do Medal (Straus, 2000 *apud* Lillios, 2019; Figueiredo et al., 2020; Reis, 2021). Early

Magdalenian starts around 20,300 – 18,700 in Cabeço do Porto Marinho (Zilhão, 1997; Bicho and Haws, 2012; Straus, 2018). Sites highlighted by Straus (2018) during the initial Magdalenian (20,000-16,000 cal BP), have been Caldeirão, Picareiro and Suão usually with numerous flakes, backed bladelets and simple burins on local raw materials. During the Middle Magdalenian, artifacts were discovered from layers of Cabeço do Porto Marinho, Caldeirão Cave and possibly Buraca Grande and Lapa do Suao (Zilhão 1997; Bicho and Haws, 2012; Straus, 2018). Backed and retouched bladelets are found together with other flake tools. The Late Upper Magdalenian is evident in Picareiro cave, Cabeço do Porto Marinho, Buraca Grande, Lapa dos Coelhos, Lapa do Suão and possibly Caldeirão (Zilhão, 1997; Bicho et al. 2006; Bicho et al. 2011; Bicho and Haws, 2012; Straus, 2018). Backed bladelets are the most common identified artifact (Straus, 2018). In Portugal there can also be found microlithic backed points including geometrics (Bicho et al., 2017). The scarcity of diagnostic osseous tools stands against a clear transition to the Epipalaeolithic industries (Straus, 2018). Further details and citations about the Upper Palaeolithic of the Iberian Peninsula are presented in other general documents (Aura Tortosa, 2012; Pettit, 2014; Zilhão, 2014; Straus, 2018; Lillios, 2019).

The end of Palaeolithic period in Western Iberia is marked by the cultural transition from Palaeolithic to the Neolithic societies accompanied by the Pleistocene and Holocene alteration of climatic conditions. Between 10,000 – 7,500 BP during the Preboreal and Boreal periods the hunter-gatherers' life changed (Gomes, 2010) and transformed to the so-called Epipalaeolithic (Bicho, 1997) or Early Mesolithic (Araújo, 2003; 2013) and Mesolithic communities (Bicho et al., 2010; Pereira and Carvalho, 2015). According to Garcês (2017) there are cases on the bibliography that the two terms Epipalaeolithic and Mesolithic are used as synonymous, although in Portugal some researchers like Bicho (1994), Pereira and Carvalho (2015) differentiate them culturally and chronologically (for more: Bicho, 1994; 2004, Soares and Silva, 2003; Valente, 2008; Carvalho, 2009 *apud* Garcês, 2017) The distinction primarily stands on how close are these communities to the Palaeolithic or Neolithic way of life (Garcês, 2017). Bicho et al. (2010) suggested that during the Epipalaeolithic the toolkits presented a "miniature weaponry" with backing retouch (Microgravette, Istres, Sauveterre and la Malaurie points) and marginal retouch (Dufour or Ouchata bladelets or points), various geometrics (triangles, crescents and trapezes made with microburin technique) using Upper Palaeolithic types of bladelets (Bicho, 1998, 2002 *apud* Bicho et al., 2010). Core-flake macrolithic technology was frequent with an intensive use of local non-flint raw materials (Bicho et al.,

2010). After the Boreal period (9,000–8,000 cal BP), during the Atlantic times the Mesolithic lifestyle was fully established with the disappearance of backed and marginal retouched weaponry, the production of geometrics with the microburin technique, the regular production and standardization of bladelet forms longer than the previous ones possibly made either by the use of a soft hammer or direct percussion (Marchand, 2005; Bicho,1994 *apud* Bicho et al., 2010). In Garcês dissertation (2017), the term Mesolithic reflects societies with continuity on the hunter-gatherer's way of life with the higher degree of complexity than previous societies (higher sedentary rates, development of new ritual, funerary and food storage practices). Pereira and Carvalho (2015) suggest based on the assemblages from Pena d'Água Rock-shelter that the environmental transition from Pleistocene to the Holocene did not radically change the socio-economic way of life of the Portuguese hunter-gatherer groups. The subsistence strategies and technology of Upper Palaeolithic largely persisted for a few more millennia following the climatic amelioration. An abrupt change occurred with the climatic event 8,200 cal BP and the transition from Borial to the Atlantic phase, possibly marking the transition to the Mesolithic, which lasted until the appearance of Neolithic ca. 7,400 cal BP (Pereira and Carvalho, 2015). Raw material acquisition became from opportunistic "strategically obtained" and the technologic variability became more standardized. The increased geometrization of the lithic toolkits was a major point of differentiation to the previous phase at the examined rock shelter. These technological changes were correlated by the authors with shifts in burial practices, diet, social organization (Pereira and Carvalho, 2015).

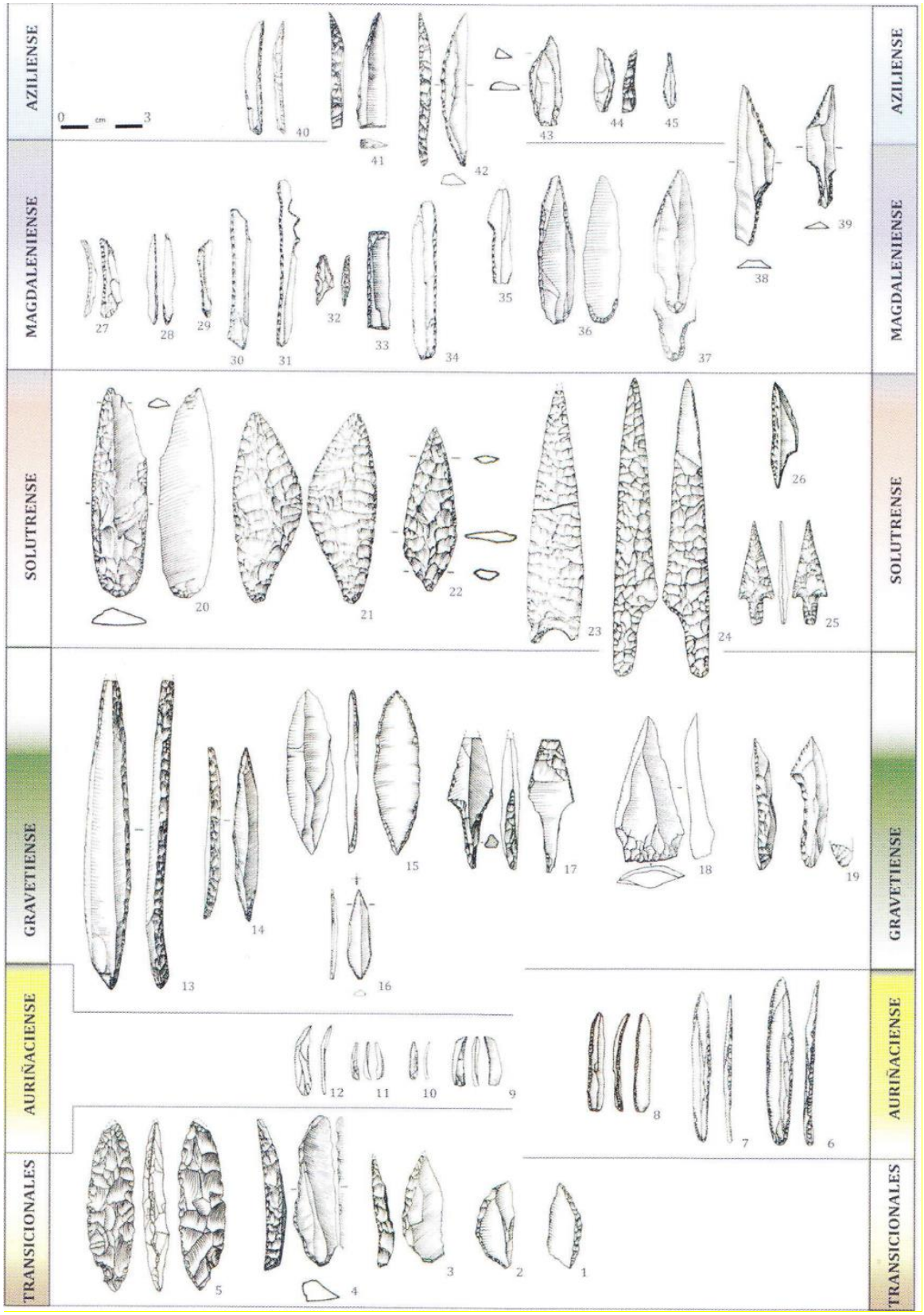

Figure 11: Indicative lithic toolkits attributed to European Upper Palaeolithic technocomplexes (Image: Aura Tortosa, 2012).

2.2. Upper Palaeolithic Rock art and the Iberian Peninsula

The European Upper Palaeolithic rock art covers a wide geographic area from the Ural Mountains to Iberia with approximately 400 sites. The biggest and most dense concentrations are found in Spain (195) and France (178) (Rivero and Ruiz, 2018), with 80% of the global Pleistocene images to be in Franco-Cantabrian region (Ruiz-Redondo et al., 2020). The Portuguese territory is rich in open air sites (71) presenting only a sole case of a cave with engravings and paintings (Reis, 2021). Sparse findings are traced in United Kingdom, Germany, Italy, Croatia, Serbia, Bosnia and Herzegovina, Romania, and Russia (Rivero and Ruiz, 2018; Ruiz-Redondo et al., 2020). A small increase of rock art sites found during the last decade in territories out of the traditional Franco-Cantabrian zone, in areas that lacked surveys, like the Balkans (Ruiz-Redondo et al., 2020), and Azerbaijan (Sigari, 2013; Bahn, 2015; 2021) that present stylistic affinities and relevant dates, currently expand even further the territorial range and the possible social networks of Upper Palaeolithic "European" art.

It is dominated by zoomorphic figures (80%), and various non-figurative signs (lines of dots, tectiforms, claviforms) (Pettitt, 2014). Horses, bison, goats, aurochs, deer/does, reindeers, bears, mammoths, lions, and rhinoceros are the most common depicted animals. In less few portions fox, wolf, chamois, megaloceros, seal, saiga antelope and hare. Cases of birds, marine fauna are scarce while snakes and anthropomorphic representations can be found in smaller numbers and according Sauvet et al. (2014) the latter usually lacks realism. Human hand stencils and handprints exist as well and are considered to be one of the oldest representations in European rock art (Collado Giraldo, 2018; Simón-Vallejo et al. 2018; Hoffman et al. 2017; Hoffman et al. 2018; Pettit et al., 2015). The various artistic techniques employed by the Palaeolithic artists resulted in engravings made by burins or other sharped tools, paintings with red, sienna, purple (haematite and goethite) and black pigments (charcoal and manganese) made with the use of fingers or sticks, stencils, prints (handprints and finger flutings), sculptures (bas-reliefs) and even in modelled clay (Ripoll López, 2012; Rivero and Ruiz, 2018; Collado Giraldo, 2018). The last technique is extremely rare, dated in Middle Magdalenian and discovered in the Pyrenees. (Rivero and Ruiz, 2018).

There are various interpretations regarding palaeolithic rock art (e.g., setting, meaning, use, etc). They were and still are influenced by theoretic trends and the spirit of the age (zeitgeist) at the time of formulation. Some of them have been the art-for-art's-sake, hunting magic, totemism, structuralist approaches, and shamanism (Table 2). Many of the images present a relative unity which exists widespread, differing in style and techniques from time to time, and

place to place, but retaining major elements. Perhaps, up to a point it can be explained by the fact that they were products of a hunter-gatherers' way of life, which did not fully change until the neolithic times. Despite that, taking into account the large chronological framework, the geographic range, the broad context of these artistic manifestations and chances of polysemy, the possibility for a single interpretation seems rather unlikely to be proven (Conkey, 1987 *apud* Bicho et al., 2007; Bicho et al., 2007; Bahn, 2011; Ripoll López, 2012; Rivero and Ruiz, 2018).

Researchers		**Proposals**
Lartet, E. and Christy, H.	(1865-1875)	Art for the sake of art
Piette, E.	(1907)	
Reinach, S.	(1903)	Magic-Religion
Durkheim, E	(1912)	
Breuil, H.	(1952)	
Bégouën,H.	(1958)	
Ucko, P and Rosenfeld, A.	(1967)	Communication medium
Leroi-Gourhan, A. and		Structuralism
Lamming Emperaire, A.	(1962-71)	
Clottes, J. and		Shamanism
Lewis Williams, D.	(1995)	

Table 2: Major proposals that influenced the Upper Palaeolithic rock art studies and the interpretation theories apud Ripoll López S. (2012a).

Since the discovery of Altamira cave by Marcelino Sanz de Sautuola in 1869 and its recognition as art produced by Palaeolithic hunter gatherers in 1902 (Cartailhac, 1902; Rivero and Ruiz, 2018), Iberian Peninsula Palaeolithic art has been a key subject in rock art studies. Through the 20th century several sites were discovered. The Iberian Peninsula until 2018 numbered up to 245 (Lillios, 2019). Bicho et al. (2007) divided the rock art sites in Iberia in seven main clusters: 1) the Cantabrian region in the north 2) Ebro's Valley in the northeast, 3) Upper Tagus and 4) Duero in the interior of the peninsula, 5) Alentejo and Spanish Extremadura at the West above Duero, 6) Levante in the southeast, and 7) Andalucia in the southernmost part (Figure 12) Palaeolithic sculptures, engravings and paintings are located in caves, rock shelters and open-air sites. For a long time, it was believed that they could be found only in karstic systems (Bahn, 2015; Balbín Behrmann and Alcolea González, 2021). The research of the last 30 years shed a new light with the identification of open-air sites with Palaeolithic engravings. Although Domingo García was initially found in 1970, its case was investigated further only during the 1980s' (Ripoll López and Municio-González, 1999a and b; Bahn, 2015) when sites resembling

the palaeolithic cave art started to be discovered. These were Mazouco, Fornols-Haut, Piedras Blancas and Siega Verde (Balbín Behrmann and Alcolea González, 2021). Like in the case of Altamira, the proposal of the Palaeolithic age for the rock art manifestations was not widely accepted straight after their discoveries. (Bicho et al., 2007). The debate that followed the discovery of the Côa Valley in 1994-1995 changed the *status quo* irrevocably. The valley up to this day is a cluster of sites with the highest numbers of Palaeolithic open-air engravings, while Foz do Medal, in the nearby valley of the Sabor river stands as the site with more mobile art (Figueiredo et al., 2014; 2020). The dating of the Côa valley rock art was done using stylistic and radiometric datings. The first was done by comparing the finds with the slabs from the stratified layers of Parpalló (Santos et al., 2021). The second was through OSL dating in the layers that contained an engraved fragment and that were covering a rock art panel in the site of Fariseu (Santos et al., 2021). Together, this confirmed the stylistic dating hypothesis providing the minimum date of 18,400 BP (Baptista, 2009; Aubry, 2009a; Santos et al., 2015; Santos et al., 2021). The hypothesis that this type of art could even outnumber cave art, although due to weathering conditions a great number of it was lost cannot be excluded (Bahn, 2001). The vast majority is found on schist outcrops (Jordá Pardo, 2012; Balbín Behrmann and Alcolea González, 2021). Paintings due to the conservation factors in open air sites are extremely rare and can be found only in rockshelters, like Faia on granite, and La Grajera in Valencia de Alcántara on quartzite (Santos, 2015; Bueno Ramírez et al., 2011; Balbín Behrmann and Alcolea González, 2021). Additionally, the discovery of a collection over 1,500 in "Gravettian, Solutrean and Magdalenian" deposits from Foz do Medal in Sabor River (Figueiredo et al., 2020) together with the numerous engraved outcrops of the Côa sites (Santos et al., 2015) define Northwest Iberia as an important region for Upper Palaeolithic art and the metamorphic schist-greywacke formations of the Hesperian Massif. During the last decades there was an increase in investigations in areas previously considered empty, or lacking intensive surveys, like the Basque country that was located between notable clusters and was proven to be much richer (Garate Maidagan, 2018).

The origins of European Palaeolithic rock art progressively gain older dates in Iberia, which could possibly extent to the Middle Palaeolithic (Pike et al., 2012; Hoffmann et al., 2018; Ramos-Muñoz et al., 2022). However, these proposals for the oldest rock art face debates about methodological issues of dating with U-Th, the authors of the oldest palaeolithic rock art (Neanderthals vs Anatomical Modern Humans), the Middle to Upper Palaeolithic transition, and the typology of the first rock representations (non-figurative vs figurative) (White et al.,

2019; Pons-Branchu et al., 2020; Hoffmann et al., 2020). Excluding these controversial proposals, the European Upper palaeolithic rock art is attributed to Anatomical Modern Humans (Rivero and Ruiz, 2018). In general, as stated by Sanz et al. (2008) and Ochoa et al. (2021) dating, and the precise periodization of the rock art are two of the hardest to answer research questions. This is primarily explained by the relevant scarcity of possible application of absolute dating methods and techniques on the rock art itself in comparison to the total number of identified art, the subsequent use of wide chrono-stylistic framework mainly constructed using indirect dating methods such as association and seriation, the limitations of dating techniques, and finally potential disturbances created by contamination cases in collected samples for U-Th, radiocarbon and OSL.

According to various authors Upper Palaeolithic rock art endures for a minimum of 20,000 years (e.g. c. 30,000 – 11,000 BP *apud* Bicho et al., 2007; c.36,500/32,000 – 12,000 14C BP (uncalibrated) *apud* Sauvet et al., 2014). Rivero and Ruiz (2018) based on the results of Quiles et al. (2016) and Corchón Rodríguez et al. (1996) suggest c. 37,000/36,200 cal. BP – c.13,500 cal. BP for Upper Palaeolithic rock art. They differentiate it from a Late Upper Palaeolithic/Early Holocene stylistic phase that follows according to the stratified associations from Parpalló c. 13,700 – 11,500 cal. BP (Villaverde Bonilla et al., 2012) and the charcoal representations in Ojo Guareña around 11,638–10,689 cal. BP (Corchón Rodríguez et al., 1996). As for the first figurative rock art in the Iberian Peninsula it probably appeared during the Aurignacian and the Gravettian. These suggestions are supported by association, samples dated with U-Th series by Pike et al. (2012) from Tito Bustillo that provided results of 37,700/ 35,500 ka – 29,600/ 25,200 ka, and by association with the archaeological material c. 39,000 cal ka (González-Sainz et al., 2013; Garate Maidagan, 2018; Straus, 2018). Ochoa et al. (2021) argue in favour of the U-Th dates. In addition, the same researchers agree with the proposal of Bueno Ramírez et al. (2007) that a “palaeolithic style” continued after 12,000 cal BP.

This large chronological span had different cultural periods with variations in space and time, without following a unilinear evolution as it was initially suggested (Menéndez Fernández, 2012; Alcolea-González and González-Sainz, 2015; Rivero and Ruiz, 2018). Nevertheless, as noted by Rivero and Ruiz (2018) there are two major phases with a barrier set around 17,000 BP. The first phase is the pre-Magdalenian. It covers time spans largely associated with the Aurignacian, Gravettian and Solutrean, and has subphases that tend to be hard to divide. On the other hand, the second phase, the Magdalenian, due to the abundance of radiocarbon dates and the portable art, is better distinguished. This division has been also suggested for the inland

Iberia by Alcolea González and Balbín Behrmann (2012). According to Sauvet et al. (2014), based on stylistic conventions of the zoomorphic figures the first one is distinguished by naturalistic depictions, and minimalism with the figures to be depicted with a contour with few details and internal elements. The second phase shows an increased naturalism, with elaborate figures that present anatomical details, infills and internal details, realistic perspectives of the limbs and the horns. These are evident as well in Western Iberia (Santos et al., 2015; Santos, 2019). It has been suggested that Upper Palaeolithic rock art in Iberia ended either abruptly with the arrival of the Holocene or transformed retaining some elements, motifs, and techniques, presenting a progressive schematization (Rivero and Ruiz, 2018; Bueno Ramírez et al., 2007). Around 12,000 – 10,000 BP, for example, in Côa, zoomorphic figures became more geometric and their details stop to be visible (Santos et al., 2015). The representations of these times bare various names: Late Magdalenian, Late Glacial, Azilian, Style V, and Epipalaeolithic (Reis, 2021; Roussot, 1990; Bueno Ramírez et al., 2007; Rivero and Ruiz, 2018; Bueno Ramírez and Balbín Behrmann, 2021). Epipalaeolithic (Reis, 2021), pre-schematic (Collado Giraldo 2004, 2006; Garcês 2017) (for more: Beltrán, 1989; Roussot, 1990; Collado Giraldo, 2004, 2006; Bueno Ramírez et al., 2007; Bueno Ramírez et al., 2009; Menéndez, Mas and Mingo, 2012; Vázquez Marcos, 2012, Rivero and Ruiz, 2018; Bueno Ramírez and Balbín Behrmann, 2021; Reis, 2021; Vázquez Marcos, 2021).

The tradition of associating specific styles with the main Western European palaeolithic cultures to provide a more consistent periodization for the rock art goes back to the previous century with the chronological frameworks proposed by the H. Breuil (1940, 1952) and L. Gourhan (1962) (Figure 13) after the identification of similarities with stratified portable art (Moro Abadía and Garate Maidagan, 2010; Petzinger and Nowell, 2011). The influence of L. Gourhan is still evident is the Upper Palaeolithic rock art studies, despite the major changes suggested after the initial application of direct dating methods in end of the 20th century (Sanz et al., 2008). The basic elements of his (style) interpretation persists (Alcolea González and Balbín Behrmann, 2007; González-Sainz, 1999, 2005 *apud* Balbín Behrmann and Bueno Ramírez, 2009; Santos et al. 2021). In addition, not all the regions of Palaeolithic Europe present the above mentioned technocomplexes, a fact that can be used to criticize the subdivisions (Alcolea-González and González-Sainz, 2015). This custom can be explained as an ease of reference due to the wealth of the artistic materials (Rivero and Ruiz, 2018) and the existence of secured dates from Franco-Cantabria (see Ochoa et al., 2021).

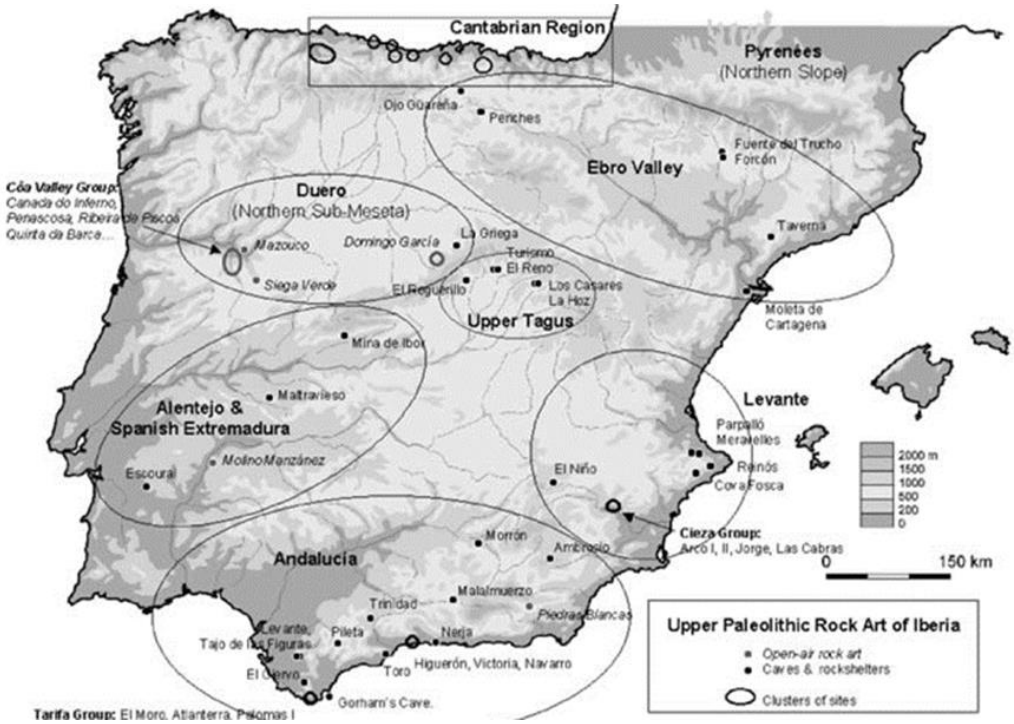

Figure 12: Clusters proposed by Bicho et al., 2017 (Map: C. González-Sainz in Bicho et al., 2017).

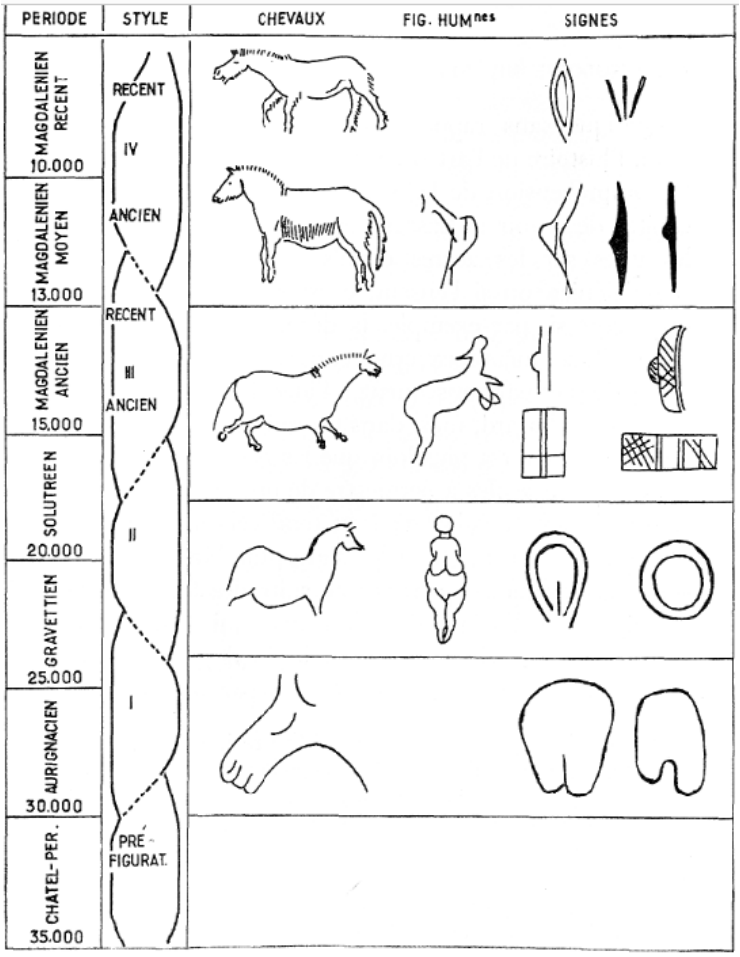

Figure 13: Table with cultural periods and the associated styles created by Leroi Gourhan (1964)(Image: published in Moro Abadía and Garate Maidagan, 2010).

2.3. The Tagus Valley Rock Art Complex

The Tagus Valley Rock Art Complex is located on the lower Tagus River, in central-eastern Portugal. The importance of the complex was recognised during the 1970's with serial discoveries of rock art sites (Garcês and Oosterbeek, 2014). The main techniques used for the creation of the engravings have been abrasion, and pecking (fine, normal, micropecking) (Garcês, 2017). The Complex covers an area of 40 km long from the Ocreza river's mouth until the dam of Cedilho, in the borders with Spain. It includes 12 clusters found on the main river and its tributaries (Figure 14): the valley of river Erges, river Ponsul, Cachão de São Simão, Alagadouro, Lomba da Barca, Cachão do Algarve, Ficalho, Fratel, Foz de Ribeira de Nisa, Chao da Velha, Gardete, and the valley of Ocreza River. In the complex can be also included, Herrera de Alcântara in Spain, and Sever River which serves as a border between Spain and the Portuguese Alto Alentejo area, that according to recent surveys presents several modern times engravings (Garcês; 2020; Henriques et al., 2011).

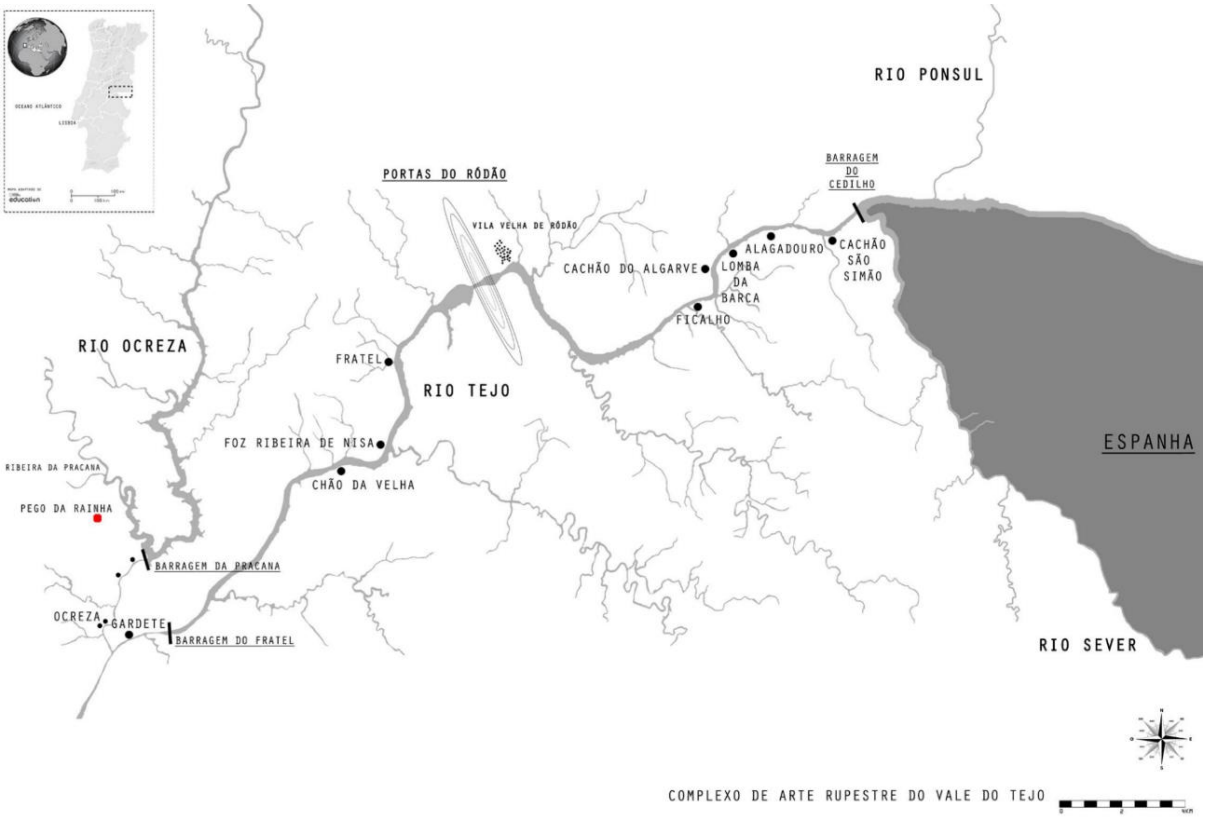

Figure 14: The Tagus Valley Rock Art Complex (Map: Garcês, 2017).

The region is abundant in schist outcrops usually exposed by the rivers similarly to the landscape portrait in the Figure 15. These outcrops have been used as supports for the rock art engravings diachronically since Upper Palaeolithic until the Late Bronze age (Garcês and Nash, 2022). With a minimum number of 1.636 rock art panels, the Tagus complex is an area of major

importance for prehistoric rock art (Garcês and Nash, 2022; Garcês, 2017). Today, most known engravings of the complex are underwater, due to the construction and use of dams. Most of the panels are attributed to the Holocene times (Table 3)(Garcês; 2017). Currently, only two panels present figurative art attributed to the Palaeolithic. Both are from Ocreza, and they are the subject of this work. These figures meet stylistic criteria commonly attributed to the Pleistocene. A limited number of figures that could correspond according to Garcês (2017) to the Pleistocene-Holocene transition from the Complex are not analysed in this dissertation. Gomes (2004; 2010) has suggested the existence of some incised lines in the sites of Ocreza, Gardete, Fratel and Erges possibly associated with the Palaeolithic, but due to their nature and the absence of the relevant context they can be highly debated and won't be considered in this work.

Animals	**Naturalistic style**	**Subnaturalistic style**	**Schematic style**
Bovine	0	5	1
Bird	0	1	4
Goat	0	17	3
Horse	1	4	3
Serpentiforms	0	0	100
Roe deer	0	7	2
Wild boar	0	1	0
Canid	0	4	0
Unidentified species	0	27	21
Reptile	0	1	1
Bear	0	0	2
Lagormorph	0	2	0
Cervid	0	79	9
Pectiniforms	0	0	3
Total	1	148	149

Table 3: The zoomorphic figures of Tagus divided according to their style by Garcês (2017), prior to the discovery of the new panel (OCR20).

Figure 15: A capture from the Ocreza Valley. Schist outcrops are evident especially at the right margin. (Photo: Nash and Garcês, 2018).

2.4. History of the research in the Ocreza Valley

The first systematic prospections in Ocreza are dated back in 1973, two years after the identification of several engravings in the wider area of Lower Tagus and the primary definition/creation/establishment of the Tagus Valley Rock Art Complex. The first findings on the complex were discovered in Fratel after a survey conducted by members of the G.E.P.P. Grupo de Estudos do Paleolítico Português (Group for the Study of the Portuguese Palaeolithic). Their goals were the archaeological survey in Quaternary formations and the tracing of some inscriptions on stones noted by P. C. Soromenho, ethnologist, in the municipality of Vila Velha de Ródão (Serrão et al., 1972). The survey occurred in the context of the Fratel dam project (Garcês and Nash, 2022). The construction of dams in the wider area due to the rich hydrographic system, played (and still plays) a major role in the recording, preservation, and identification of rock art. The Fratel dam hastened the recording process as the reservoir was scheduled to be filled in 1974. To save the valuable information, latex moulds of the panels' surfaces were created before most of the engraved panels were covered by water (Garcês and Oosterbeek, 2015). This act was crucial. In between, according to Baptista (2001), on 17/4/1973 a team from the same group conducted a rock art prospection following the

stream of Ocreza from the Pracana dam until Tagus. Their mission resulted in the discovery of three panels with schematic engravings. In 1974 and 1976 during a period of systematization of the research in the complex, A. M. Baptista, J. P. Monteiro, M.M. Martins, M.V. Gomes and V. Serrão revisited Ocreza. They recorded 20 panels located at the right margin of the river, dated in the Holocene based on the schematic style of the representations (Figure: 7 and 8). These panels had similar parallels with other sites of the Tagus Complex. In addition, other information about engraved dimples (Monteiro and Gomes, 1974-77) at the area of the Pracana dam were never proved due to the covering from the water of the reservoir (Baptista, 2001).

Ironically, despite being G.E.E.P. who initiated the research and traced the engravings on Lower Tagus at zero time, it was only after the passage of the millennium that the first panel with a figure dated on the Pleistocene would be discovered. Baptista argues that it was the urgent process of moulding that negatively influenced the systematization of the research (plus inadequate raining conditions) responsible for the delay of discovering the Palaeolithic Horse panel (Figure 16). In 2000, a new investigation related to the construction of the A23 (former IP6) (Appendix Figure: 193) highway led to the discovery of the panel with a single pecked horse figure. The expedition was organized by CEIPHAR - Centro Europeu de Investigação Pré-Histórica do Alto Ribatejo (Upper Ribatejo European Center of Archaeological Research) and CNART, Centro Nacional de Arte Rupestre (National Center of Rock Art). The members of the latter carried out the survey. The team was consisted of A. M. Baptista, F. Barbosa, J. Felix, M. Almeida, and A. C. Lima.

Figure 16: Ocreza Horse (OCR 15) (Photo: G. Nash).

The rock art from Ocreza has been presented in various publications, articles, monographies, and some theses (Serrão, 1972; Monteiro and Gomes, 1974-77; Gomes, 2000, 2001, 2004; Oosterbeek, 2002, 2003; Oosterbeek and Cardoso, 2004; Figueira and Oosterbeek, 2011; Coimbra and Garcês, 2013; Garcês and Oosterbeek, 2015; Garcês and Nash, 2017, 2018, 2022 *apud* Garcês and Oosterbeek, 2015; Garcês, 2017). In 2008, CEIPHAR initiate the creation of a *corpus* for both engravings and painting of the Tagus Complex, including Ocreza. This was largely accomplished with the collection of all the data from the old latex moulds and the latest discoveries in 2018. The IMQP - Erasmus Mundus International Master in Quaternary and Prehistory contributed as well to the studies of the Complex, with references on Ocreza (Carvalho, 2006; Nobre, 2006; Garcês, 2009; Ridel, 2009; Silva, 2011 Santos da Rosa, 2012; Abdul, 2013), but without any exclusive thesis up to this point. Regarding the Palaeolithic panel the first significant publications were made by Bahn (2000), Baptista (2001, 2009; Oosterbeek, 2002, 2003). At the beginning of the previous decade the site was revisited by M.V. Gomes (2010) as part of his PhD dissertation, an extensive and major work that covered the rock art of the lower Tagus basin. Another important PhD thesis integrated with the creation of the Tagus corpus was that of Garcês (2017). The researcher also focused on cervid figures of the complex, reviewing on the parallel the figurative and non-figurative art of the remaining non-submerged sites (final part of Ocreza before Tagus, Gardete, and São Simão sites) together with the old moulds. The last relevant dissertation that examined the Ocreza Horse but this time on the general Palaeolithic figurative context was that of Santos (2017).

The intensification of erosive processes in the slopes, result of the 2017 fires and the creation of a touristic trail rang the alarm. In the summer of 2021, the second panel with palaeolithic rock art engravings of the Tagus Complex was unearthed in Ocreza (Figure 17). The excavation was conducted due to the previous findings on the site in an attempt for further contextualization, as no excavation was ever made at the area, but also for conservation/preservation reasons. The major goals were to uncover rock art remains, the identification of archaeological layers, the use of updated technologies for the existed panels (e.g. photogrammetry, GIS etc.), and geoarchaeological analyses. The campaign was performed by ITM -Instituto Terra e Memória (whose director is Dr. Luiz Oosterbeek), IPT – Instituto Politécnico de Tomar, UAL – Universidade Autónoma de Lisboa, and directed by Dr. Telmo Pereira (fieldwork and lithic specialist) and Dr. Sara Garcês (rock art specialist). The team consisted of students from different academic grades, institutions, and nationalities. These were Dionysios Danelatos, Fotini Danai Preka, Felix Devis Kisena, Opeyemi Adewumi,

Isabella Brandão de Queiroz, Maria Ana Rosa, Joaquim Maças, Denise Furtado, Nehana Andrade and Mário Costa. The team was assisted by Anabela Borralheiro Pereira, Margarida Dias Pacheco, Rodrigo de Melo Santos, and Pedro Cura.

Figure 17: The new panel (OCR21) (Photo: Garcês).

3. Methods and Materials

3.1. Excavation method

As it was mentioned before the discovery of the new panel OCR20 was a result of an excavation fieldwork. The excavation of 4x4 m area (Figure 18) was opened on a path, regularly used because of the sediments covering the schist outcrops providing a smoother trail instead of the irregular already exposed rocky areas (Appendix Figure 194). Furthermore, the position was promising based on its proximity to post-palaeolithic engravings, a spiral OCR18 (Appendix Figure: 195) and other two zoomorphic figures. The excavation was directed by Dr. Telmo Pereira and Dr. Sara Garcês (Pereira, T. et al., 2021). The excavation process followed the stratigraphy. When archaeological layers were identified, the sediments were removed subdividing the geological layers in artificial levels of 5cm. The site area was divided into 16 horizontal squares 1 x 1m (1m2). Each quadrat was labelled numerically in hundreds (e.g. 100, 200, 300). The squares were subdivided in 0.5 x 0.5m (0.25m2) horizontal subunits ordered as A, B, C, D, clockwise. The sediments were sieved with a 3mm mesh, and the collected artifacts were stored and labelled with reference to the Square, Stratigraphic unit and the artificial level from where they were extracted. The sediments were also water floated with 0.01 mm mesh. Colluvial debris and sterile or sediments with recent bioturbation were sieved with meshes c.3-5 mm. Excepted from this process were sediment samples. The position of the layers' depth and of the collected and recorded material was measured using a total station and recorded with a unique individual sequential number (ID) associated with a characteristic code that identifies its nature (lithic, fauna, charcoal, rock etc.). The materials were transport at the facilities of the Earth and Memory Institute for their analysis (Instituto Terra Memória).

Figure 18: The excavation square with the top part of layer C2. Orthophoto of the 3D model (S. Garcês).

3.2. Documentation methods

Despite the publication of various methodological proposals, there is not a formal universal methodology for rock art recording. According to Brady et al. (2018) this is primarily a result of the different needs and possibilities of the research team (budget, equipment, time etc.). Other parameters that equally affect it are the variation of the context of the studied site (location, environmental or anthropic interventions, state of rock art), the experience and the decision-making of each researching team. Brady et al. (2018) highlights as well, the attempt to seize on the advantages of the rapidly and constantly evolving digital technology that results in the re-evaluation of the applied techniques. In general, documentation is important for

scientific research, publications, and preservation. Rock art recording can be defined as any form of visual documentation of rock art and its environment. This involves the acquisition of analogical and digital photographs, illustrations (drawings and tracings) and 3D models virtual or real (Sanz, 2014).

Following the works of various authors such as Domingo et al. (2013), Alexander et al. (2015), Robert et al. (2016), Ruiz et al. (2016), Garate Maidagan et al. (2016), Garcês (2017) in the current study the methodology applied involved the creation of a record in the form of a field sheet, digital photography, direct and indirect tracing, and virtual 3D modelling. Digital documentation is evident throughout the methodological outline. It provides records that can be accessible all over the world, at any time and by anyone. It makes possible the easier and faster use of the recorded data for scientific, educational, or conservational reasons. Digital data usually require smaller storage capacity than the traditional forms, can be accessed more easily and face less possibilities of damage. Nevertheless, sometimes vice versa, under specific conditions, the cost, the size of the created files, and the need for experts on the software used can be listed as well among the limitations (Brady et al., 2018). The methods presented analytically in the following parts are divided in field and laboratory.

3.2.1. Documentation methods in the field

3.2.1.1. Field sheet

Important part of the fieldwork is the filling of a field sheet with all the necessary details of the rock art panels. The form used has been created from rock art researchers of the ITM - Instituto Terra e Memória. It is consisted of two pages: The first page (Figure 19) has a section for the record number, the date and the name of the researcher fulfilling the form. Besides these, general information regarding the site (location, type, geological details, conservation state of the panel) is asked together with a general sketch of the site. The second page (Figure 20) focuses on the description of the panel accompanied with a sketch of the rock, the production techniques, and other observations. The advantage of this documentation form is that it contains all the necessary data for the systematization of the research and the rapid analysis of the results.

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FICHA DE CAMPO DE ARTE RUPESTRE

Record n.°____ DATE _____NAME_____			GENERAL SITE ASPECTS				
			Type of site			Geology/Geomorfology	
Location		Access itenary (description)		Barrier		Type of rock	
Site name				Rock shelter		Coloration	
Council				Cave		Current environment	
Parish				Hill		Forrest	Cultivation area
Location				Plain land		Sterile	Other
District				River		Proximity	
Region				Submerged		Spring	Water body
Military map n.°				Other (description)		Habitation	Communication road
Coordinates GPS						Archaeological site	
Elevation						Type:	

General sketch of the site (draft/sketch)	General state of conservation	
	Very good	Satisfied
	Bad	Very bad
	Description of causes	
	Chemical Alt.	
	Anthropic Alt.	
	Fisical Alt.	
	Other:	
	Status of the site	
	Public	Private

Figure 19: First page of the documentation sheet.

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FICHA DE CAMPO DE ARTE RUPESTRE

Description of rock number _____			Sketch of the rock in relation to its environment
Maximum dimensions (in cm)	Width		
	Height		
	Ground height		
	Inclination		
Orientation _____			
Coloration			
Support	Horizontal	Vertical	

TECHNIQUE								Photo of the technique used		Observations
Engraving					Painting					
Engraving technique	Incision		Simple line		Technique	Buffered				
			Continuous line			Finger painting				
	Abrasion		Single line			Blowing				
			Repetead line			Pencil				
	Pecking		Superficial			Continuours				
						Discontinuous				
			Deep		Bichromy					
					Polychromy					

Notes:

Figure 20: Second page of the documentation sheet.

3.2.1.2. Photography

Photography has been diachronically a precious tool not only for documentation reasons but also for interpretation, and preservation of the initial capture of a panel at the time of the study (Brady et al., 2018; Robert et al., 2016; Garate Maidagan et al., 2016; Garcês, 2017). Digital photography was used as it allows a great number of pictures to be captured, high-resolution analysis, and further processes, like digital tracing, and the creation of 3D models. In total, over 580 photos were collected. Aerial drone footage was also taken to capture the aerial perspective of the excavation area, the site location and that of the panel. In addition, the methodology applied for the documentation of the panel was also recorded with digital photography (Figure 21). The collected photographs of the panel were captured not only during excavation, but also during three-night sessions, after the excavation ended. Night sessions give the advantage of using artificial light. The manipulation of the light angle is extremely useful for engravings that are not deep and profound or in cases that the rock support does not provide a clear view of the figures due to issues of texture, patina, or weathering. The interplay of the light with the shadows can reveal different perspectives that are not always visible. Two types of light devices were used a spotlight and flashlights. Except the combination of flashlights, some photos were taken while using a single flashlight. In all cases the camera was in a stable position, on a tripod, focusing at the beginning on the whole panel, and afterwards on specific points and figures, while the light angle was rotating. Four examples of photos captured during the night tracing are the ones in Figure 22. For the image acquisition were used the following cameras:

1. Fieldwork photos: Nikon D3300, Canon EOS 7D
2. Fieldtrip photos: Canon PowerShot G1 X
3. Night tracing: Canon EOS 5D Mark II
4. 3D model: Canon EOS 5D Mark II, Canon PowerShot G1 X, Sony DSC-HX60

Figure 21: Documentation of the Excavation process through photography (Left image) (Photo: S. Garcês), Documentation of the panel through sketching (Central Image) and digital photography (Right image) (Photo: F. Preka).

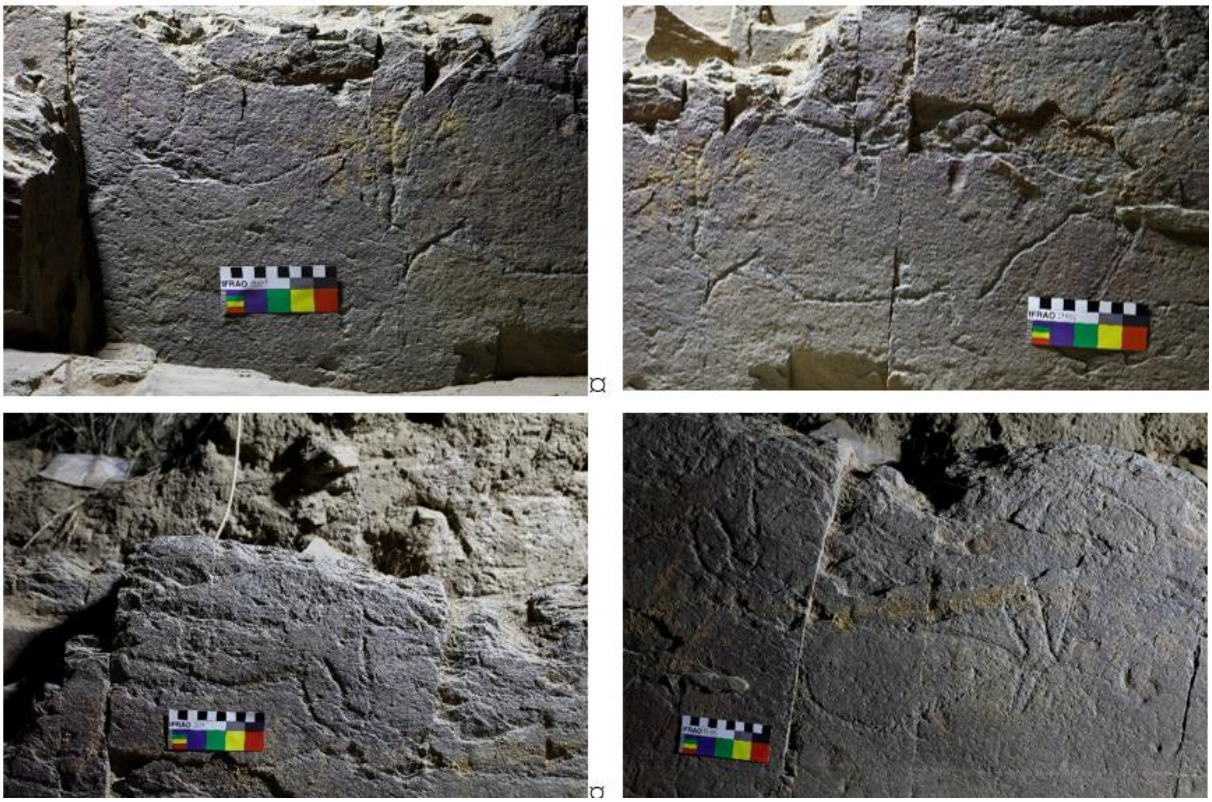


Figure 22: Night captures used for the Detailed Photos (Photos: H. Collado Giraldo).

3.2.1.3. Direct tracing

The method of direct tracing was chosen additionally to provide a complementary view of the figures and the techniques used on the panel OCR20. The aim of direct tracing is to depict all the essential elements of the panel, anthropic and natural traces (marks, figures, cracks, fractures, and rock edges). The methodology that was followed has been used with success in the past in the Tagus complex (Garcês and Nash, 2022; Garcês, 2019). It was initially developed in Valcamonica rock art sites (Fossati, Ludwig, Abreu, 1990; Abreu, Jaffe, 1996; Fossati, Arcà, 1997; Fossati, 1997 *apud* Garcês and Oosterbeek, 2014). It can be applied only in panels with engravings, that lack fragile surfaces. The procedure was conducted in a one night session due to the benefits of artificial light that have been discussed previously. The materials used were plastic translucent sheets, blue tack and permanent markers. Two plastic sheets of A1 size (594 × 841 mm) and 0.8 mm thickness were applied covering two division of the panel, having a small intersection (1 cm) which was sketched in both sheets to retain the continuity of the details. The plastics were attached in the rock support with blue tack in the perimetry of the panel, in places without anthropic traces, following a horizontal disposition from left-to-right (Figure 23). At the edge of the plastic sheet was written the number of the tracing (e.g. Plastic 1), accompanied with a 10 cm scale. They were signed with the names of

the authors and date (day/ month/year). Different colours were used for the different techniques, following the code blue for incisions/abrasions, black for peckings, and red for cracks and fractures (Figure 24). In the solely clearly identified case of superimposition at that time, the colour selected for the older figure was green (Figure 26).

Figure 23: Placing the plastic with blue tack. (Photo: K. de Aguiar Ribeiro).

Figure 24: Capture during the procedure of direct tracing. Pecking marks are highlighted with black colour, while fractures are with red (Photo: K. de Aguiar Ribeiro).

Figure 25: The final result of the direct tracing. (Photo: K. de Aguiar Ribeiro).

The final tracing (Figure 25) was scanned in A0 scanner (Figure 26). The digital image was saved in a .jpeg and .tiff.. These file formats are compatible with a wide variety of digital image processing software. After this step the produced scanned images were united and digitized using Adobe™ Photoshop® (Figure 27). The techniques, the fractures, and one superimposition were separated in different digital layers to be compared with the previous indirect digital tracings) to create the final digital tracings.

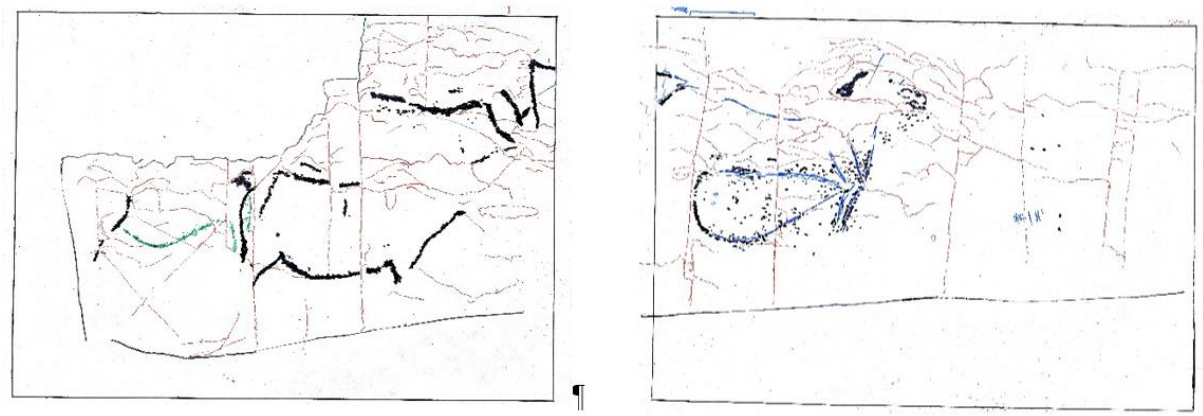


Figure 26: The two plastic sheets scanned.

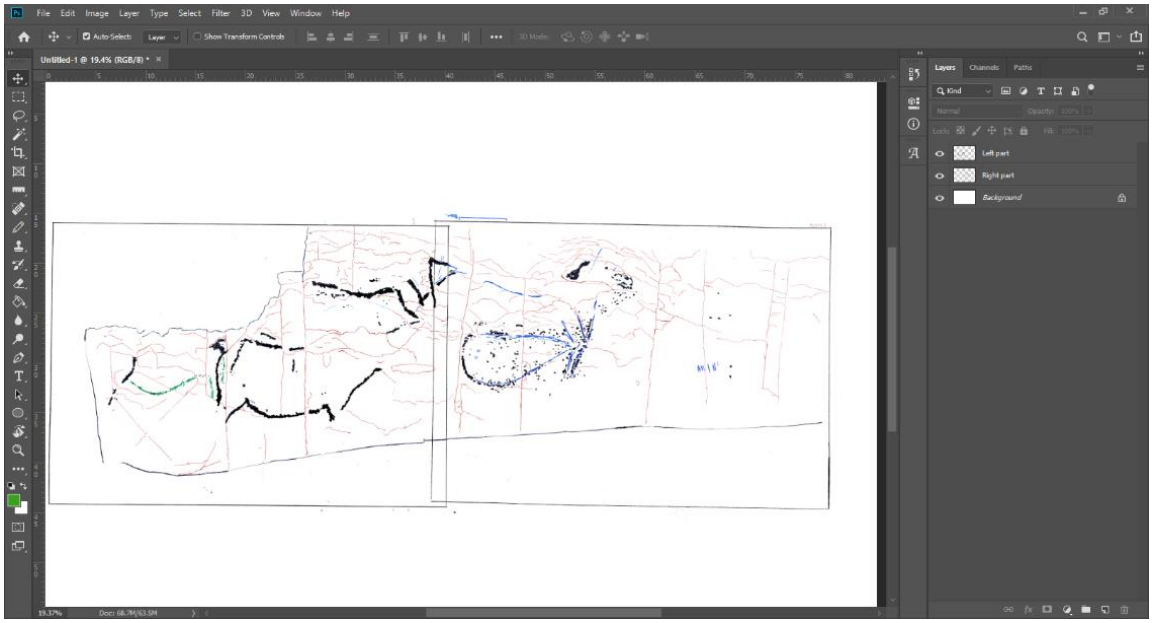


Figure 27: Uniting the direct tracing sheets after scan with Adobe photoshop, prior to the elimination of the frames.

The advantages of the current methodology are the following: First, it provides a high level of accuracy, allowing to understand a number of details that are only possible by the physical observation of the panel (Figure 28), it is not destructive (as long as it used wisely and under the condition that the rock surface is not fragile and there is absence of pigments). In case of a mistake during the tracing, the problem can be easily solved by erasing the marker lines on the plastic surface using alcohol. In addition, it has a relatively cheap cost, and the sheets can be easily transferred due to their light weight. Finally, the size of the sheets can be adapted to regular A0 scanner machines.

Figure 28: Inspection of a possible continuation of pecking marks (Photo: K. de Aguiar Ribeiro).

3.2.2. Documentation methods in the laboratory

3.2.2.1. 3D modelling

In rock art studies 3D modelling is extremely useful due to the accuracy in details, the compatibility with high-definition recording, digital enhancement processes, spatial contextualization, and statistical analysis (Angás and Bea, 2014; Fritz et al., 2010 *apud* Rivero and Ruiz, 2018; Jaillet et al., 2018). Furthermore, replicas can be created in digital versions or in physical objects based on the digital model (Pieraccini et al. 2001; Jaillet et al., 2018). This action can offer replicas for exhibition, study or even as merchandise, while heritage is being protected (Pieraccini et al. 2001). According to Pieraccini et al. (2001) in general, digital photogrammetry, pre-requirement of the digital 3D modelling, can be beneficial for the conservation of heritage. Digital restoration allows experiments without harmful effects on the items restored. Monitoring open environment monuments with the detection of deformations and cracks is also aimed using photogrammetry (Pieraccini et al., 2001). Nevertheless, a major point that needs attention according to Rivero et al. (2019) is the 3D modelling workflow. In some cases, major concepts related to photogrammetry, together with the adaptability that new technologies provide are neglected by researchers following a very strict workflow. This can lead in complications regarding the accuracy, which is already highly depended on the complexity of the panel geometry.

For the documentation of the new panel the image-based 3D modelling process was used. In this process 2D photos are selected for the creation of 3D models (Quan et al, 2007). After the image acquisition non-contact systems based on light waves, active or passive sensors generated the model (Remondino and El-Hakim, 2006). Based on common points of at least two photos the necessary geometry is generated and apart from the geometric texture created, the surface texture of the objects can be depicted as well (Alshawabkeh et al., 2011). Nowadays, image-based 3D modelling is a tool recurrently used, in both archaeological fieldwork and the heritage sector (Alshawabkeh et al., 2011).

Three 3D models were created with three different compact digital cameras (Table 4). The first one (1.) was created with Low Quality with 103,979 faces and 53,194 vertices, using 136 aligned cameras captured with the Canon EOS 5D Mark II. The second model (2.) was made with Ultra High Quality with 21,979,299 faces and 11,038,399 vertices, using 64 aligned cameras captured with a Canon PowerShot G1 X (15.1 mm). These two models were used as trials, although the second due to the high quality was used additionally for inspection. A third and final model (3.) was created in a more balanced resolution to be compatible with computers

that have more moderate graphic cards and Ram. The produced model had 5,818,144 faces and 2,920,220 vertices, and there were used 32 aligned cameras captured with the SONY DSC-HX60 (Table 5). The model was made as well in Ultra High Quality, but the difference was in the number of selected cameras and the mild filtering mode of depth maps instead of the aggressive mode selected on the previous model. These differences gave an advantage reducing the time required, while providing a fine model in a slightly lower quality compared to the second 3D model. The model aimed the acquisition of a high quality orthomosaic/orthophoto that would be used for the digital tracing. The potential asset of the 3D orthophoto is the enhancement of the depth of the engravings. The various marks on the panel surface are shown better, based on the photogrammetry rules with the merging of the different shades recorded with the night photos. 3D 1. and 3D 3. were created using photos captured during night sessions with artificial light manipulation, while 3D 2. was created with photos taken during the daylight.

3D No.	**Camera Model**	**Resolution**	**Focal Length**	**Pixel Size**	**Aligned photos**	**3D model quality**
1.	Canon EOS 5D Mark II (50 mm)	5616 x 3744	50 mm	6.55 x 6.55 μm	136	Low
2.	Canon PowerShot G1 X (15.1 mm)	4342 x 3264	15.1 mm	4.3 x 4.3 μm	63	Ultra High
3.	Sony DSC-HX60 (4.3 mm)	5184 x 3888	4.3 mm	1.39 μm²	32	Ultra High (Mild filtering)

Table 4: Major differences in the camera models used, the resolution of the images, the focal length, the pixel size, the number of the aligned photos and the quality of the three-3D model produced.

Below it is presented the process that was followed for the creation of the final 3D model (3.). The 32 pictures that were selected, were taken along the length of the panel. The panel was measured with a conventional measuring tape, overlapping photographs were acquired from a distance from a closer range covering the whole panel and its details. The images were captured facing the object from Southwest to Northeast, while moving in a parallel straight line from

left to the right and covering from different angles the object, always taking into consideration the necessary overlap between the two-dimensional photos.

Camera brand	SONY
Model	DSC-HX60
Focal length	4 mm
F-stop	f/3.5
ISO-speed	1600
Lens	35mm focal
Shutter speed	1/13 sec

Table 5: Camera parameters for image acquisition.

The production of the 3D model was performed in a desktop with Windows 10, 64-bit operating system, a 32GB RAM and an AMD Ryzen 3 3100 4-Core Processor with 3.60GHz. The images were imported at Agisoft Metashape Professional 1.6.3 build 10732.) following Plisson and Zotkina (2015) for the great possibilities offered; dense point clouds with pixels that have spatial coordinates, meshed, measurement and cross section options and its compatibility with other software (for example ArcGIS, QGIS and Meshlab).

The workflow that followed the import started with the preparation of the images. Initially the process involves the import of the selected images. The cameras were calibrated automatically. Next, a point cloud was generated (Figure 29). The process continued with the image alignment, the automatic reconstruction of the image scene, matching the images automatically through common feature points. In addition, reference points were given. The panel was referenced by measuring real distances between points and assigning the measured distance to scale bars in the software's interface. A local Coordinate Reference System was created with manually applied CRS points, as a total station for exact Ground Control Points (GCPs) was not available, but the exact position of the excavation and of the panel were aquired during excavation using a GPS-RTK; therefore, both the excavation and the panel are georeferenced. This part is a requirement for building a Digital Elevation Model (DEM) and an Orthomosaic/ Orthophoto. Five measured distances were taken into consideration. To create measured distances (scalebars) it prerequired to add points. A second attempt was made with 3 measured distances in a triangle shape to minimize further the errors (Figure 32). The scene geometry got better with the automatic optimization of the camera parameters and the triangulation. A dense point cloud was built (Figure 30), a 3D mesh (Figure 31), and an Orthophoto (Figure 33). Among the benefits of 3D modelling are the accuracy in geometry and details, the possibilities for further statistical or other numerical, and spatial analyses, the manipulation of

perspective, the representation of the morphology, the accessibility to the site without the physical need, at any time (Jaillet et al., 2018).

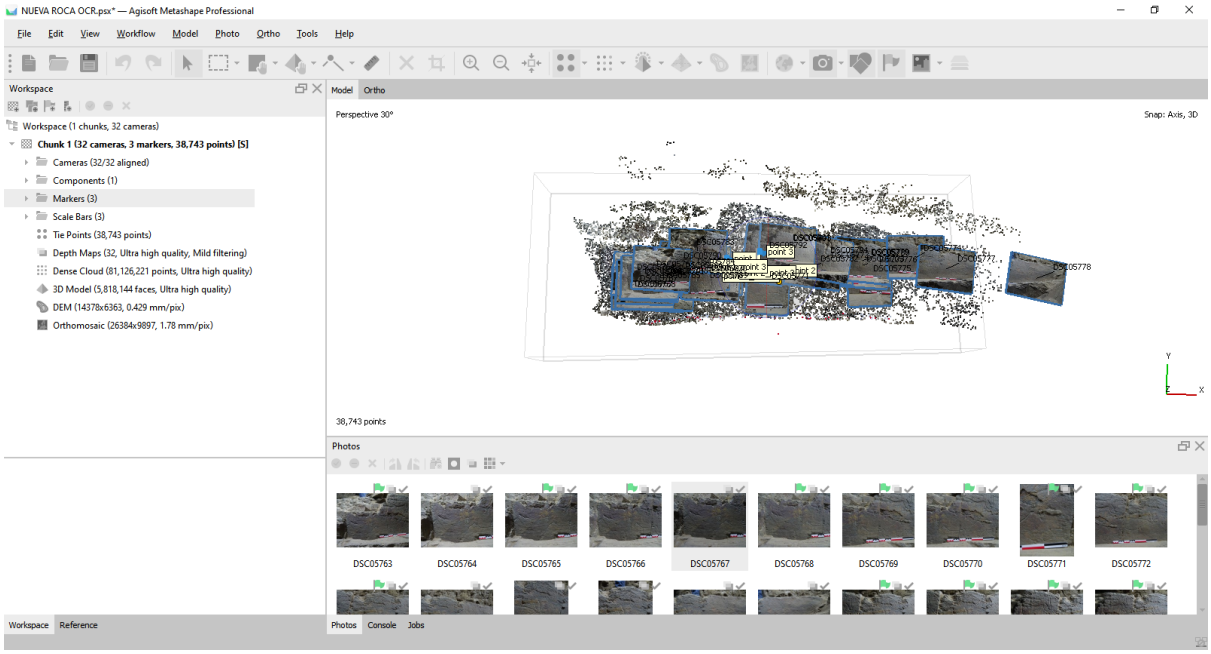


Figure 29: Point Cloud with the thumbnails of the images used in Agisoft Metashape interface.

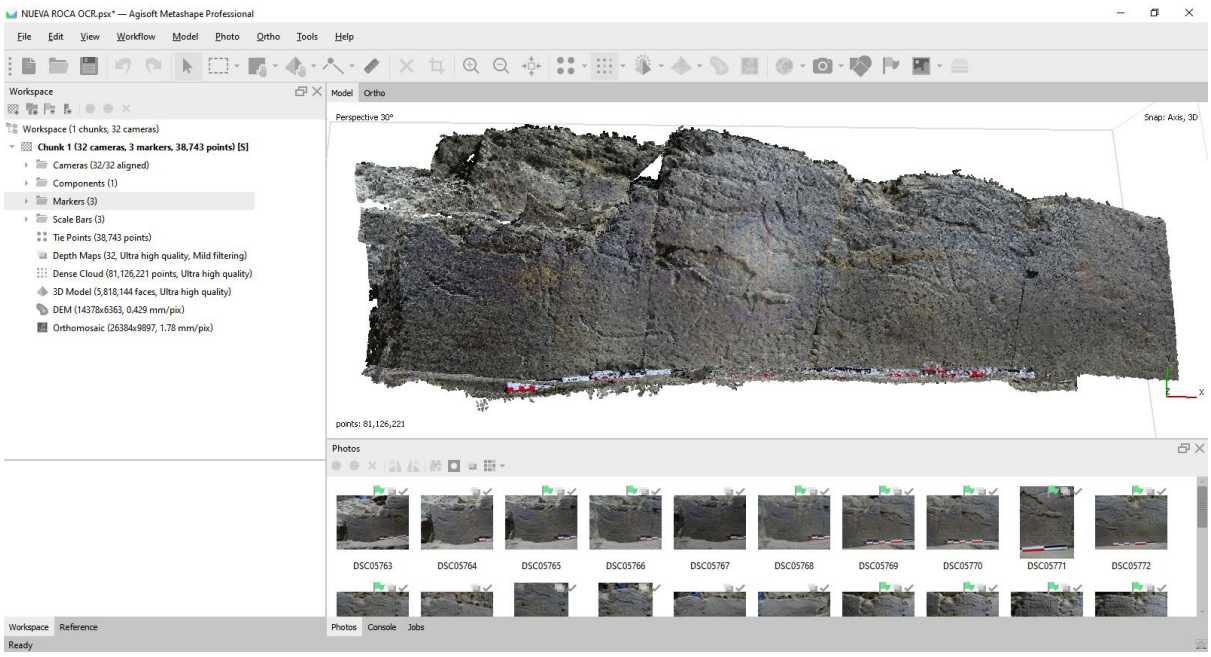


Figure 30: Dense Point Cloud in Agisoft Metashape interface.

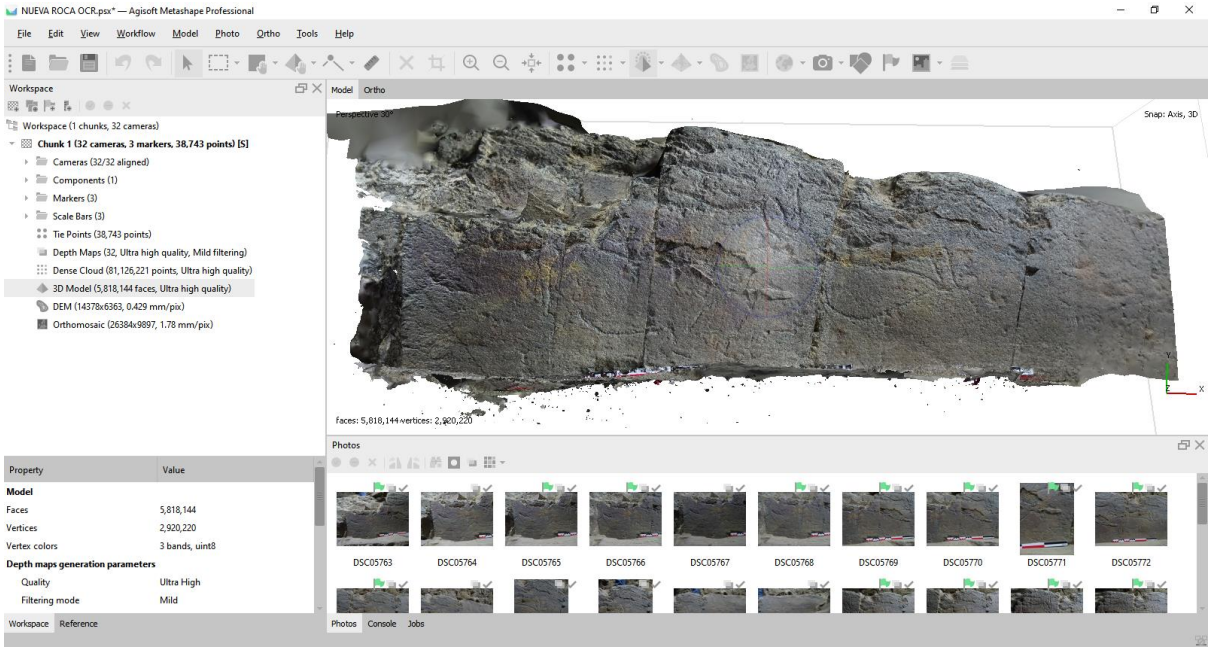


Figure 31: 3D mesh in Agisoft Metashape interface.

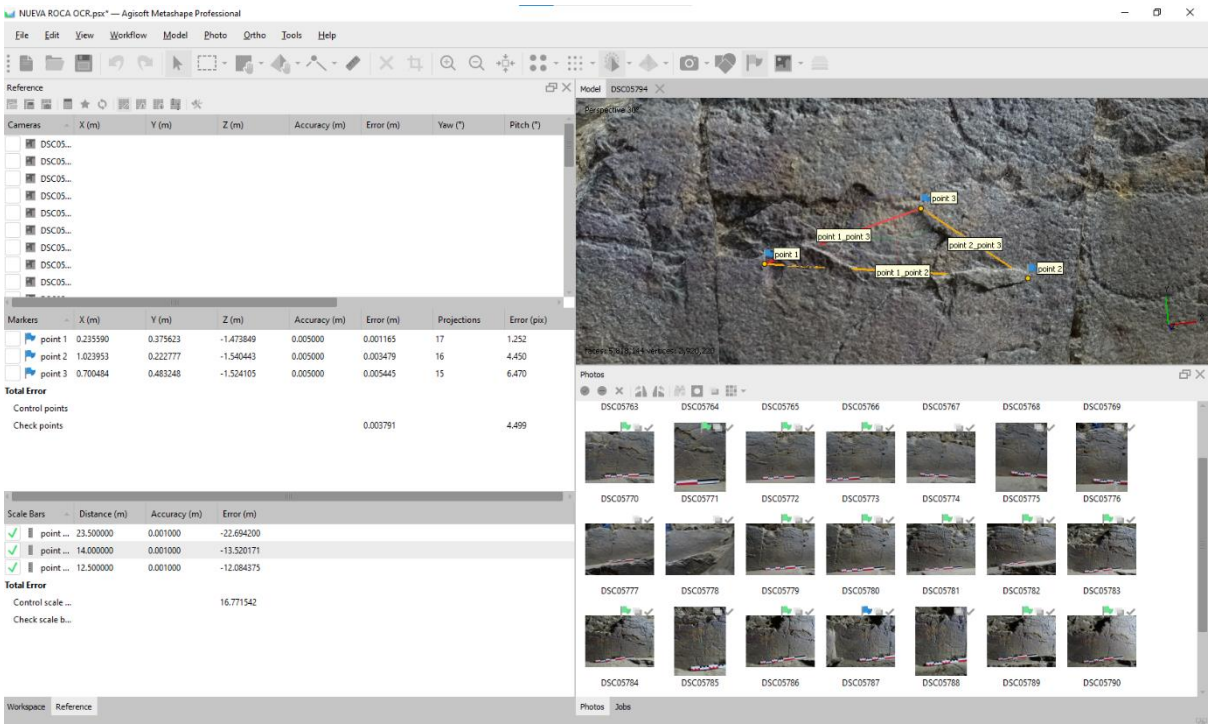


Figure 32: Application of CRS with three measured distances.

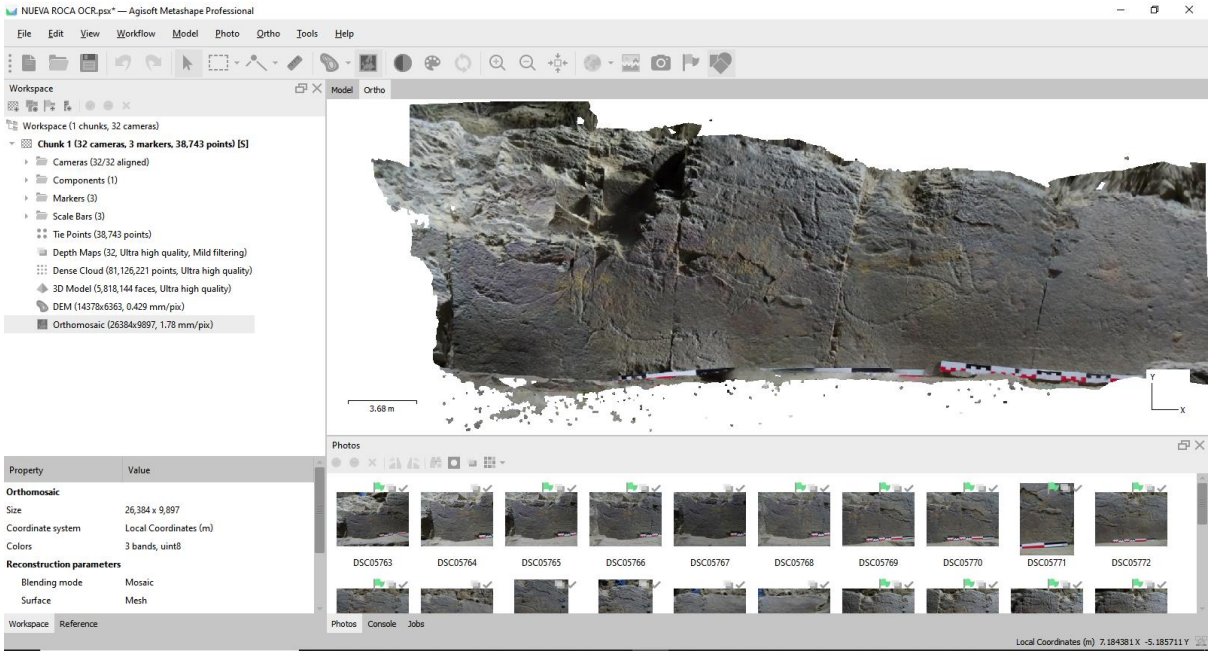


Figure 33: Orthomosaic in Agisoft Metashape interface.

3.2.2.2. Digital tracing (indirect)

Initially prior to direct tracing, digital tracing was selected as a regular method of rock art documentation due to the facts that it is a non-destructive technique, it presents a high level of accuracy, involves easy processes and manipulation of data, allowing an inspection of details that sometimes cannot be traced by the naked eye, while additionally, it can be time saving compared to direct tracing regarding the fieldwork (e.g. photography requires less time than direct tracing, and there is an immediate digitization). Like in direct tracing, the primary goal remains to document the rock art and other important features of the panel. It provides an entire range of possibilities for the produced data. The traced elements can be separated in different layers, duplicated, modified, and erased offering different views that are valuable for the interpretation of the representations.

The software that was used for the digital tracing was Adobe Photoshop CC 2019 20.0.5. for a Windows x64 operating system. It can be listed among the most common image enhancement programs that rock art researchers use (Bardy et al., 2018). According to Bardy et al. (2018) there are two categories of image enhancement techniques. The first category is considered a conventional one with software such as Adobe™ Photoshop®, Gimp®, Multispec®, or similar that offer tools like channel mixers, filters, contrast, brightness, and saturation. The second presents more advanced techniques like MIA - Multispectral Image Analysis, PCA - Principal Components Analysis, ©DStrecth - Decorrelation Stretch, and others.

The panel was processed in three phases. The first phase focused on specific figures and traces of the panel (Figure 34). The goal was the production of detailed tracings and layers. A series of stable close-range photos were used, presenting different shades caused by the rotation of the artificial light around the panel. The light-shadow interplay led to a comparison of the photos that had as a goal the identification of the anthropic marks on the rock surface. New layers were created and were named after what the tracings could have resembled in terms of techniques (peckings, incisions, abrasion) and graphic units (GU). Extra layers were created for the fractures and a blank layer in white colour, which later became more transparent to allow viewing in the background the rock support. The fractures were examined carefully to understand better the morphology of the rock surface and address the question whether they influenced the creation and the shaping of the figures. The generated layers can be masked, enhanced, or exported individually allowing a better inspection. Some of the tools that were used have been: the pencil tool (filling the peckings) (B), the pen tool (for incisions) (P), the eraser (E), the paint bucket (G), and the magic wand tool (W). Based on the size of the peckings, the size of the pencil changed accordingly. Furthermore, in cases of a superimposition and when some elements were not clearly attached in a specific contour, alternative hypotheses were traced, to analyse better the representations. Pecking marks and the fractures were painted black. Incisions and abrasions were marked with blue colour. Their differentiation in specific parts regarding the limits of single incisions and abrasions caused by multiple incision the requires further inspection with macrophotography. For the representation of the superimpositions were selected different colours, red and green, (Figure 35). The colour overlay option was proved useful for altering the colour of already made graphic units that were superimposed. Different groups of layers (Hypotheses, Photos, etc.) were created to organize better the work surface.

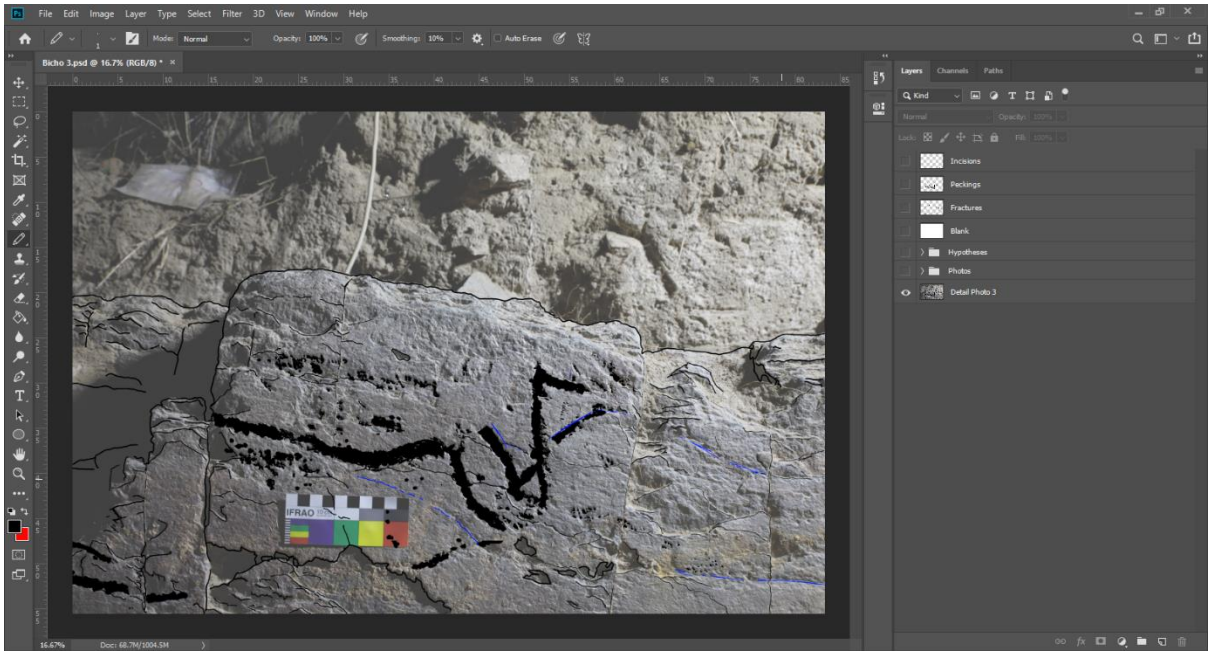


Figure 34: Example of Detailed photo 3 and its workspace.

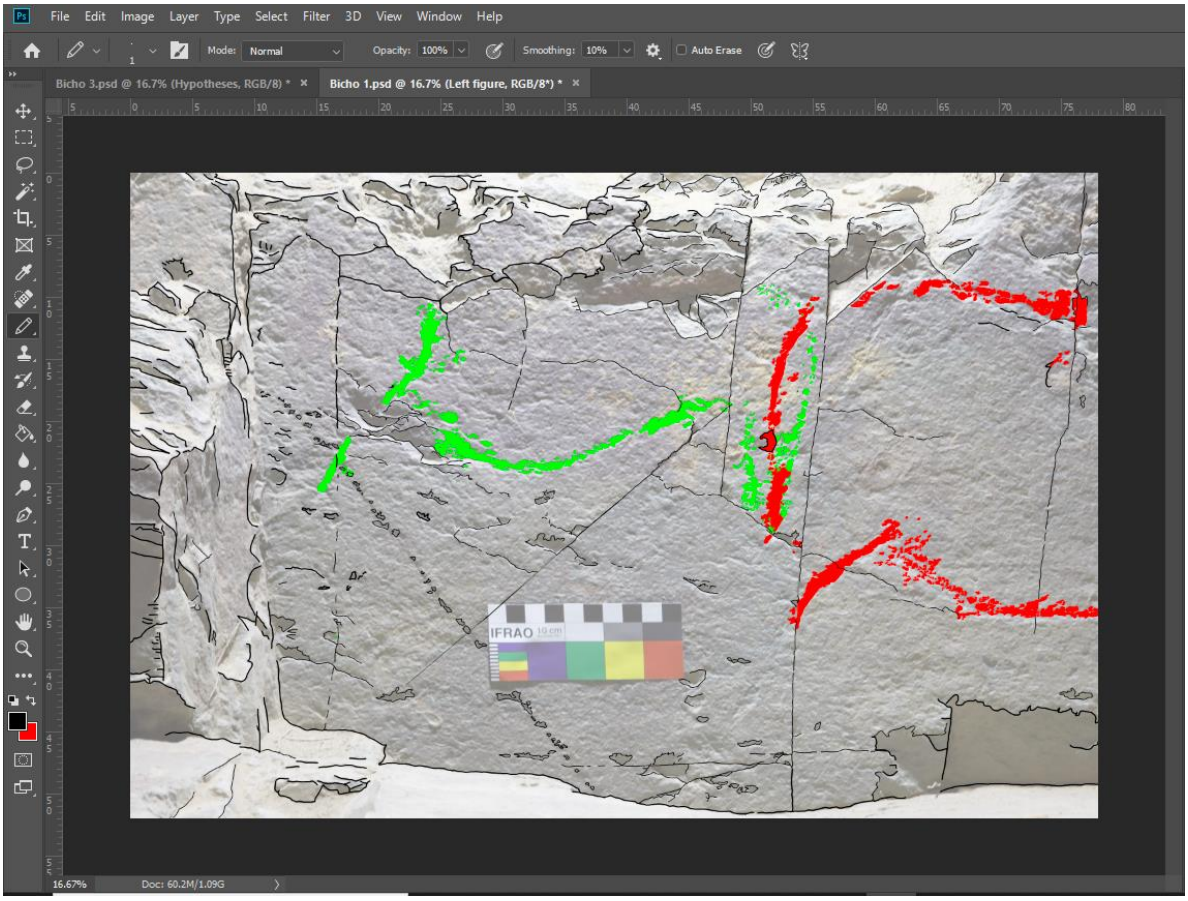


Figure 35: Superimposition traced in Detailed picture 1. Green colour corresponds to the GU1 together with GU2 in green, with the latter found under the red GU4 that is presumably younger as it was made after the GU2.

At the second phase, the detailed photos were compared with the digitized layers of the direct tracings. At the final phase, a new psd. file was created to cover the whole panel. The layers

with the tracings previously created were placed all together above a rasterized layer with the orthophomosaic created by the 3D model of the panel. The orthomosaic was transformed by the settings with the contrast tool in black and white coloration to provide enhanced details. In addition, there were added the digitized layers of the direct tracing for bigger accuracy. Both layers from the direct tracing and the detailed tracings were compared to assure the limits and the presence of the real marks of the panel. Because the previous tracings were made on captures with specific orientation and size, they tend not to fit 100%. To overcome this obstacle either they were reshaped adjusted on the orthophoto using the Free transform selection (Ctrl+T) or they were created anew upon the orthomosaic. The final tracing had groups with layers of each graphic unit, the graphic units' numbers, the techniques, fractures and a scalebar (Figure 36).

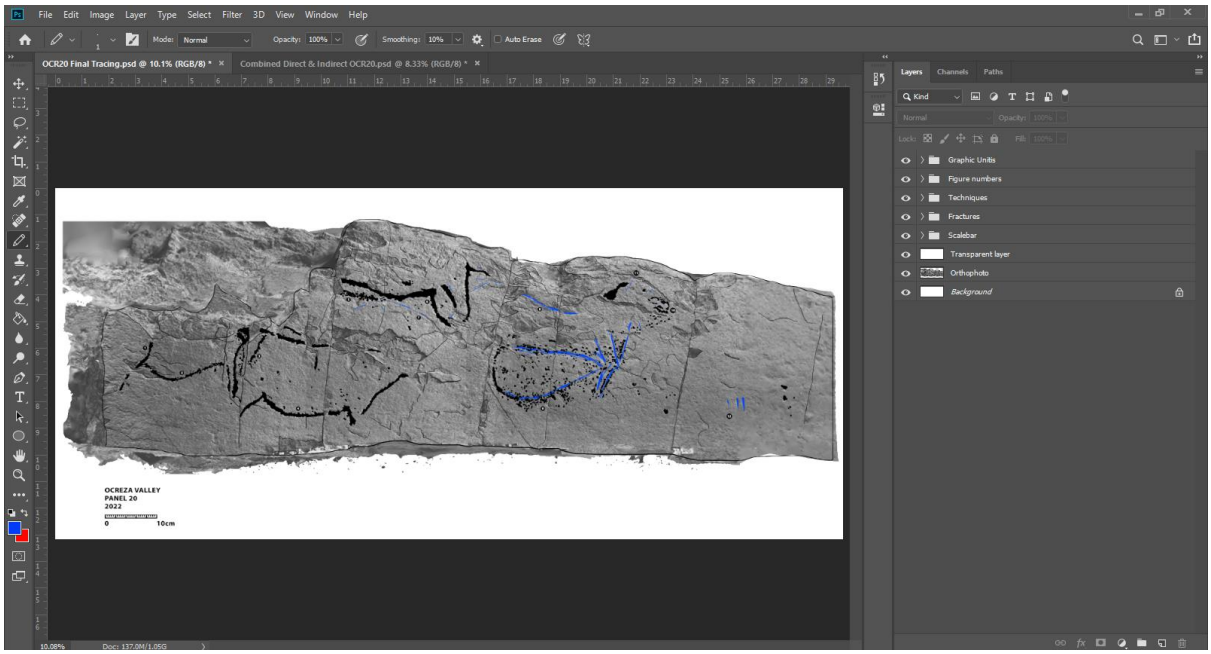


Figure 36: Capture from the final tracing.

Adobe™ Photoshop® gives the option to save the layers in various digital formats like .jpeg and .png (images) .psd (project) or .pdf. For illustration purposes, the format .png was selected for the tracings published on this dissertation. In the final stage a scale bar was created based on the IFRAO scale that visible in the captured images.

The main benefits of digital tracing are 1) to provide great accuracy, 2) it is a non-destructive documentation method, 3) facilitates the analysis of the rock art with a wide range of digital tools, 4) it carries common benefits of digitization, such as the easy transfer of the archives for

research or publication purposes (online/USB), and 5) it can have a relatively low cost, depending on the choices of the researchers. On the other hand, it is important to acknowledge here that the indirect tracing is highly influenced by the individual's perception, experience, the quality of the photos (angle of light, camera pixels), software and hardware capabilities and the state of the panel (how evident are engravings/or paintings and the preservation of the rock surface), thus a risk for mistakes proportionally exists. So, the final product is a result of the researcher's projection/view of the rock art panel, which can be also the case for direct tracing (Brady et al., 2018). When the figures do not have clear outlines, especially in cases of superimposition, or when the rock support might interplay with the art, cross-examination is required using other recording techniques, but also other researchers' opinions.

3.3. Literature research and fieldtrip visits

To understand further the general context of the engravings (i.e. possible chronology, animals represented, techniques applied, cultural practice, etc.) literature research followed the documentation, searching for similarities within the general framework of rock art in the Iberian Peninsula. Because the prehistoric hunter-gatherer artistic behaviour was not limited to panels in open air sites, cases of portable art, engravings, and paintings from rockshelters and caves were examined as well. Major focus was given on important open-air sites of Western Iberia such as the open air sites of Côa Valley (Canada do Inferno, Penascosa, Ribeira dos Piscos, Fariseu, Quinta da Barca, Faia, etc.), the Tagus Valley Rock Art Complex, Poço do Caldeirão, Pousadouro, Foz Tua, Mazouco, Siega Verde, Guadiana, Piedras Blancas, Domingo García and the caves of Escoural, Maltravieso, La Cueva del Moro, Mina Ibor, La Pasiega, La Pileta, La Griega, Nerja and the mobiliary art from Parpalló, Vale Boi and Foz do Medal.

In addition, to train the eye of the author on in situ visual aspect of the techniques applied at open air engravings in primary position, the shapes of the representation, and to collect photos of panels and also to gain relevant information, a number of visits were made to the Upper Palaeolithic rock art sites of Canada do Inferno, Penascosa, Ribeira dos Piscos and Fariseu, Siega Verde and Mazouco (Figures below: 37-41) and the Côa Valley Museum. It must be noted though that only a limited number of panels where available following the tour guides' regulations. The only exception was the site of Mazouco that is accessible without a guide, but currently presents a single panel.

Figure 37: A capture from Siega Verde (Photo: D. Danelatos).

Figure 38: A capture from Ribeira dos Piscos (Photo: D. Danelatos).

Figure 39: A capture from Fariseu with a panel that was covered under sediments, which was unearthed after excavation fieldwork (Photo: S. Garcês).

Figure 40: A capture from Canada do Inferno with a panel at that time exposed above the level of the Côa River (Photo: S. Raimers).

Figure 41: An enormous incised auroch located in a visible but hard to access area in Ribeira dos Piscos (Photo: D. Danelatos).

3.4. Materials

3.4.1. OCR 15

The OCR15 (Figure 42) is a sub-horizontal panel (48 X 24 cm), with southeast orientation, which today stands out with its unique coloration and shape, uncovered from lichens, on a platform made by exposed schist outcrops. The rock surface is highly smoothed, and it is altered by water erosion. This weathering process has affected the engraving altering its texture and depth. The rock support presents grey-blue coloration, and it is patinated. Represented here is a single figure together with sparse pecking marks.

Figure 42: The Ocreza Horse panel (OCR 15) (Photo: K. De Aguiar Ribeiro).

3.4.2. OCR 20

The new panel (OCR 20) is found as well in a schist support, but on a vertical surface with bigger dimensions (1,90 X 0,48 m) (Figure 43). The rock surface exhibits a rather complicated panel, with fractures and cracks, broken, incomplete or not well-defined figures and marks, with a few cases of superimpositions. The panel can be divided in six parts based on slightly inclined vertical natural fractures. At the time that was uncovered by the archaeological excavation it had a grey coloration. After its exposure, due to the chemical weathering process of oxidation presents a grey-orange colour. The panel presents figurative art, together with several engraved lines and pecking marks.

Figure 43: The new panel (OCR20) (Photo: H. Collado Giraldo).

4. Results

4.1. Excavation

The excavation fieldwork was fruitful leading to the discovery of a new rock art panel in Ocreza. The panel was unearthed in a slop area, under colluvial sediments that in total did not exceed 1m height. Nine stratigraphic Units (S.U.) were identified, including the bedrock. They were consisted mainly by colluvial depositions with silts and sands, mixed with schist blocks and fragments, coarse quartz sand, schist of greywacke pebbles (Figure 44).

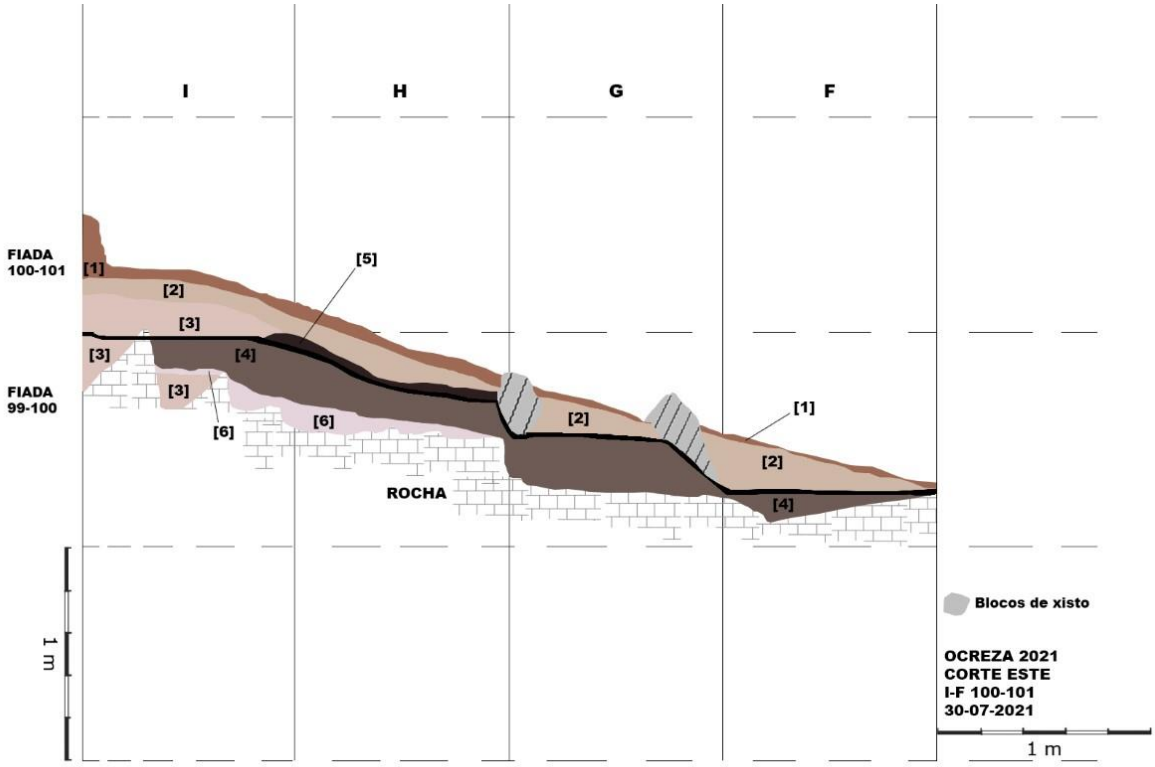


Figure 44: Transversal view of the stratigraphy (Original sketch: T. Pereira; Digitization: D. Danelatos and S. Garcês).

Despite the absence of clear Palaeolithic artefacts, a hearth was identified at SU 4. A sample of Ericacea charcoal remains collected from it was sent for radiocarbon dating at the Waikato Radiocarbon Laboratory and provided a date of c. 1,710-1,548 cal BP. Because SU 4 partially covers the panel, it suggests that the panel was already covered during the Roman period, and the engravings were made prior to this occupation. The prehistoric artist(s?) used a vertical area of c. 1,90 X 0,48 m. The small number of lithic tools that were collected, three flakes of quartzite and a fragment of a flint flake, lack of diagnostic evidence for technocultural dating. During the excavation there were also traced three unidentified representations. Further inspection with photography, direct and indirect tracing brought to the light further elements and increased the number in at least four.

4.2. Fieldsheet

The final fieldsheet of OCR20 (Figure 45, Figure 46) was digitized and they were added to it the digital versions of the site's sketches made by T. Pereira, the panel sketch made by the author in Adobe™ Photoshop®, and two digital photos captured by H. Collado Giraldo with the techniques that were used for the creation of the engravings.

Instituto Terra e Memória – Grupo "Quaternário e Pré-Histórica" do Centro de Geociências (uID73 – Fundação para a Ciência e Tecnologia)

FICHA DE CAMPO DE ARTE RUPESTRE

Record n.º 1 DATE 30/7/2021 NAME Dionysios Danelatos

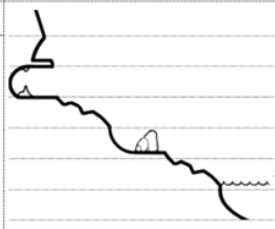
Location	
Site name	Vale Do Ocreza
Council	Mação
Parish	Envendos
Location	Vale Da Rovinhosa
District	Santarém
Region	Ribatejo
Military map n.º	323
Coordinates GPS	39°32.763'N 07°49.537'W
Elevation	58 m.a.s.l

Access itenary (description)

Access by car from A23 motorway with direction Abrantes-Castelo Branco. At São José das Matas exit, take the E359 road, turning left at the E359-1 interchange. After 250m, turn right and follow a 4km dirt road. Rest of the path on foot towards west.

GENERAL SITE ASPECTS

Type of site



Observations: Situated on a trail path, uncovered of woods.

Barrier	
Rock shelter	
Cave	
Hill	
Plain land	
River	X
Submerged	
Other (description)	

Geology/Geomorfology

Type of rock	Schist
Coloration	Grey

Current environment

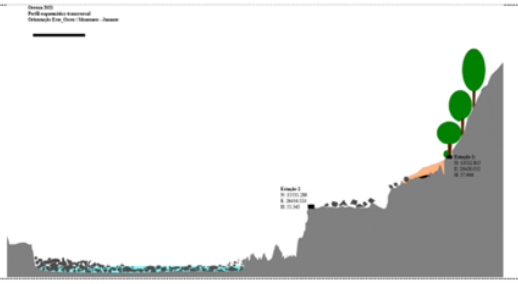
Forrest		Cultivation area	X
Sterile		Other	

Proximity

Spring		Water body	X
Habitation		Communication road	

Archaeological site	X
Type: Open air rock art site	

General sketch of the site



General state of conservation

Very good		Satisfied	X
Bad		Very bad	

Description of causes

Chemical Alt.	?
Anthropic Alt.	?
Fisical Alt.	X
Other:	

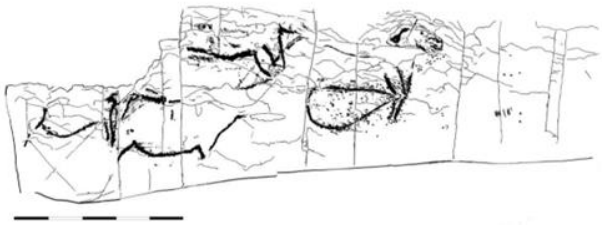
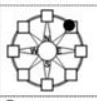
Status of the site

Public	X	Private	

Figure 45: First page of the documentation sheet informed with a digital sketch of the site made by T. Pereira.

Instituto Terra e Memória – Grupo "Quaternário e Pré-Histórica" do Centro de Geociências (uID73 – Fundação para a Ciência e Tecnologia)

FICHA DE CAMPO DE ARTE RUPESTRE

Description of rock number OCR20					Sketch of the rock
Maximum dimensions (in cm)	Width	1.90 cm max. rock surface 3.27 cm			
	Height	0.48 cm (Mid of Panel)			
	Ground height	-			
	Inclination	-			
Orientation Northeast		30°			
Coloration	Grey				
Support	Horizontal		Vertical	X	

TECHNIQUE										Photo of the technique used		Observations
Engraving						Painting						
Engraving technique	Incision	X	Simple line			Technique	Buffered				Incisions & Abrasion	-Third figure at the right with mix-technique -Middle, highest figure with deep incision, Upper part missing -Left part of panel presents incisions
			Continuous line		X		Finger painting					
	Abrasion	X	Single line				Blowing					
			Repetead line				Pencil					
	Pecking	X	Superficial	Fine			Continuours				Pecking	
				Thick	X		Discontinuous					
			Deep	Fine		Bichromy						
				Thick	X	Polychromy						

Notes: At least 5 unidentified figures. The lack of features commonly used for species identification are missing or are not very clear.

From left to the right: The first figure is c. 19 x 9 cm. Its back superimpositions with a possible auroch or cervid (34 x 18 cm).

In an area above there is a complex of unidentified figures (27 x 15 cm). Further right exist an oval body (ibex?) (27 x 11 cm), and a horse head at the top.

There are sparse peckings and a few incisions.

Figure 46: Second page of the documentation sheet informed with a digital tracing made by D. Danelatos and detailed photos with the techniques captured by H. Collado Giraldo

.

4.3. Direct tracing

The direct tracing (Figure 47) aimed at the confirmation of 12 Graphic Units identified during the indirect tracing (Their description follows in 4.6.2.), but also of several details that were noticed before and needed further inspection in situ. Therefore, it can be said that it worked complementary in few cases for final corrections. For example, three lines previously marked as fractures were proven to be incisions, and some pecking marks turned to be outcomes of weathering. In addition, the limits of incised and pecked parts were easily defined when in many cases during the indirect tracing procedure the limits were unclear. At least one case of superimposition became more recognizable through this process. The superimposition was identified at the left part between Graphic Units GU2 and GU4 (Figure 48). Another possible superimposition among the two techniques mixed at the top-middle part of the panel at GU8 was also noticed but cannot be clearly seen in the other documentation methods.

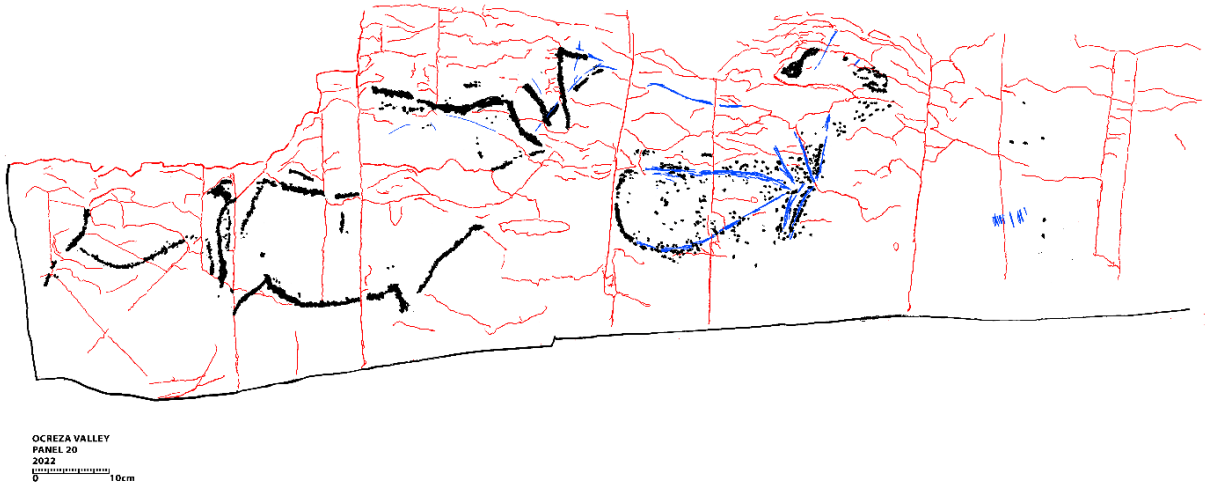


Figure 47: Digitized direct tracing showing the techniques applied on the panel. In black are the peckings and the limits of the panel. In blue the incisions/and abrasion and in red the fractures.

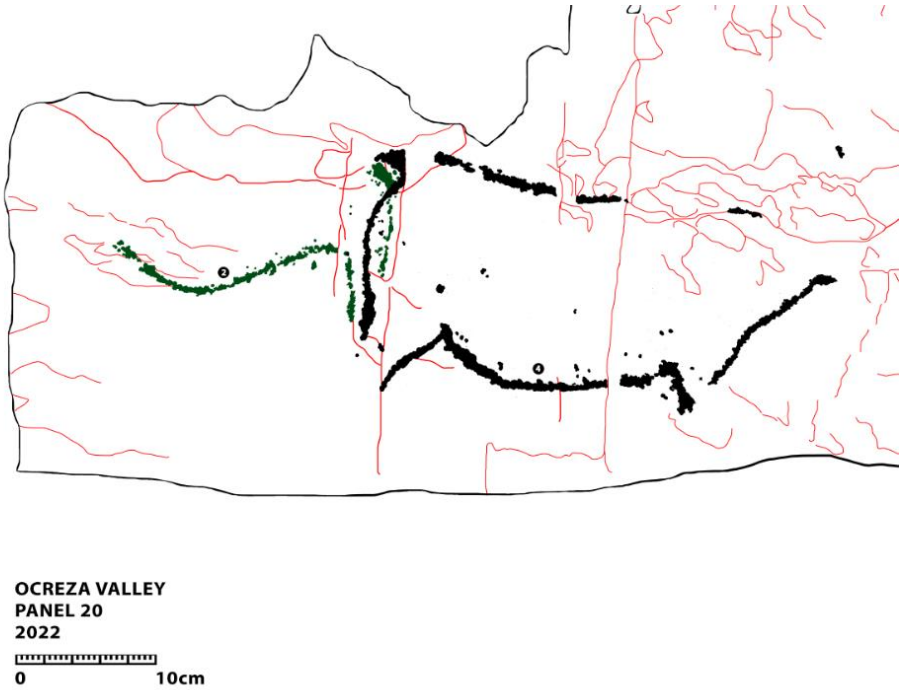


Figure 48: Superimposition at the left part of the panel. In green GU2 is found under the GU4 a fact that suggests that the former was made before GU4.

4.4. 3D model

Three 3D models were created (Table 6). Two of them, the second (2.) and the third (3.) provided the possibility of detailed inspection without being in situ due to their high-quality. The models were studied using the Meshlab® software through inspection (Figure 49) and 3D image acquisition (save snapshot). The inspection and acquisition of captures was valuable during the digital tracing process for the examination of the pecked and incised limits and depth, the description phase, and at the hypotheses stage related to the cases of superimpositions, and the existence of natural and potentially fractures caused by anthropic activity (i.e damage caused during the engraving process or for questioning the use of fractures for artistic reasons) (Figure 50 to Figure 52), even the potential role of natural light, through the manipulation of artificial light provided by the software (Figure 53). The orthomosaic of the final 3D model (3.) (Figure 54) was used for the final digital tracing. Despite not having the highest quality, the produced orthomosaic helped to enhance the depth of the engravings. It is recommendable though that if there are no time restrictions, and an updated and powerful computer (RAM, CPU, GPU) is available, to work with the maximum capacity possible to use the finest filtering and resolution. The produced DEM did not present the expected results and due to time restrictions its correction and final use was abandoned. Most probably this is related to the manual positioned GCPs/CRS points and the difficulty to position them on the 3D model and to confirm that the points in each “camera” coincide. The coloration and the texture of the rock surface did not aid the manual process. The use of standard GCPs would be essential for a future attempt to generate a DEM through the recreation de novo of the 3D model.

3D	General View	Detail
1.		
2.		
3.		

Table 6 :The 3D models with the panel of OCR20. In detail can be seen the differences in the quality of the produced models.

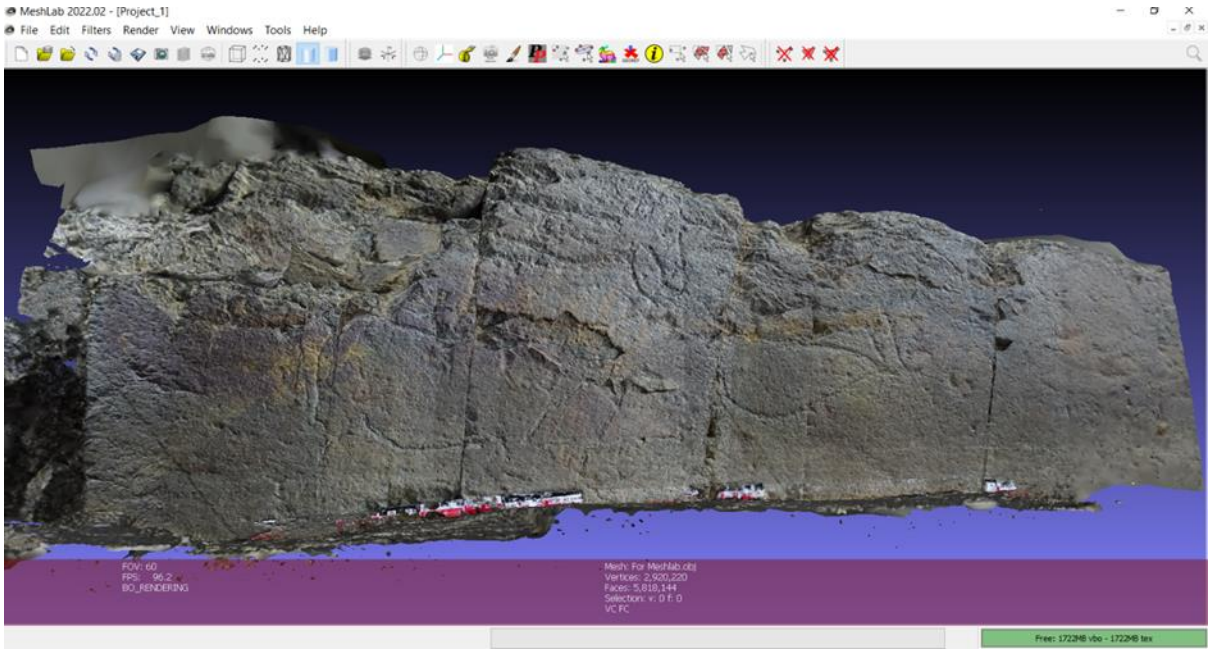


Figure 49: Inspection of the 3D model using Meshlab.

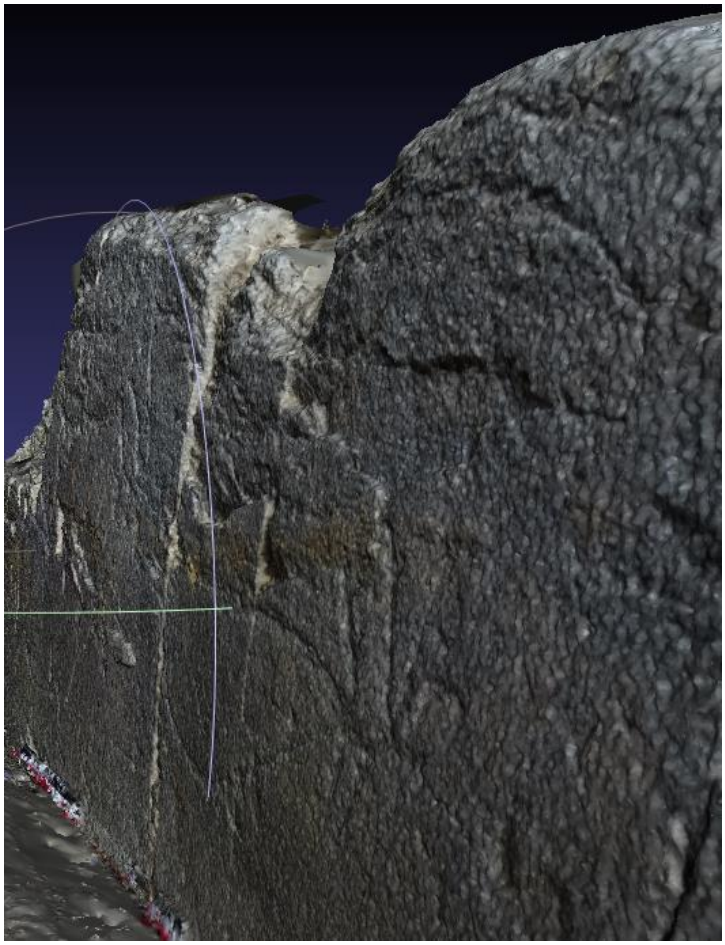


Figure 50: Angle manipulation for the examination of the engravings and fractures depths.

Figure 51: Inspection of the Graphic Units 2, 3, 4, focusing on of the superimposition and of the broken surface at the top right.

Figure 52: Detail capture from the panel.

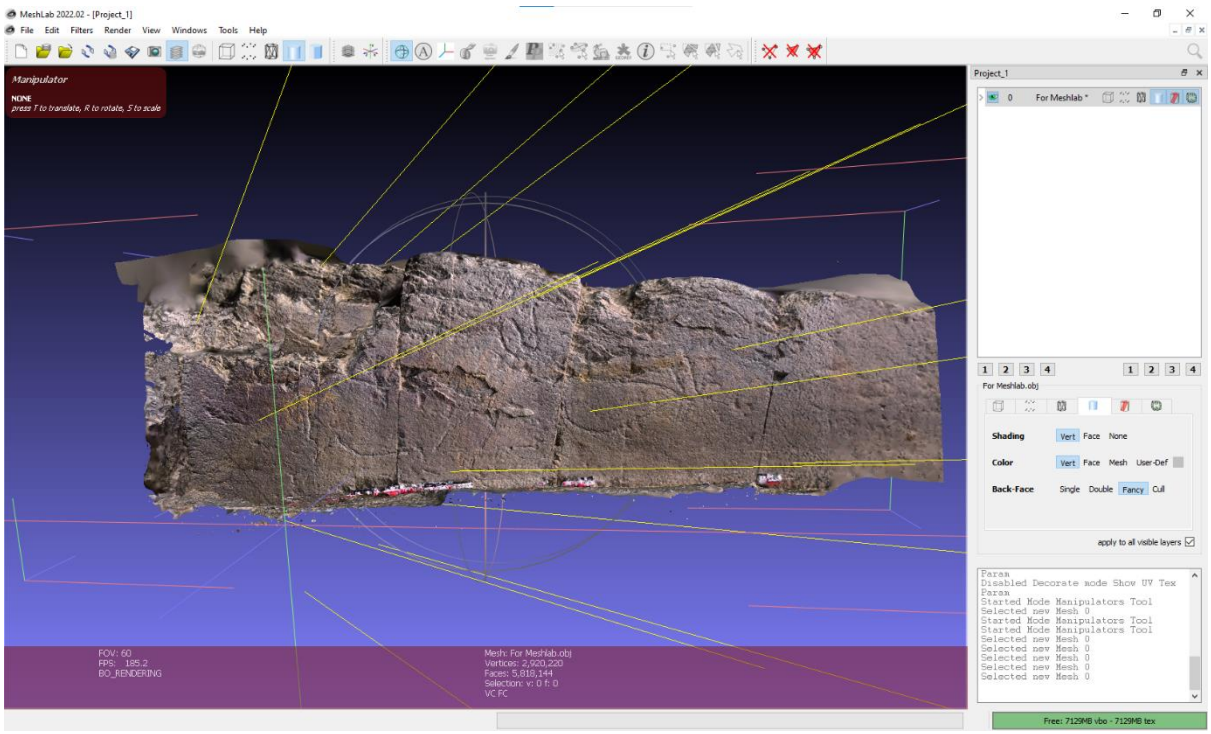


Figure 53: Artificial light manipulation using the relevant Meshlab tool.

Figure 54: The orthomosaic from 3D model (3.) that was used for the final digital tracing.

4.5. Digital tracing

The first phase of the digital tracing prior to the direct tracing resulted in the creation of four detailed photos (Figure 56). At the second phase, after the acquisition of the direct tracing, the detailed photos were compared with the digitized direct tracing and were corrected (Figure 55, Figure 57, Figure 58, Figure 59). During the third phase, the whole panel was recreated using the layers of the detailed pictures, the direct tracing layers and the orthomosaic produced by the third 3D model (3.). The result was a new .psd file with the complete panel surface and everything distinguished in unique layers (Graphic Units, numbering, techniques, and fractures). The final results are presented at the following subchapter 4.6. together with the description.

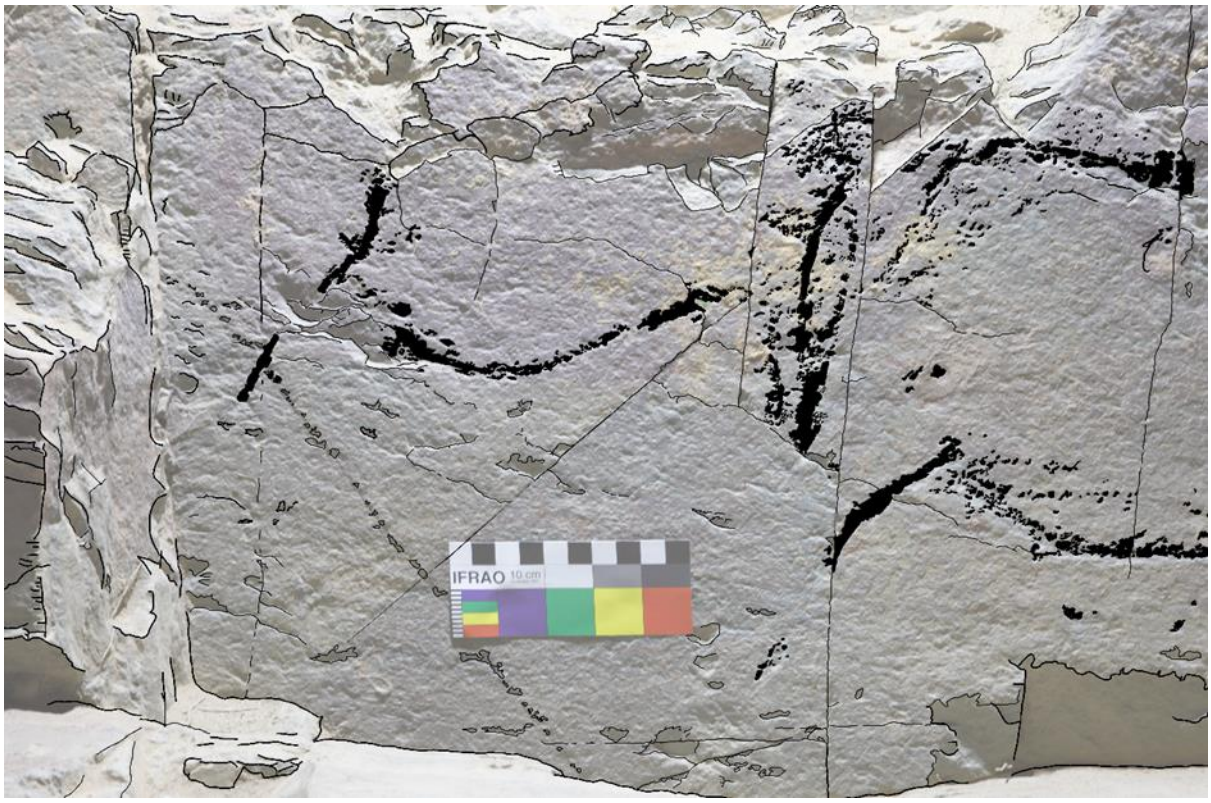


Figure 55: Detailed photo 1. After the comparison with the direct tracing.

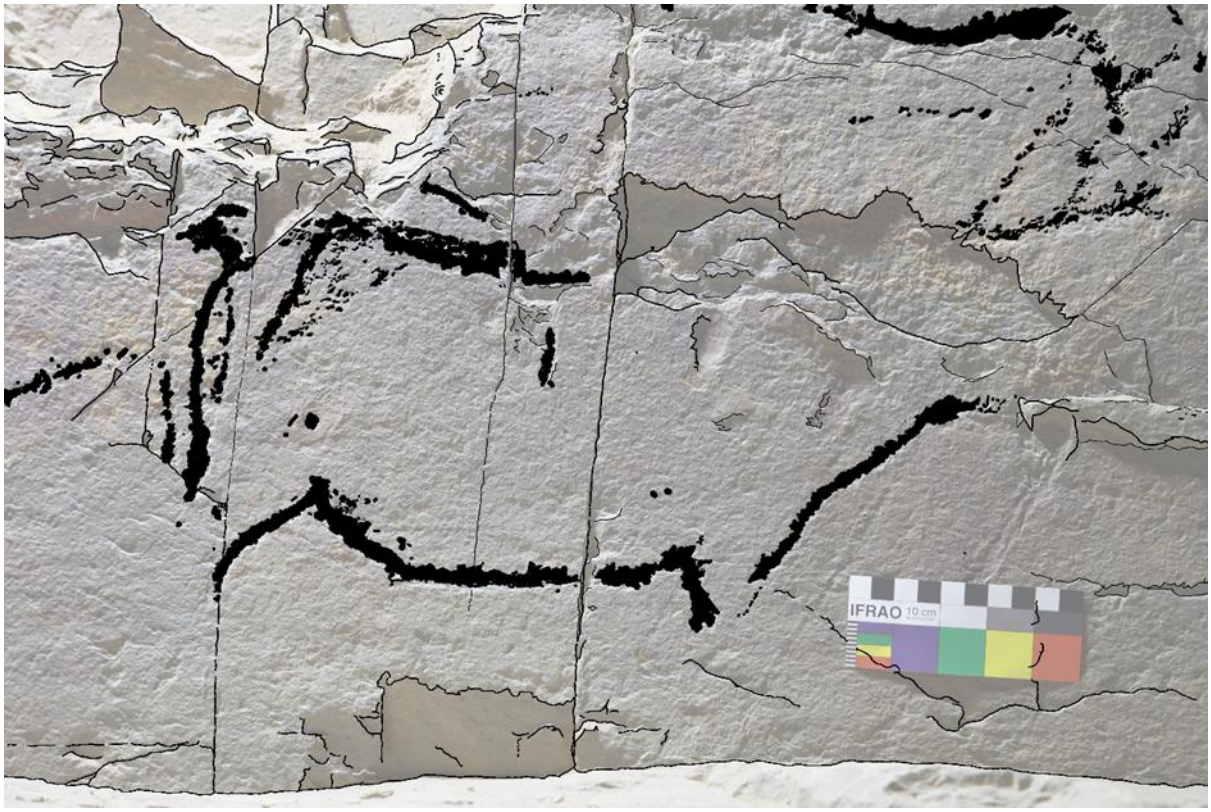


Figure 56: Example of Detailed photo 2 during the first phase of indirect tracing.

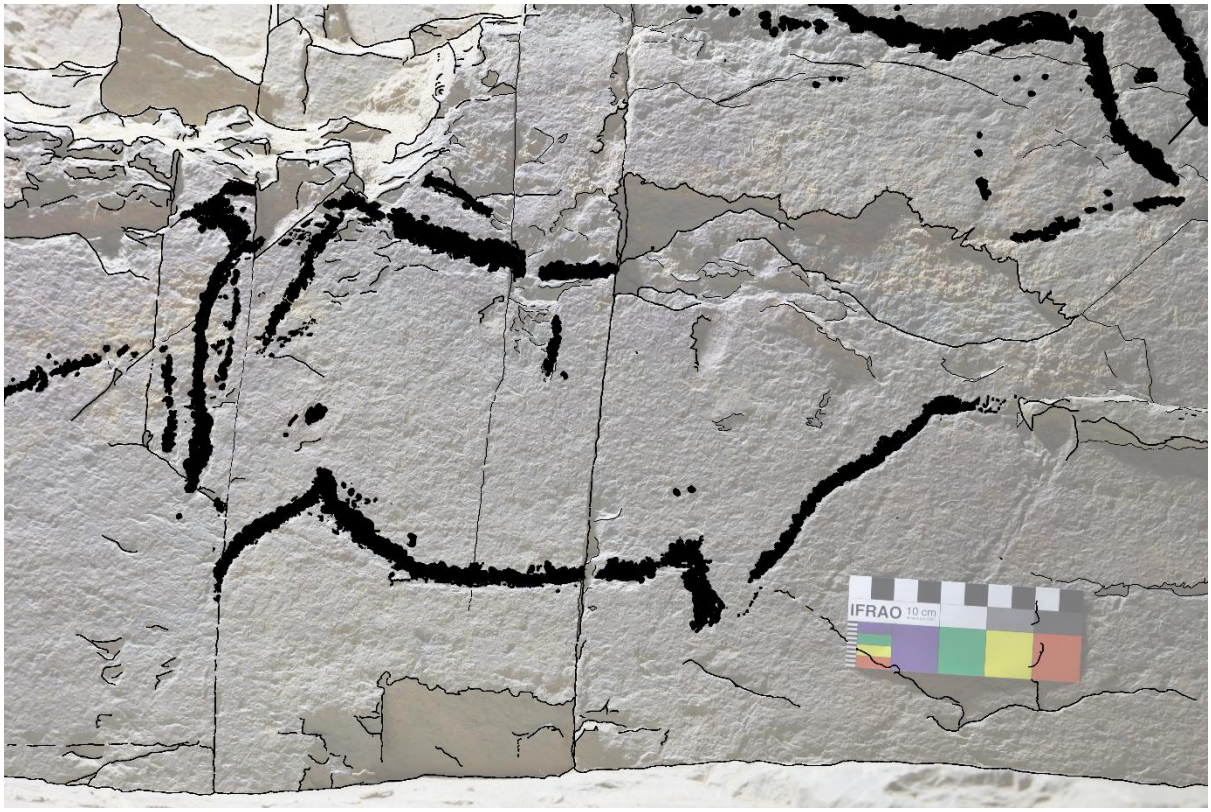


Figure 57: Detailed photo 2 at second phase of indirect tracing, after the direct tracing. Corrections followed in few incisions found on the top previously traced as fractures, while part of the top right peckings were considered natural cracks.

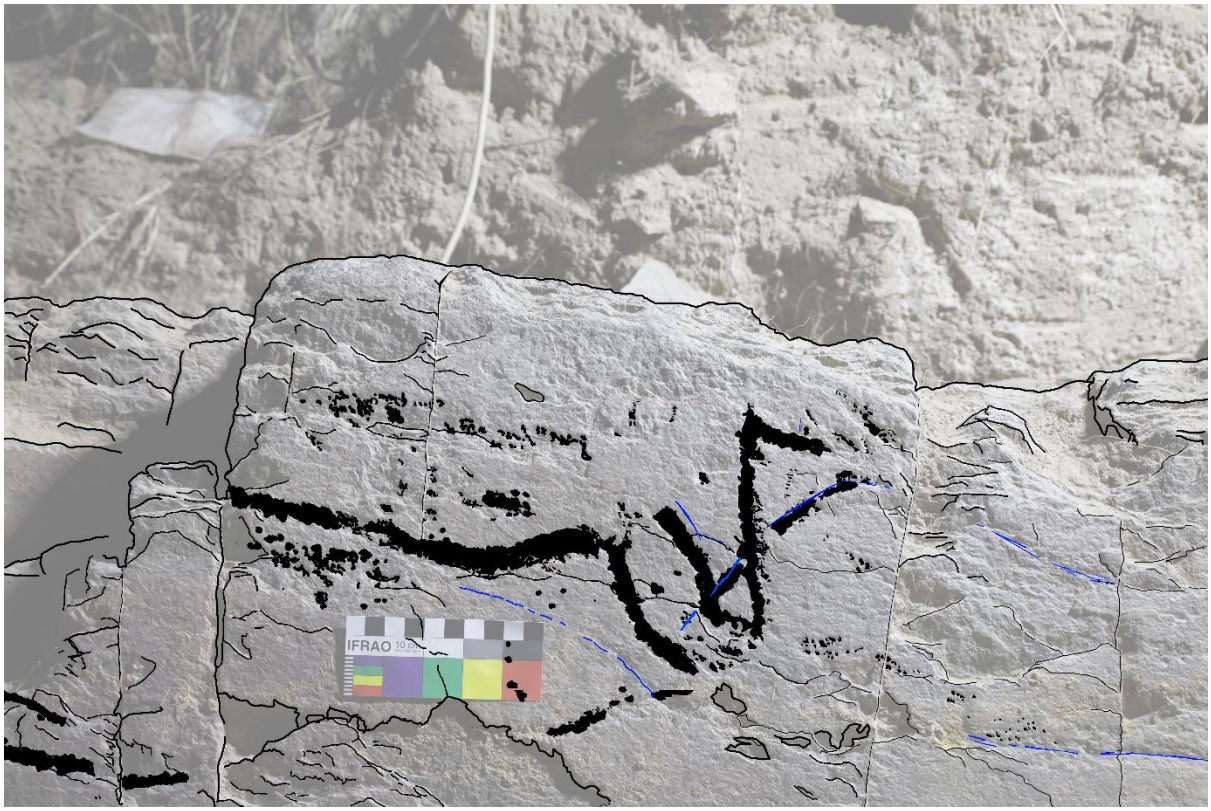


Figure 58: Detailed photo 3 after the comparison with the direct tracing. In blue are the incisions and in black are the peckings.

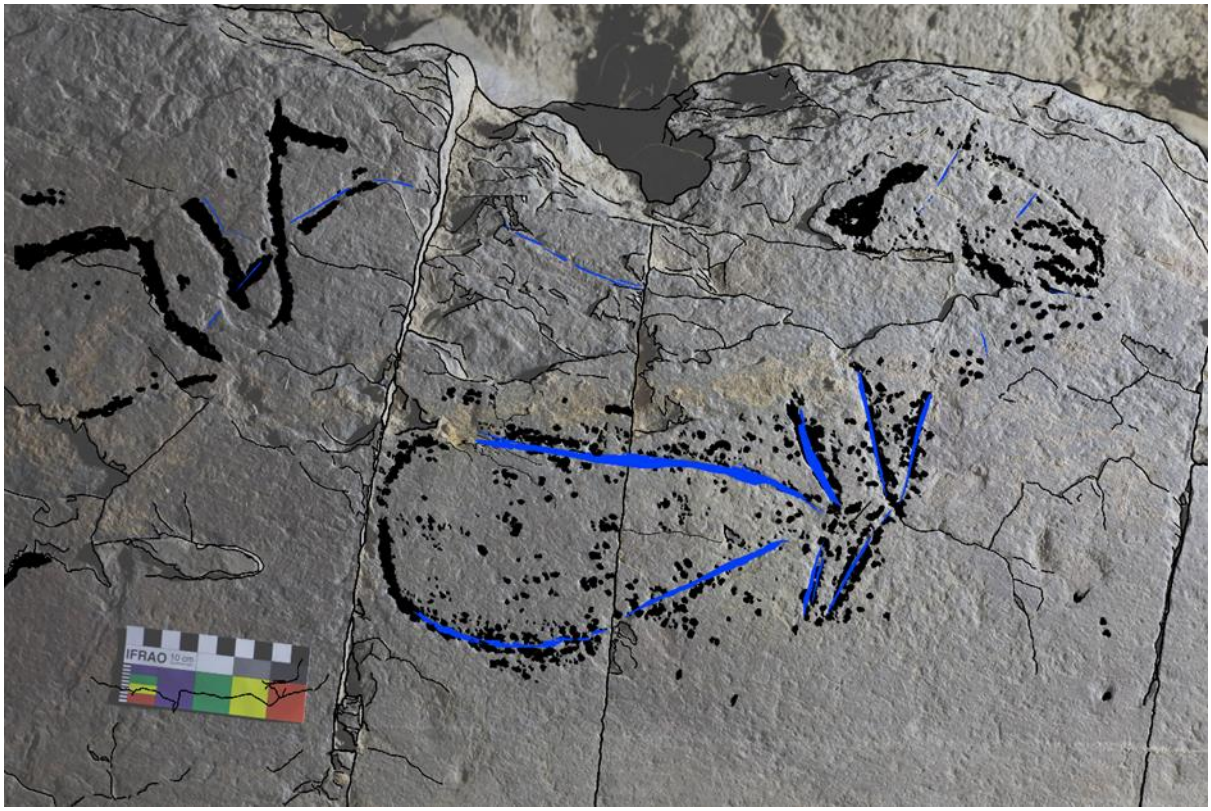


Figure 59: Detailed photo 4 after the comparison with the direct tracing, presenting the techniques applied.

4.6. Description of the panels

4.6.1. OCR 15

The panel (Figure 60) presents a single pecked zoomorphic figure, and a few sparse pecked marks. The animal is represented in a naturalistic manner in small dimensions (28,5 X 19 cm). It is depicted in absolute profile with one leg per pair, facing the right part of the panel. The upper part of the figure is represented with a continuous cervico-dorsal line in S-shape that results in a tail. The hoofs of both legs are absent, while the lower part is interrupted by the rock's shape with an abrupt end. The back legs are consisted of two lines which open in opposite directions at the top, giving an idea of a massive leg quarter. The ventral of the animal is depicted voluminous created by a series of peckings that are united with a solid pecked line that joins the back part of the front leg. The front leg is made by two almost parallel close lines, with angles that remind motion. The frontal part of the front leg is on a continuous line that extends after a small alcove to the chest of the horse. The continuous line becomes faded with a number of eroded peckings probably the remnants of a wide neck. The head of the figure seems absent or incomplete.

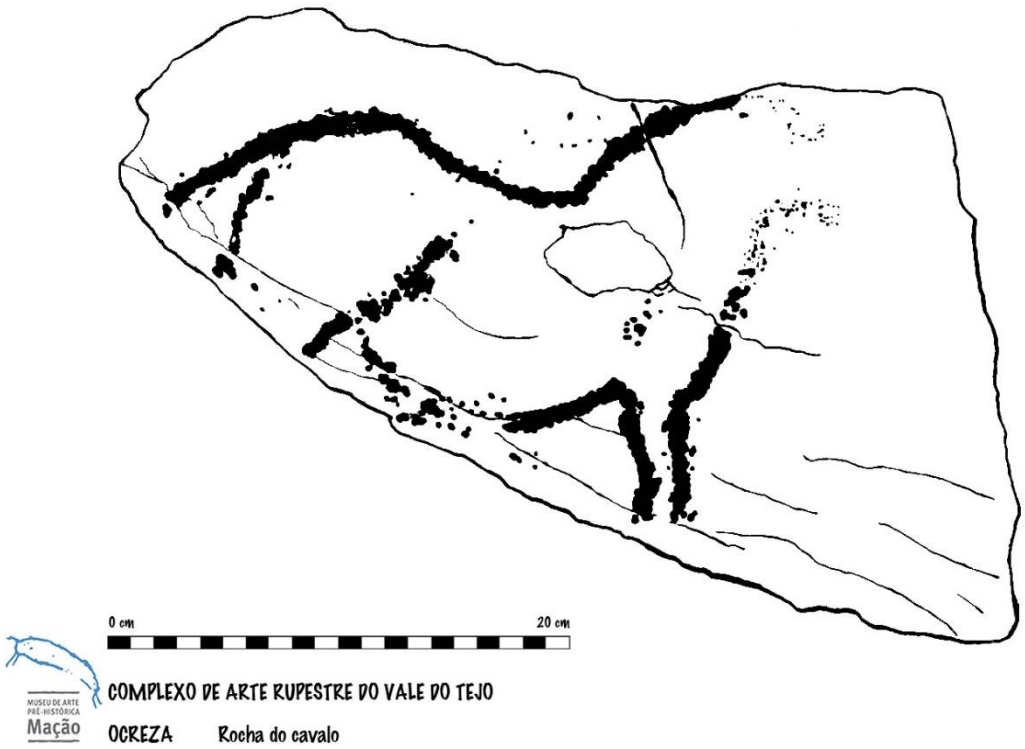


Figure 60: Tracing of Ocreza Horse created by G. Nash and S. Garcês.

4.6.2. OCR 20

The vertical panel of OCR 20 (1,90 X 0,48 m) presents a minimum number of five unidentified zoomorphic figures (GU2, GU4, GU6, GU9, GU10), together with incised lines and pecking marks (Figure 61).

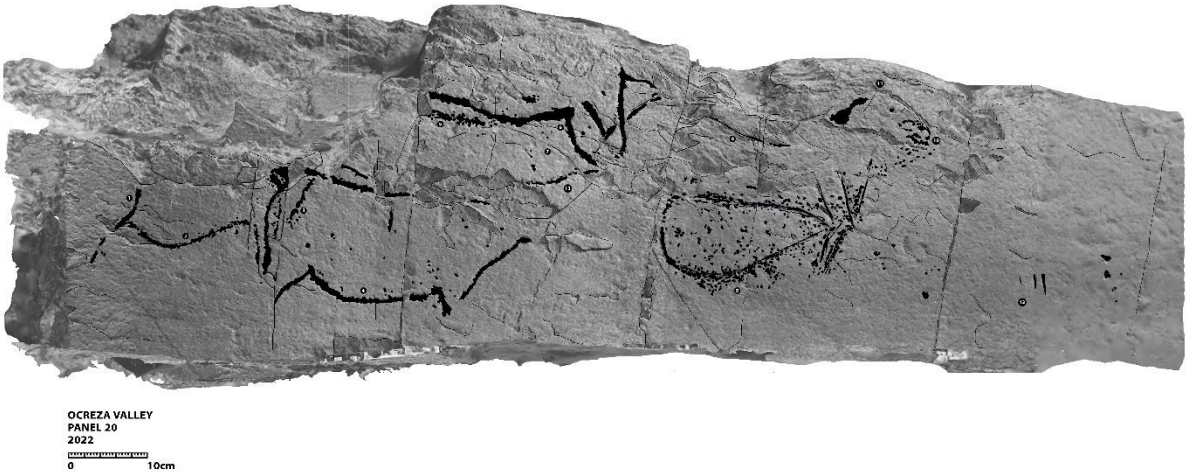


Figure 61: The panel with the numbers of the Graphic Units identified by the author.

All the zoomorphic figures are depicted in naturalistic way and on absolute profile, possibly except one (GU9). The techniques applied for the creation of the rock art have been pecking, incision, and abrasion (Figure 62 and Table 7). Cracks and fractures are widespread.

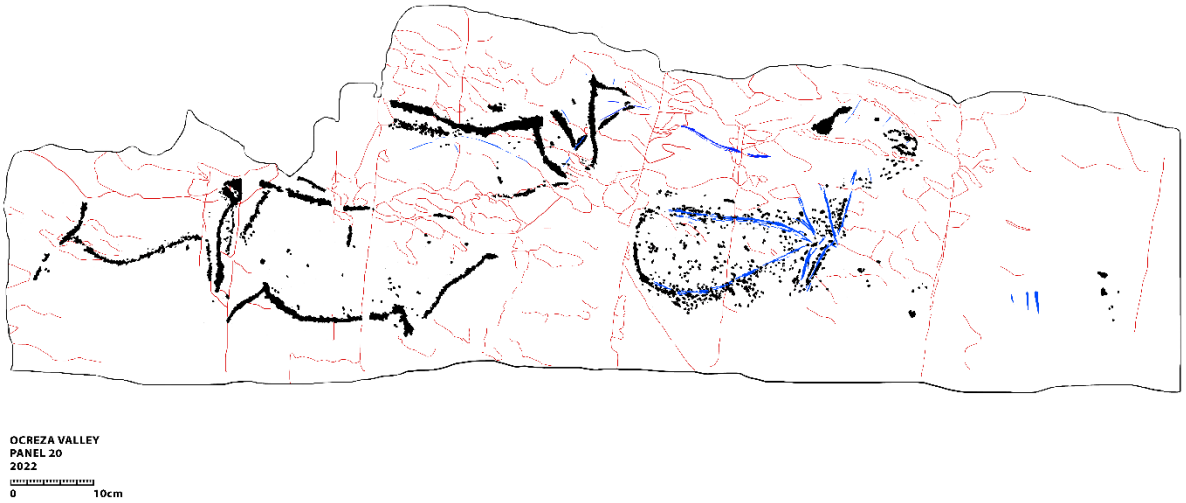


Figure 62: The panel with two main techniques. In black the peckings and in blue the incisions. At the right part, at the oval shape (GU9) there is abrasion possibly caused by repeated incisions that are hard to differentiate.

Pecking

Incision

Abrasion


Table 7: Enlarged photos with the three different techniques applied on the panel (Photos: H. Collado Giraldo).

The panel has five vertical fractures that could divide it at six non symmetrical parts. The vertical surface is highly eroded and broken at the upper part, particularly at the left side. The broken parts could bare remains of the GU 1,2,5,6,8 and 10 but we currently do not have any evidence from the schist pieces collected during the excavation. There are two evident areas that were exfoliated/broke and collapsed intervening to our current view of GU 4, 8, 9, 10 as well (Figure 63). It is worth of noticing that the fractures on the panel are all patinated, suggesting long exposure to the elements and abrasion due to one or several colluvial actions.

Figure 63: The two major broken parts of the panel. Left photos: (Upper) S. Garcês, (Lower) H. Collado Giraldo 3D captures: D. Danelatos.

At least one superimposition among the Graphic Units was traced, between GU2 and GU4, and one less clear at GU9, among the two techniques that are mixed on this entity, because the limits of the superimposition are hard to identify (Figure 64).

The description of the artistic remains of the panel follows an order from left to the right. The engravings that stand alone or it is unclear if they belong to a specific representation/figure will be addressed here as Graphic Units (GU1-13). Some of the Graphic Units could be subdivided or united with others based on different interpretations. Inevitably, here the division is given based on the authors judgment, acknowledging the possibility of mistakes. This division is done primarily according to the depth, the thickness of the engraved lines, the orientation and continuation of the lines and the probable contours.

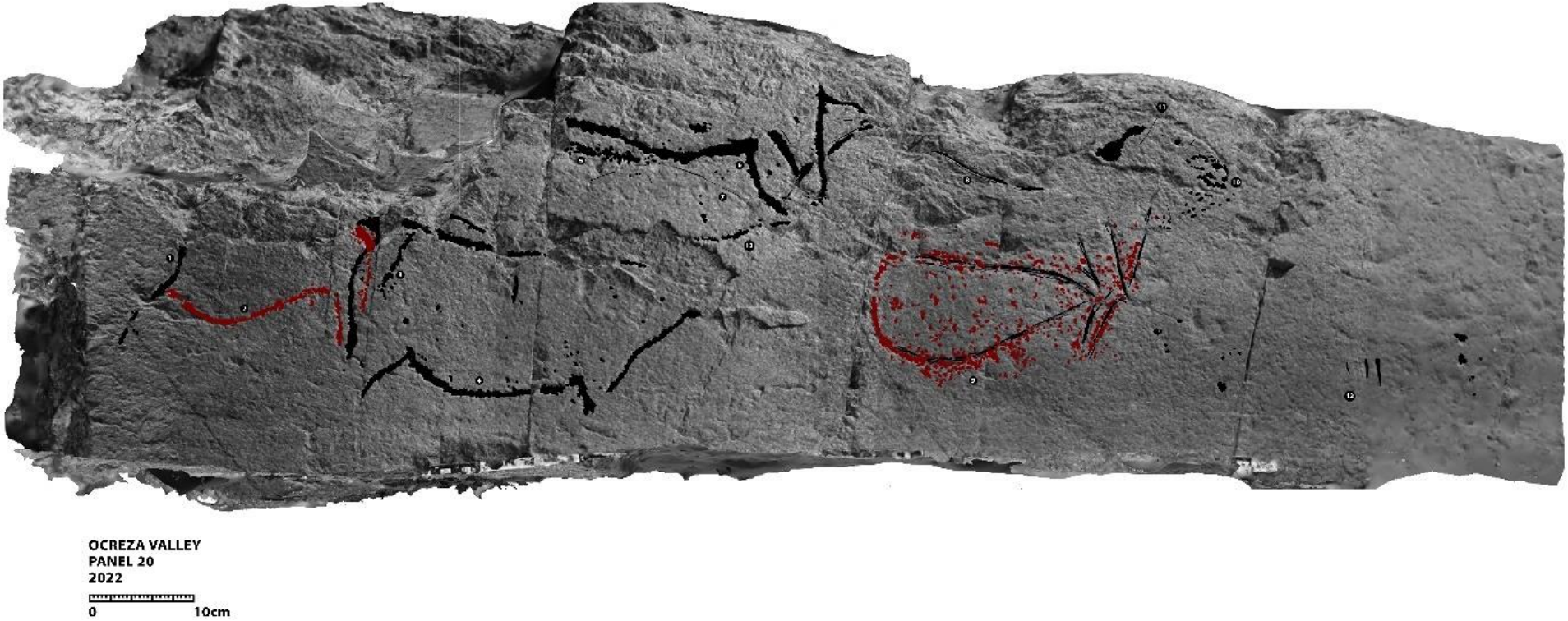


*Figure 64: At the left, GU2 is found under GU4. At the right, in a simplified **de**piction, some pecking marks seem to be found under incisions and abrasions attributed to GU9.*

GU1. The first Graphic Unit (GU1) is spotted at the extreme left of the panel (Figure 65). It is consisted of four intermittent parts, the upper two are c.6 cm, while the other two together do not overpass 4 cm.

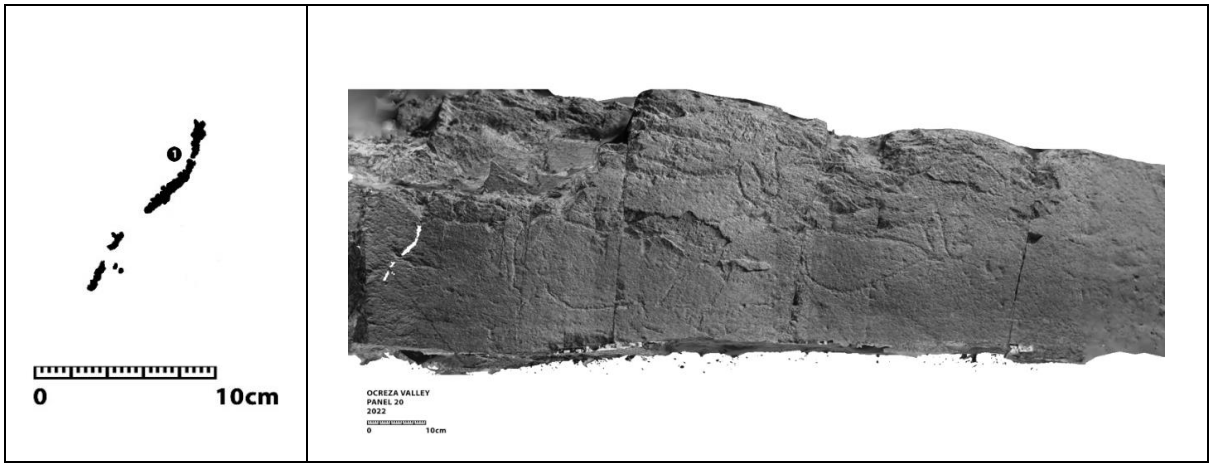


Figure 65: Graphic Unit 1 (Left image). The position of GU1 at the panel, in white colour (Right image).

GU2. The second Graphic Unit (GU2) (19,7 X 9 cm) seems to be consisted of two pecked lines (Figure 66). The lower one is a ventral line (8 cm), with a slightly pronounced belly, that ends at the right, formulating the left part of a single leg. The leg lacks a hoof and a tail. Additionally, there is no dorsal line and no head. A second vertical pecked line (17 cm) looks like it was the back part of the same leg, although the two lines are not united. The upper part where the tail could grow is depicted thicker due to the fact that this part is extra broken. In addition, the pecked line of the c.17 cm is superimposed by the back of another zoomorphic figure (GU4).

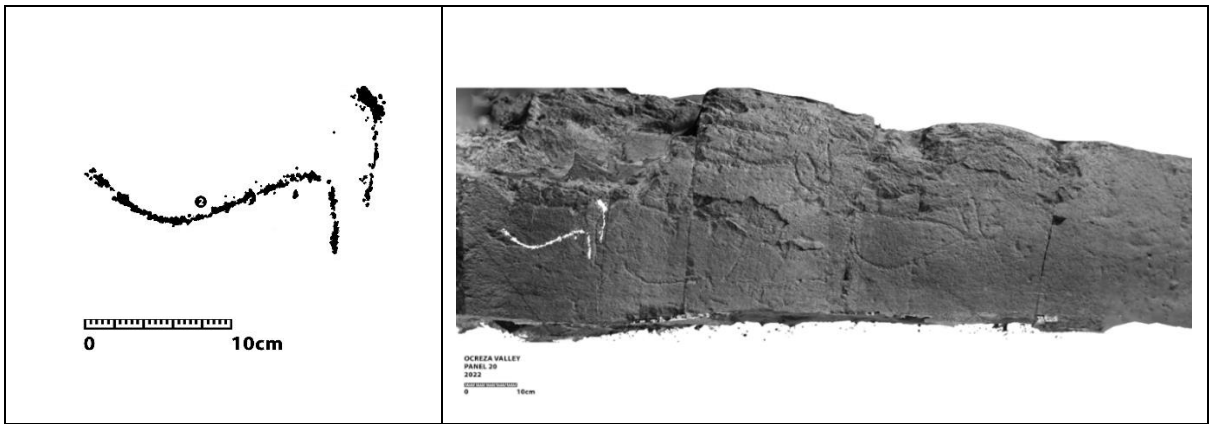


Figure 66: Graphic Unit 2 (Left image). The position of GU2 at the panel, in white colour (Right image).

GU3. Graphic Unit 3 (GU3) it is consisted of few sparse peckings and three identifiable pecked lines that seem to be independent from the GU4 (Figure 67).

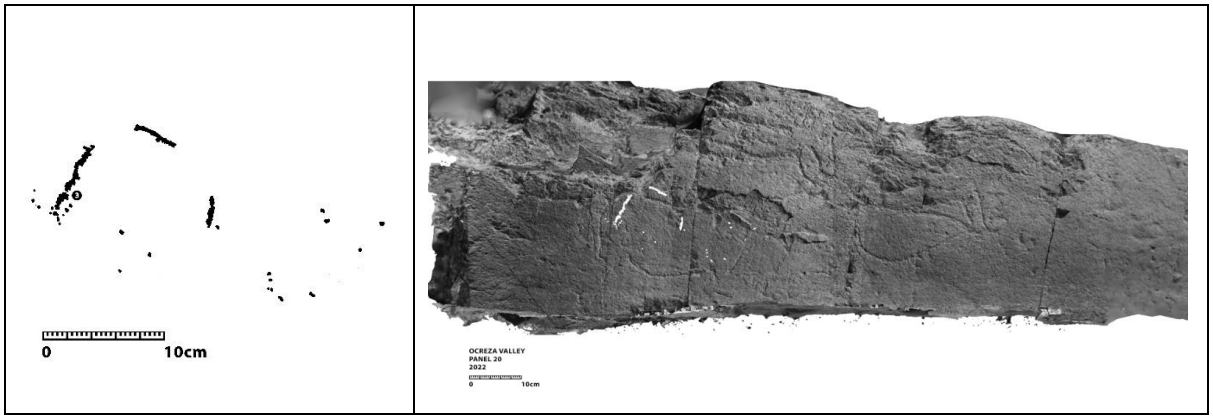


Figure 67: Graphic Unit 3 (Left image). The position of GU3 at the panel, in white colour (Right image).

GU4. The zoomorphic figure Graphic Unit 4 (GU4) faces to the right and has bigger dimensions (34 X 18 cm) (Figure 68). It is depicted in absolute profile with a single leg per pair. The ventral line (23 cm) presents a belly and the interior lines of two legs. Again, the members of the animal are represented partially, the hoofs are missing, and the legs are not united. The front part of the animal is depicted until the neck with a relatively inclined line (12cm). At the area where the neck and head should appear the rock surface is destroyed. At the back a triangular shape created by pecking strikes and points, is united with the dorsal and back lines. These shapes look like a tail or the start of a tail. Few peckings are found dispersed mainly inside the lower part of the body.

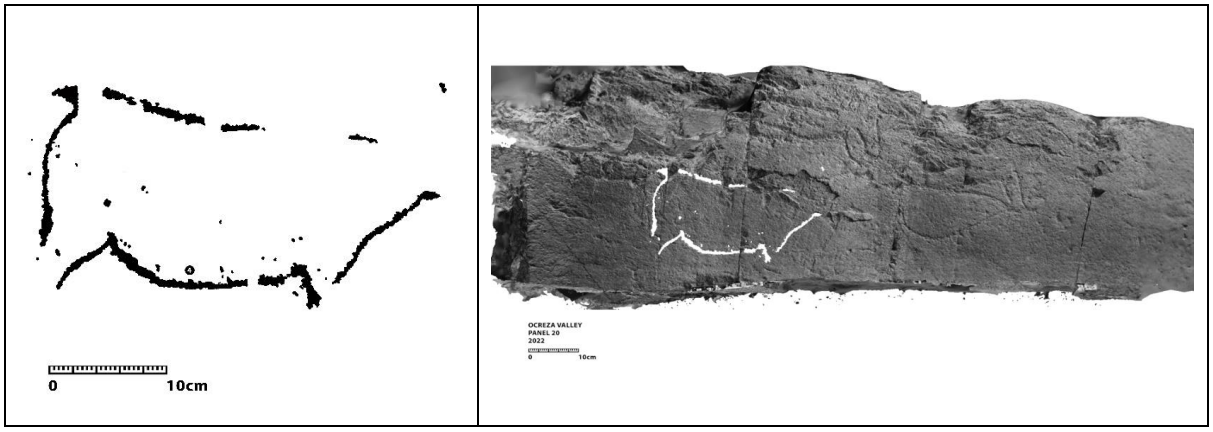


Figure 68: Graphic Unit 4 (Left image). The position of GU4 at the panel, in white colour (Right image).

GU5. At the top of the panel, c.24 cm above the base of the panel, exists a complex of peckings (30 X 16,5 cm) together with some incised lines. There are at least 9 (10) pecked lines, 6 of them deeply engraved. Graphic Unit 5 (Figure 69) is consisted of several pecking marks that create an sub horizontal line at the upper part of the panel in the middle, and follows for 6 cm a semi-horizontal line part of GU6 (Figure 70).

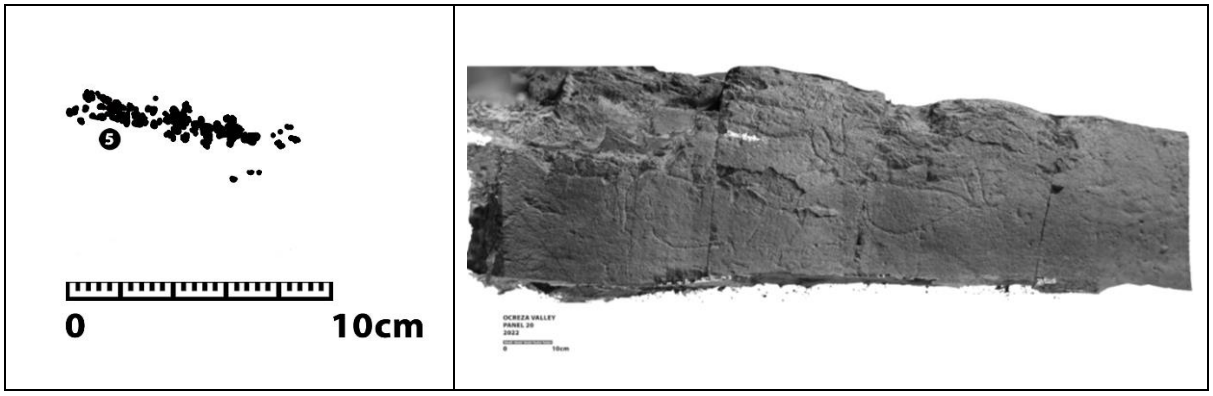


Figure 69: Graphic Unit 5 (Left image). The position of GU5 at the panel, in white colour (Right image).

GU6. Graphic Unit 6 (GU6) (Figure 70) is consisted of three pecked lines, a small concentration of peckings and few sparse marks made with the same technique. The longest pecked line extents c.15 cm horizontally to the right following a small inclination that gets lower until it advances higher, creating a small peak. After this point, the line goes down creating the shape of a parenthesis bracket. It is unclear whether it is a dorsal or a ventral line of an animal or if it is truly part of the other lines. Just on the opposite side, and separated, exists another subvertical line which seems to be part of another pecked line forming a U-shape. Between the former long line and the latter U formation there are some peckings with the bigger of the two reminding an eye. Inside the U formation, exactly at the centre there is a single pecked mark similarly like an eye. This detail transforms the image to the face of a possible animal. In addition, the last pecked formation on the right creates a pattern like an angle of 90° degree or a Greek Γ, whose upper part reminds a horn.

Figure 70: Graphic Unit 6 (Left image). The position of GU6 at the panel, in white colour (Right image).

GU7. Bellow GU 6, at the left part, four incised lines form a curvature line. Few sparse scratches are found isolated at the right part (GU7) (Figure 71).

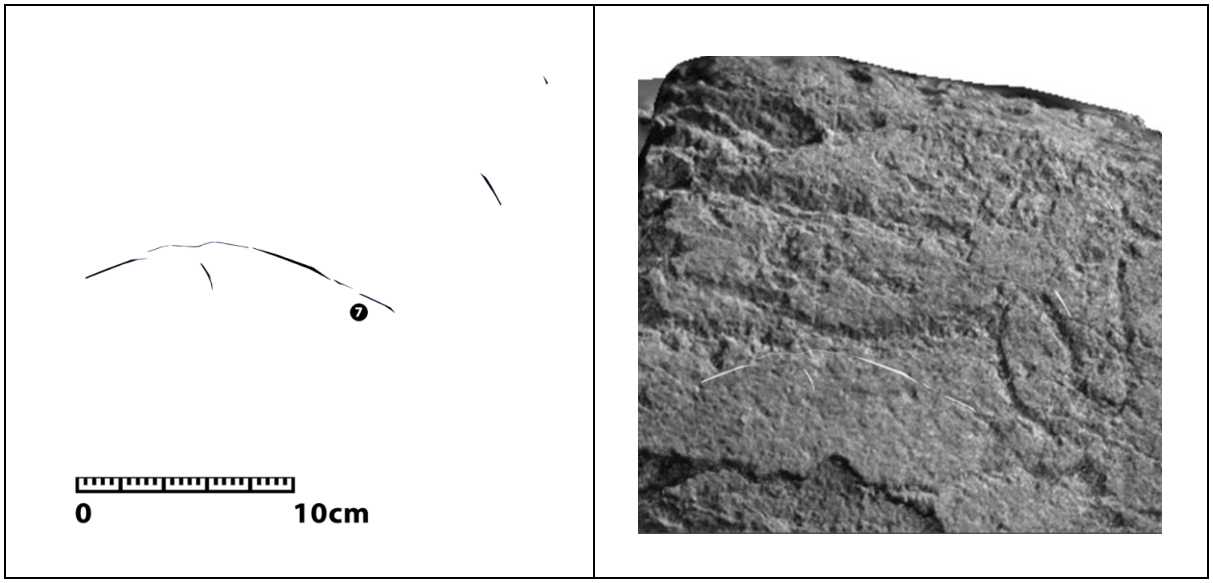


Figure 71 Graphic Unit 7 (Left image). The position of GU7 at the upper-middle part of the panel in zoom and in white colour (Right image).

GU8. The right part of the panel is characterized by concentrations of pecking points as well, while the number of incised lines is increased. The first incised lines start from the middle top of the panel at GU6 and they follow a left to right orientation. Based on the direct tracing at least one superimposition is found here but is extremely hard to distinguish. At the lowest right part of GU6, an incised line and some peckings could superimpose GU6, but again it is not certain whether a part of the pecking belonged to GU6 or if the marks of GU8 cross GU6. They are attributed to GU8 (Figure 72) as they seem to be the continuation of anthropic marks coming from the right part of the panel. More precisely, at this part of the panel, the incisions of Graphic Unit (GU8) are composed by three interrupted parts and an extra horizontal incision at the top, together with four peckings that follow the same subvertical orientation, nearly united except one part. This part is found between the U-shaped like right part of GU6. It is unclear if the incised line superimposes the pecking marks or if it was under them. On the other side of the panel the incisions most likely continue to the last part of the engraved panel, on the right. The panel surface is interrupted by a slightly inclined vertical fracture product of the outcrop's schistosity. The surface presents an anomaly, with the schist "sheet" to be positioned c.3 cm inwards from the main panel surface area previously described. The right part of the GU8 presents thicker and repeatedly incised lines (c.10 cm).

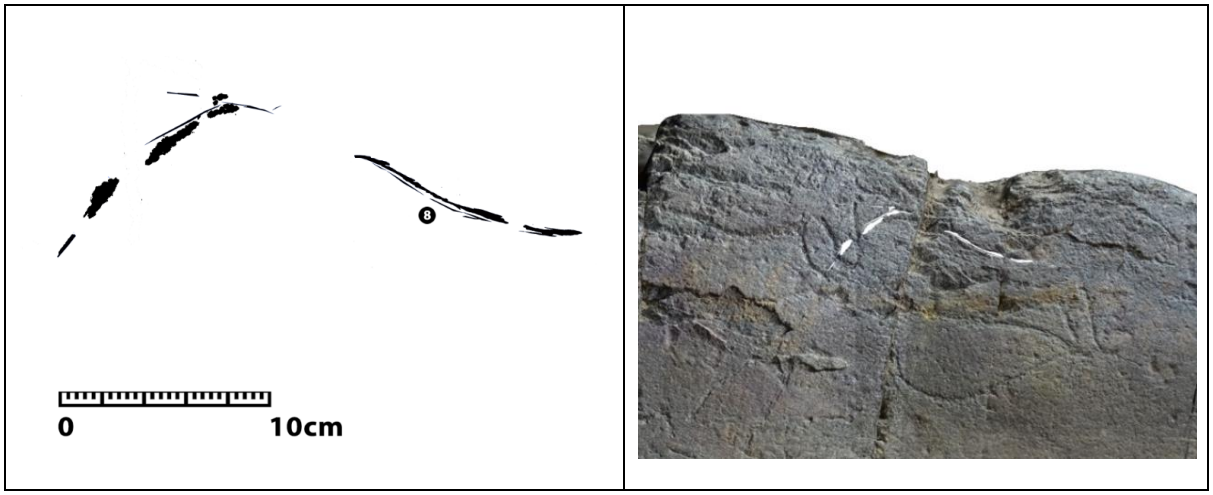


Figure 72: Graphic Unit 8 (Left image). The position of GU8 at the upper middle-right part of the panel in zoom and white colour (Right image).

GU9. The area with the biggest and most profound incisions exists at the right part of the panel. They formulate a relatively oval shape (c. 27 x 11 cm) (GU9) (Figure 73). Here there is a combination of the incision, abrasion and pecking techniques. The extreme left part is made mainly by peckings that create an arc, similar line, although shorter (6 cm), to the figure and the lines of the left part of the panel. Other pecking marks can be found inside the oval shape. Some of the incised lines attributed to GU9 are found a few centimetres lower than the right incised lines of GU8 previously mentioned and 4 cm below the zoomorphic head (GU10). The left-to-right inclined incisions under this head are depicted with an angle of 120° (left) and 110° (middle) in parallel, while another one comes from the opposite direction and has an angle of 80°. The former two parallel incisions are deeply engraved, and they are combined with pecking marks. Below them exist few repeatedly incised lines that formulate a member which extends for approximately 8 cm presenting a slight left inclination. On the right it is traced another parallel incised line c. 5 cm.

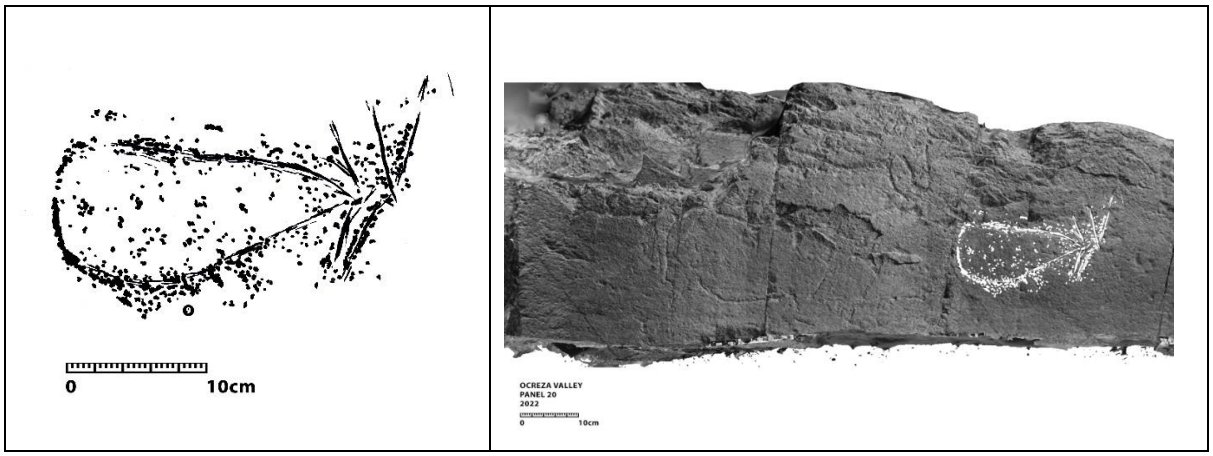


Figure 73: Graphic Unit 9 (Left image). The position of GU9 at the panel in white colour (Right image).

GU10. At the top of the panel there are some broken parts, and the panel surface is highly affected by weathering. Following a description from the top to the ground, the highest positioned pecked concentrations, in combination with the fragmented texture of the rock, resemble an animal head (15 X 6 cm) (GU10) (Figure 74). The potential role of the fragments it is be part of the discussion in the next chapter.

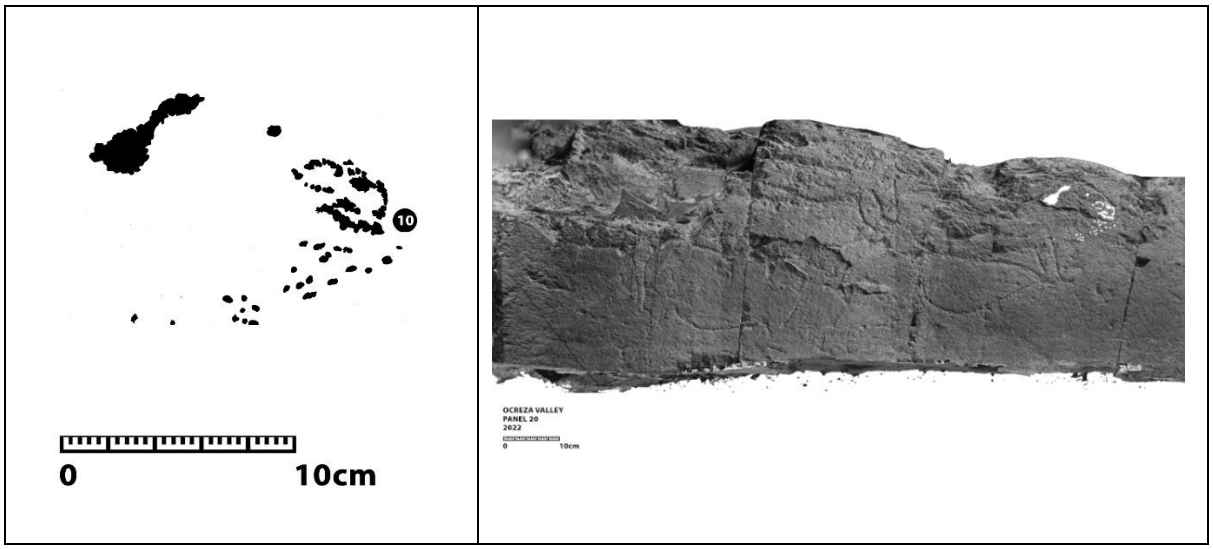


Figure 74: Graphic Unit 10 (Left image). The position of GU10 at the panel in white colour (Right image).

GU11. Some elements suggest the possible details of an eye and a mouth, to be depicted as well. Below the GU10 the panel surface is damaged with a piece of the vertical surface area to be missing. Next and below this spot several dispersed pecking points are found following a diagonal orientation from left to right. Their numbers increase at a part of the panel with deep incised lines (GU9). At the upper part of the head there are two inclined from right to left, incised lines like scratches (GU11) (Figure 75).

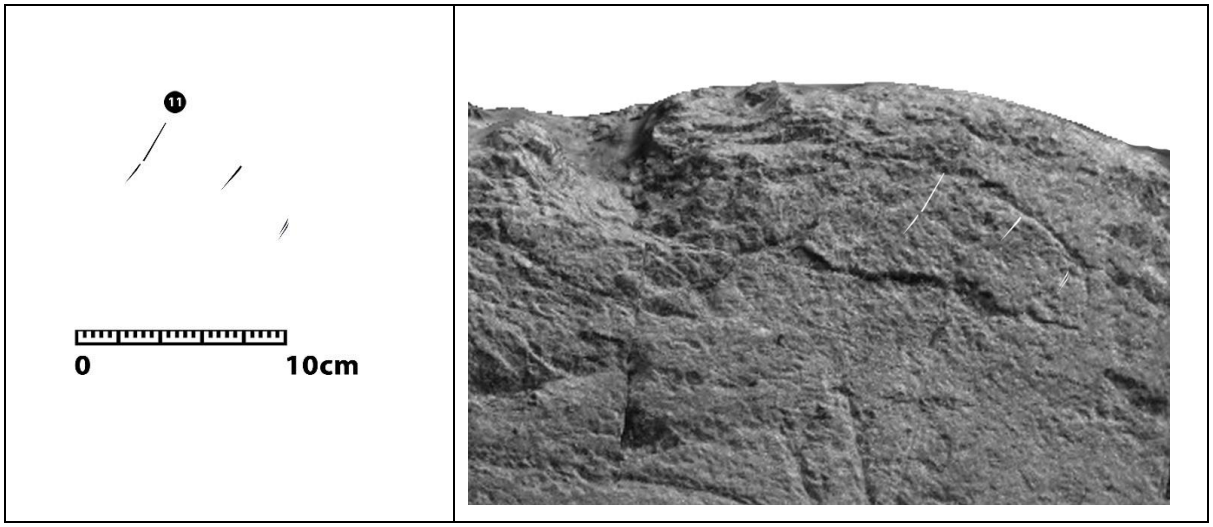


Figure 75: Graphic Unit 11 (Left image). The position of GU11 at the upper right part of the panel in zoom and white colour (Right image).

GU12. At the far right 9 linear incisions are found isolated together with sparse peckings (GU12) (Figure 76).

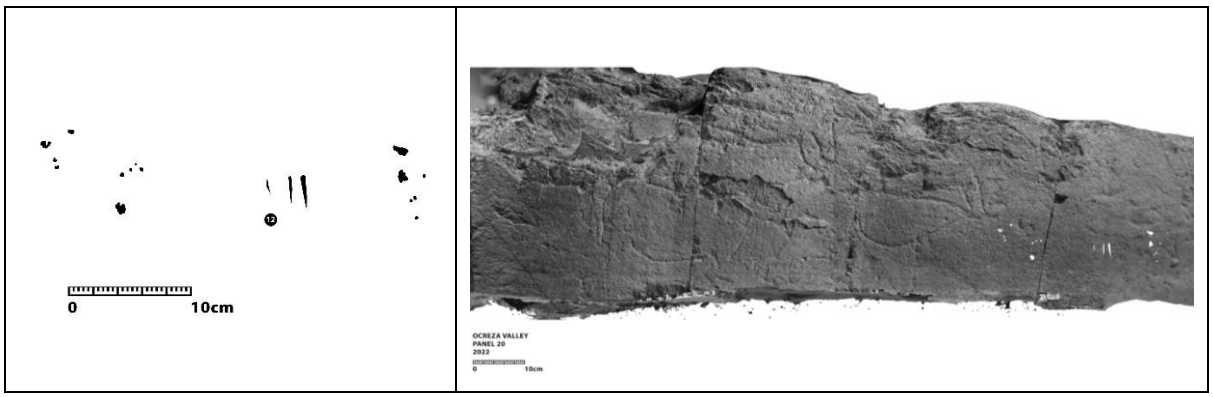


Figure 76: Graphic Unit 12 (Left image). The position of GU12 at the panel in white colour (Right image).

GU13. The final Graphic Unit detected (GU13) (Figure 77) is under dispute, whether it truly is an anthropic mark and, if so, in which Graphic Unit it belongs or whether it is independent (GU3, GU4 or GU6). This is the reason why it was given the last number. The traces might be natural, but during direct tracing they were recorded and in shape they look like the pecking lines of GU3 and GU4 rather than 6.

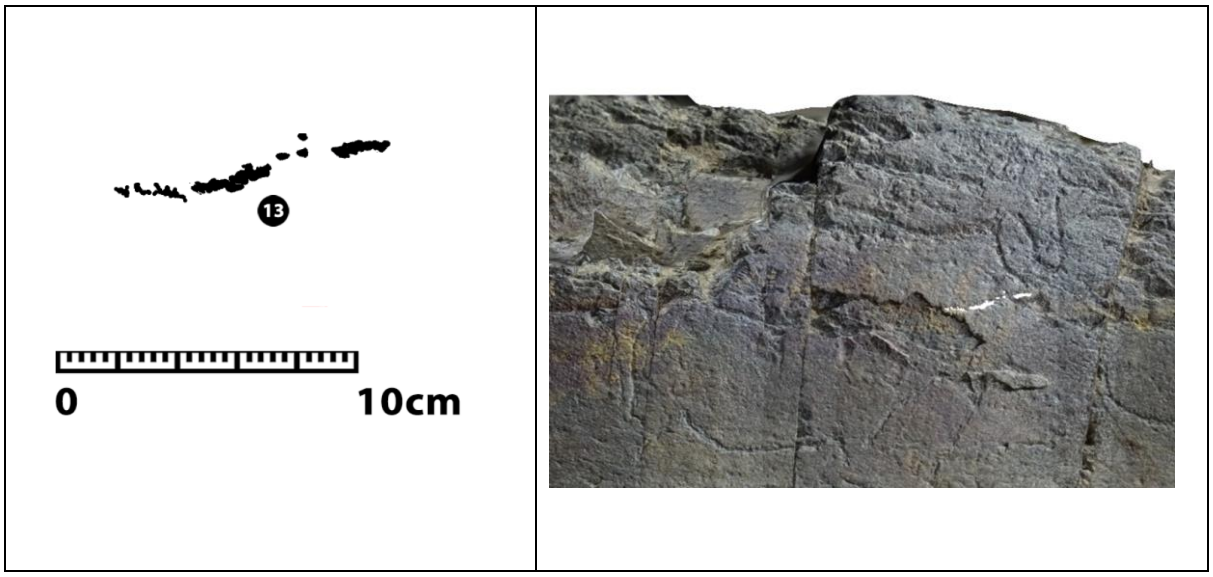


Figure 77: Graphic Unit 13 (Left image). The position of GU13 at the panel in white colour (Right image).

4.7. Comparison of Ocreza rock art with the Western Iberian rock art

The results from the literature research and the fieldtrip could be divided in comparisons between techniques, contours, forms, and species represented, style and the relevant chronological framework. Because as comparisons they can be highly subjective, they are considered part of the discussion chapter. Nevertheless, bellow follows a synoptic proposal based on the evidence collected for a possible relative dating of some of the Ocreza figures.

One of the major problems in rock art studies is its dating. Until the evolution of absolute dating methods like AMS radiocarbon (Rivero and Ruiz, 2018) and the other relevant dating techniques of thermoluminescence, OSL and U-series (Arias et al., 1998; Bischoff et al., 2003 *apud* Ochoa et al., 2021), the estimation of the chronology of rock art panels, including the Palaeolithic ones, was based on relative dating techniques, such as stylistic comparisons of parietal and portable art, the analysis of superimpositions, stratigraphic associations by covering the parietal art or detached pieces, representations of extinct fauna, association of mobile art with stone and bone tools, etc. (Aubry and Baptista, 2000; Pettitt and Pike; 2012; David et al., 2013 *apud* Ochoa et al., 2021; Ochoa et al., 2021). According to Ochoa et al. (2021) debatable points can be the potential role of technical differences between portable and rock art example, cases of "unsubstantiated stylistic comparisons", the rarity of portable art during specific phases, but also as Bahn (2015) mentions, subjectivity. Ucko (1987) has suggested there might even be the possibility of several contemporary styles with differences caused by the application of various techniques or based on the artistic ability or regional variations (Ucko, 1987 *apud* Pigeaud, 2007). Davidson (2018) highlights the fact that the limits of transitional phases can be hardly defined. Even so, cases where relative dating suggested based chronostylistic sequences follows the absolute dates have been identified (Alcolea González and Balbín Behrmann, 2007; Bicho et al., 2007; Ochoa et al., 2021). Despite the numerous debates on the limitations of stylistic comparison, this relative dating technique/approach has been a tool of primary importance in the studies as usually prehistoric rock art does not meet the criteria of the other dating techniques to be applied (Pigeaud, 2007; Alcolea-González and González-Sainz, 2015; Ochoa et al., 2021).

The comparison of Ocreza with the clusters mentioned in Chapter 2, but particularly with Côa Valley that has a rich record of Pleistocene engravings associated with over imposed archaeological layers rich in rock art, diagnostic artefacts and OSL dates (Santos et al., 2021) was crucial for the interpretation of OCR15 and OCR21. Among the sites of the latter cluster, Fariseu has provided a relative chronology confirming the antiquity of the oldest phases of the rock art, previously suggested based on their style (Zilhão, 1995; Guy, 2000). A terminus ante quem around 18,000 ± 1,600 ka BP was suggested based on OSL dates acquired from a stratigraphic sequence covering Rock 1, together with a detached engraved fragment (Figure 78, Figure 79) (Aubry et al., 2010).

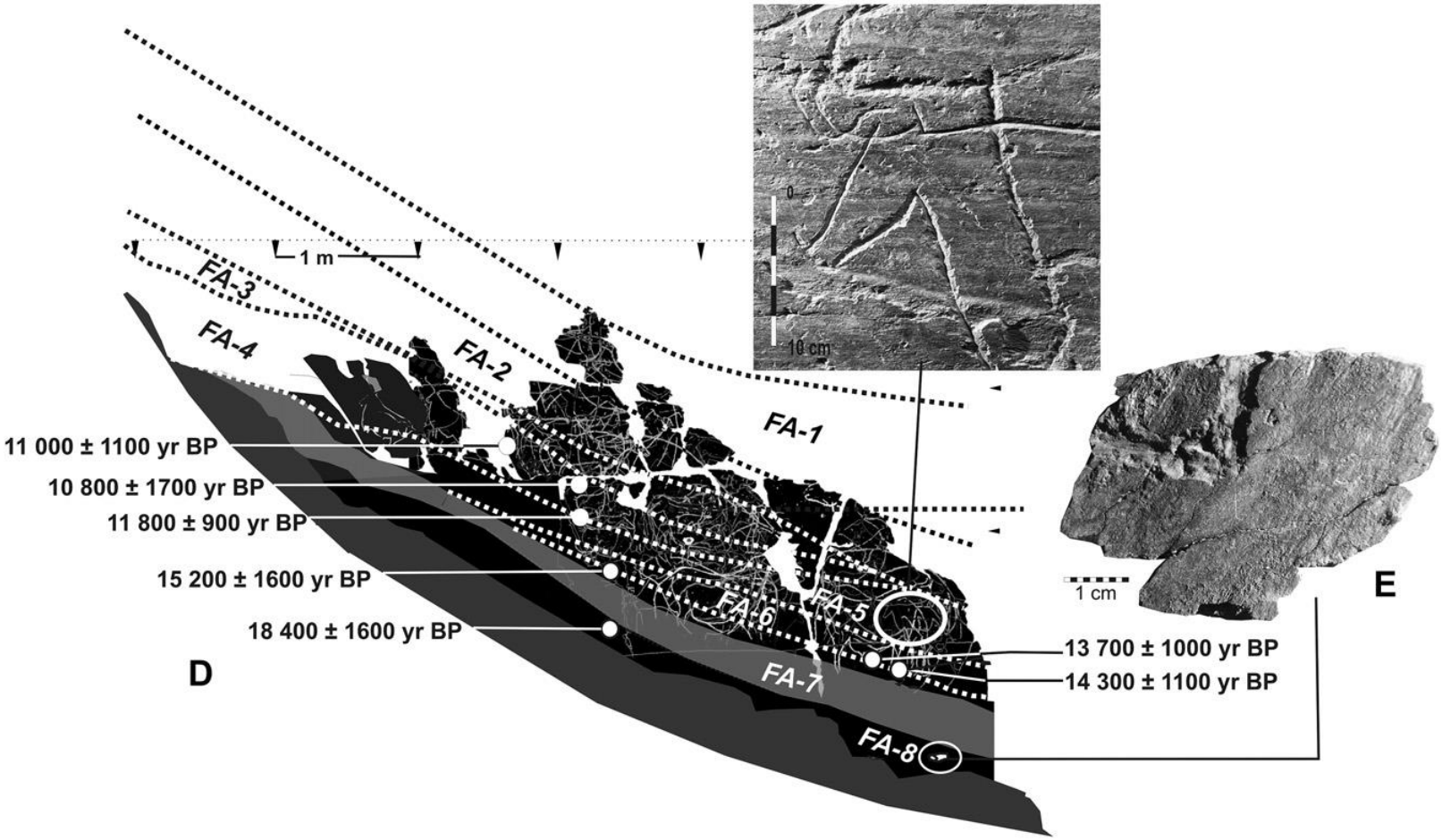


Figure 78: The stratigraphic sequence with superimpositions dated by the luminescence in front of Rock 1, Fariseu (Côa Valley). The first photo is a detail from a figure that is attributed to the older graphic period of the Valley. The fragment of the E photo was detached from the panel. It was found in the stratigraphic Unit FA-8 which is dated by OSL ca. 18,400 ka BP. (Image and text: Aubry et al., 2010).

Figure 79: Fariseu Rocha 1 (Tracing: F. Barbosa, assisted by M.Almeida, J.Félix and A.T. Santos in Santos, 2017).

Côa Valley presents the two main artistic periods of Upper Palaeolithic, the Pre-Magdalenian/Gravettian-Solutrean and the Magdalenian (Baptista, 2009). In 2012, Santos proposed three phases (Figure 80). The first, corresponding to the Gravettian/Solutrean (c.30,000-18,000 BP), the second to the Magdalenian, possibly still initiating in the Upper Solutrean (c.18,000-13,000 BP) and a third between the end of the Pleistocene and beginning of the Holocene (c.13,000-10,000 BP) (Reis, 2021).

According to Reis (2021), during the first phase, the animal figures are represented in a naturalistic manner and standard types, few or absent body details, usually static although cases of animation through the repetition of body parts rarely occurs. At the second, naturalism is evolved, and stylistic variation exists, body details are very common and the figures present expressions. During the third phase, naturalism disappears, stylistic variation is reduced, while incorrect proportions and geometrization are common. Lately, Santos et al. (2021) made a new proposal of further division in four phases based on archaeological and geoarchaeological evidence and the use of statistical analyses. The two oldest subdivisions of Santos et al. (2021)

do not have a precise chronological frame. The first phase could even predate Gravettian, but it ranges from the Gravettian until the Middle Solutrean. Suggested parallels are found in Iberia with at the sites of Ocreza, Mazouco, Redor do Porco, Foz Tua and Siega Verde, Escoural, La Pileta, El Reno, even in France with La Croze à Gontran, Pair-non-Pair and Mayenne-Sciences. The second phase ranges from Middle Solutrean to Early Magdalenian, with parallels with figurative art from Siega Verde, La Griega, Domingo García and Poço do Caldeirão (Santos, 2019).

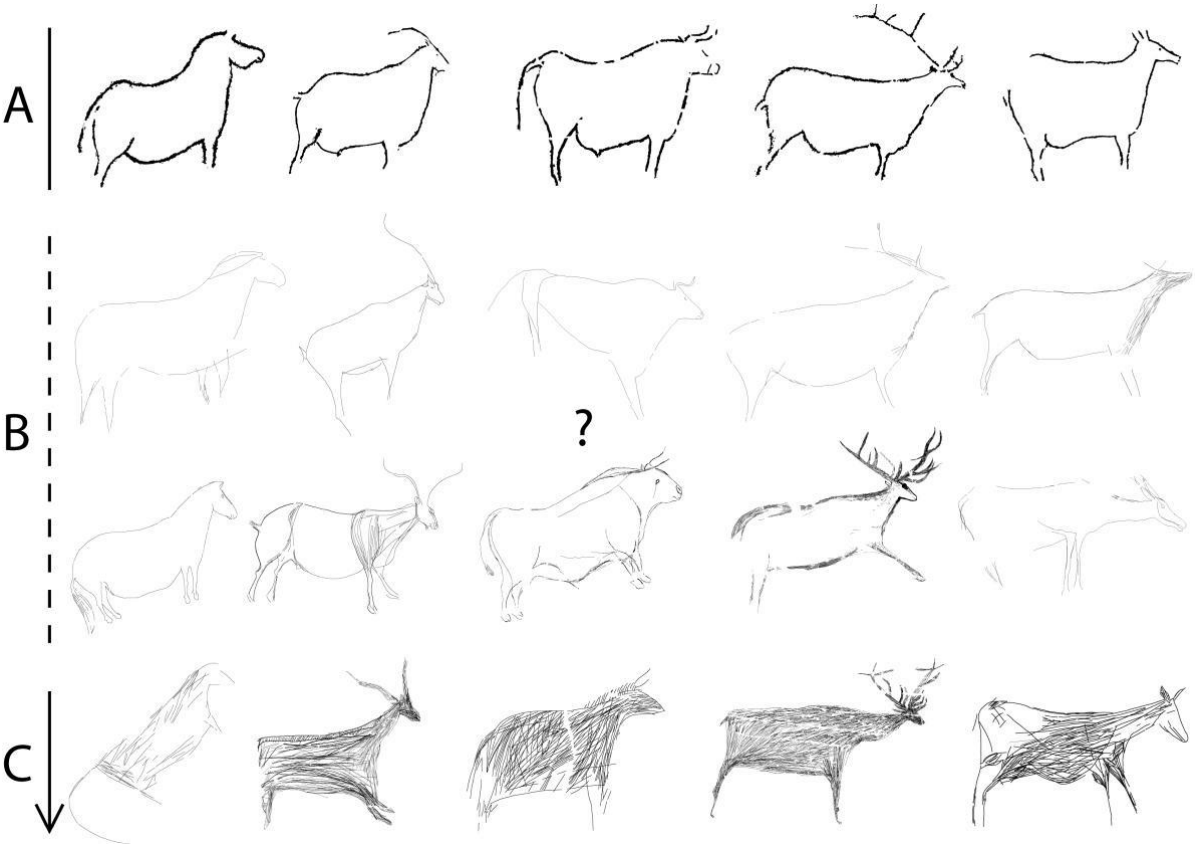


Figure 80: Proposal for the evolution of artistic phases with the main species depicted in the Côa Valley (Image: Luís et al., 2015).

In the case of the OCR15 panel, the iconography clearly represents a horse whose Palaeolithic age (Gravettian-Solutrean) is well attested by Baptista (2001, 2009) and Santos (2017). According to Baptista (2009) its cervicodorsal line in S shape and the representation of one leg per pair is typical for the phase of Upper Palaeolithic rock art. The pronounced ventral line in horses is commonly found during the Solutrean (Bernaldo de Quirós and Cabrera Valdés, 1994; Martínez García, 2012), but according to Santos et al. (2021) could extend back to the Gravettian and Aurignacian. Baptista (2001) suggested parallels from Piedras Blancas (Figure 81), the Côa Valley, like Rocha 1 Ribeira de Piscos (Figure 82) and Fariseu Rocha 1 (Gravettian-Solutrean), La Pileta (Figure 83), Trinidad and Nerja (Lower or Middle Solutrean),

and Escoural cave (Figure 84), whose chronology is still under dispute, but most likely covers the Gravettian-Solutrean (Reis, 2021). Similarities were also proposed with the Parpalló plaquettes, covering a transitional period between final Gravettian and Lower Solutrean (Reis, 2021). During the bibliographic researcher the similarities with Côa have been traced as well in other examples like Figure 82 and Figure 85. Additionally, an interesting case that shows a similarity is that of a schist plaquette, from Vale Boi discovered in a dated Solutrean layer with associated stone tools that is dated to c.25,000-24,000 cal BP (Figure 86) (Bicho et al., 2012). The S line is very similar in both zoomorphic figures, although the animal represented on the mobiliary art has been interpreted as an auroch, and the back part with the tail is missing.

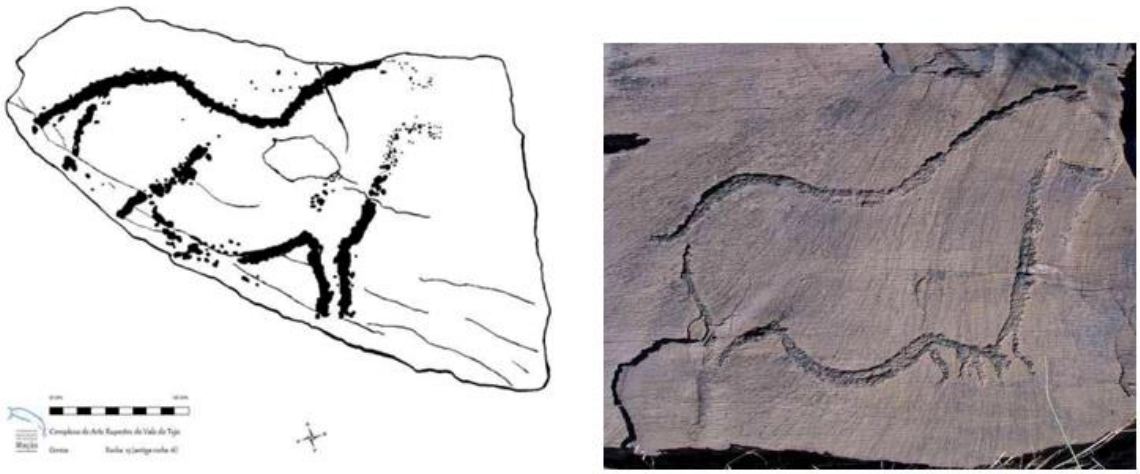


Figure 81: The Ocreza horse (Tracing: S. Garcês and G.Nash) and the Horse from Piedras Blancas, attributed to Solutrean Inferior according to Martínez García (2009) (Photo: J. Martínez in Martínez García, 2009).

Figure 82: Left image: Horses from Ribeira de Piscos Rocha 1 (Tracing: F. Barbosa, M. Almeida and A. M. Baptista in Santos, 2017). Right image: Tracing of a possible horse of the oldest phase of Côa, from Quinta da Barca Rocha 20 (Tracing: F. Barbosa/ CNART/ PAVC in Baptista, 2009).

Figure 83: Horses from La Pileta (Image: after E. Ripoll in Cornellà et al., 1995).

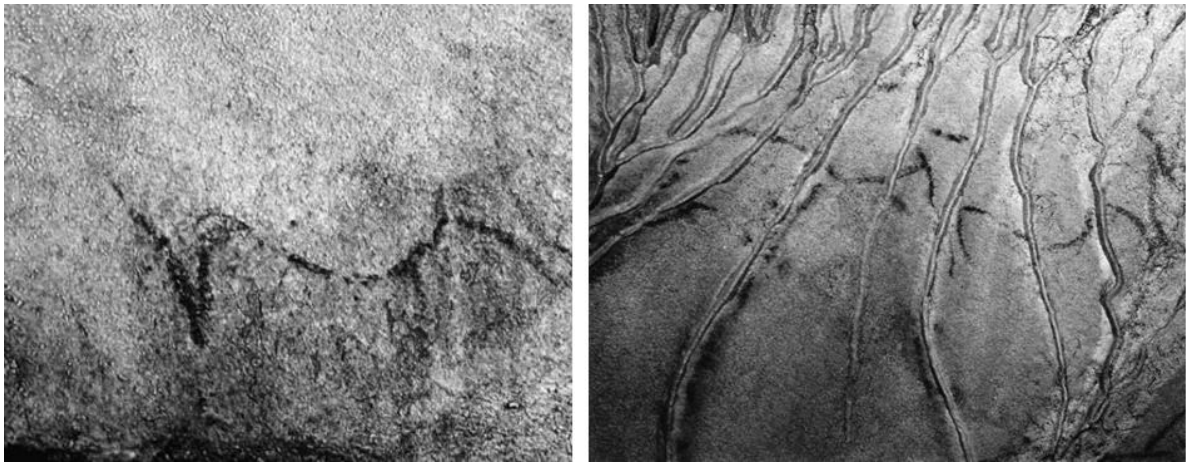


Figure 84: Zoomorphic figures with black pigment from Escoural. Corchón Rodríguez (2008) proposes an Upper Solutrean chronology (Photos: F. Jordá in Corchón Rodríguez, 2008).

Figure 85: Zoomorphic figures from Rocha 6 Penascosa (Tracing: A. M. Baptista, M. V. Gomes and F. Barbosa/ CNART/ PAVC in Baptista, 2009) (Photo: Reis, 2020).

Figure 86: Left image: The cervicodorsal line of the OCR20, isolated, forming the typical S line. (Tracing detail from the original tracing of G. Nash and S. Garcês). Right image: The zoomorphic figure of Vale Boi plaquettes securely dated c. 25,000-24,000 cal BP based on stratigraphy (Image: Bicho et al., 2012).

Panel OCR20 presents a complicated picture due to the complexity of the panel's surface, the state and nature of the representations (broken parts, not clear outlines, mixed-techniques, unfinished and eroded contours). Despite the absence of conventions securely attributed to specific chronological period, the panel presents some indications for an Upper Palaeolithic chronology, primarily represented on GU2 and GU4. These are:

1) The existence of zoomorphic representations. Nevertheless, this is not sufficient, as animal figures on Tagus can be found in the following periods (Gomes, 2010; Garcês, 2017). However, they are still relevant because they are not associated with other typical Holocene engravings;

2) The representation on absolute profile, static movement and the naturalistic style, extremely common in Upper Palaeolithic rock art (Santos et al., 2021; Luís and Fernandes 2009);

3) The pecking techniques applied, although this cannot be considered a safe marker, and the possible use of fractures on GU10 (Fernandes et al., 2017);

4) The most important indicator is the style of the two Graphic Units, like the Pre-Magdalenian phases of Côa. The remain GUs are insufficient by themselves; animal representations and techniques exist as well in post-palaeolithic periods, while the use of fracture in our case is unclear. Yet if combined they increase the chances of a Pleistocene chronology.

The GU2 and GU4 from OCR20 seem to correspond to the first phase of Côa (Figure 87, Figure 88, Figure 89). In general, Pre-Magdalenian zoomorphic figures are represented with "prominent and convex bellies, rounded hips, naturalistic heads with few or no anatomical

details”. They tend to have only one leg per pair, while the hoofs are not depicted. Accordingly, a single horn is represented, and when they demonstrate a pair of them, they are in straight or oblique bi-angular profile. The tails follow specific patterns according to their species. The dorsal lines present anatomical features as withers, back and croups. These characteristics are considered as details of the ancient phase by Balbín Behrmann and Alcolea González, (2002), Zilhão (2003), Baptista (2012), Santos (2012) and Santos et al. (2015) and are evident at the stratified plaquettes of Parpalló (Villaverde Bonilla, 1994; Zilhão, 1997; Bicho et al., 2007). Santos et al. (2015) suggest for this phase that parallels can be found among various figures from Escoural, Siega Verde, Redor do Porco, Ribeira da Sardinha, Fraga Escevida, Sampaio, Pousadouro, Ocreza, La Grajera 2, Mazouco [although a Magdalenian chronology have been proposed for this site prior (Santos, 2017)] and Foz do Tua.

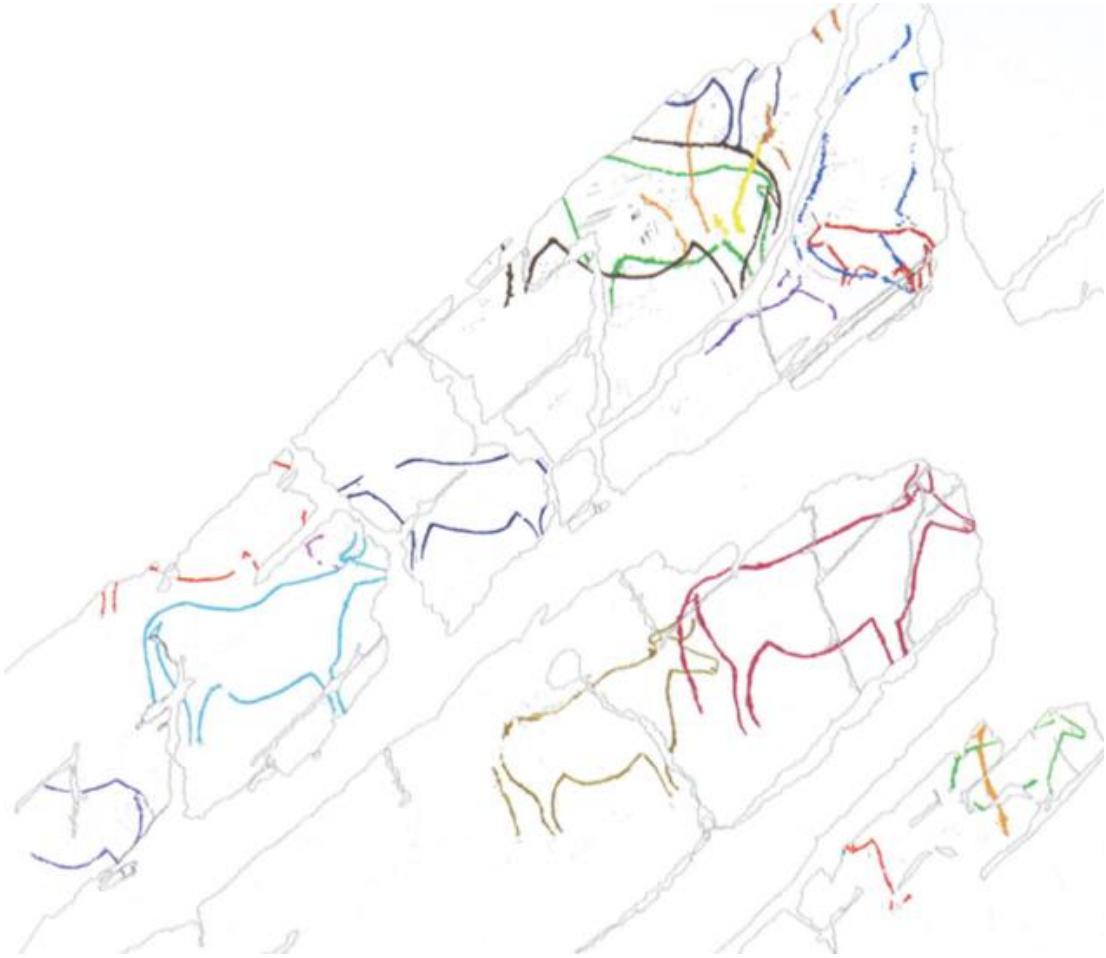


Figure 87: Zoomorphic figures attributed to the ancient phase from Canada Do Inferno, Rocha 1 (Tracing: A. M. Baptista, M. V. Gomes and F. Barbosa, CNART in Baptista, 2009).

Figure 88: Left image: Tracing of GU1 and GU2 (OCR20). Right image: Horses from Ribeira de Piscos Rocha 1, the perspective was manipulated by the author (Tracing: F.Barbosa, M. Almeida and A. M. Baptista in Santos, 2017).

Figure 89: Left image: Tracing of GU4 (OCR20). Right image: Quinta da Barca (Tracing: A. T. Santos, assisted by M. Almeida, A. Costa and S. Figueiredo in Santos, 2017).

5. Discussion

5.1. Chaîne opératoire

According to Rivero and Ruiz (2018) the analysis of the methods and techniques behind rock art creation are important to understand social implications, learning systems and cultural traditions. This analysis was influenced by the concept of *chaîne opératoire*, the sequence of the steps that were followed until the final product, concept introduced by L. Gourhan in 1964. Most of the times some important elements of the *chaîne opératoire* are missing, but the way it was conceived and when well applied, it usually allows the "mental refitting" (Pelegrin, 1995). This in the case of the engravings of the Ocreza panels, as the lithic tools with which they were made were not identified in the archaeological layers excavated. The steps could be organized in the case of the rock art panel in the following order: 1) Raw material selection, 2) Production, 3) Use, 4) Discard, 5) Recycling. The raw material selection in our cases is that of the schist outcrops. The production involves the methods and techniques that were used for the creation of the panel. The use can be related with the zoomorphic figures depicted and intangible aspects that belong to the field of interpretation. As discard we could interpret the overexposing of the surface and the absence of further use for a certain time. As recycling could be considered the reuse of the panel, with the addition of superimpositions or new engravings (and paintings) in blank areas.

5.1.1. Raw material selection

All spaces and rock surfaces could have been used for rock art. The location of palaeolithic rock art is highly affected by conservation reasons in both karstic environment and open-air sites (Balbín Behrmann and Alcolea González, 2021). Searching only caves and metamorphic outcrops, slates, and schists, is a reductionist perspective based on conservation and geological issues (Balbín Behrmann and Alcolea González, 2021). Other reasons that could possibly interfere with the selection of rock, besides hardness and the use of morphology and fractures, could have been the colour and the sound produced during the engraving process (Sundstrom, 2017; Blake and Cross, 2015). In any case, the importance of schist/slate outcrops due to the preservation of the engravings has been highlighted the most by researchers besides Balbín Behrmann and Alcolea González, like Bicho et al. (2007), Garate Maidagan et al. (2016) and Fernandes et al. (2017). Schist outcrops are considered as surfaces resistant to natural weathering in comparison with other rock formations. We must not forget the potential role of lichens and their expansion on rocky surfaces that could have been used as panels in the past. A case-study for Côa Valley regarding this topic has been published by Aubry et al. (2012)

who examined the spatial distribution and preservation of panels in Côa and Douro, considering solar radiation, humidity, lichen, and bryophyte colonisations, together with other variables like the topography of the slopes, the orientation of the panels and the distance from watercourses. The microclimate conditions should be examined before tracing surveys. Apart from the risk of natural degradation, open-air rock art sites are largely affected by the anthropic intervention. For example, studies have suggested that the big concentration of rock art in Côa and Siega Verde survived through time, because these territories had sparse population, while there was an absence of massive agricultural or industrial development as in other areas (Fernandes et al., 2017; Reis, 2021). In reality, the construction of the dam was the reason for the discovery of Côa, Sabor, Tejo and Guadiana engravings strongly support this idea. If the dam had been completed, everything would be now covered by water, like in many cases from the Lower Tagus basin (Garcês and Nash, 2022). Lastly, it can be said that the knowledge of the geological settings is precious not only for finding rock art sites and understanding the prehistoric people behaviour, but also for the purpose of future preservation (Aubry et al., 2012; Fernandes et al., 2017).

Schist outcrops and plaquettes, based on the current data seem to be adequate for symbolic purposes, facilitating the process with their usually medium hardness resistivity of the rock (comparing to sandstone, quartzite, and basalt for example (Sundstrom, 2017), their surface morphology either straight or occasionally bulky, and with fractures that could stimulate the artist's creativity, while they provide good preservation conditions. It would be adequate to investigate further the presumably preferential schist choice over other types of rock outcrops, questioning not only the preservation of the rock surface and the resistibility during the engraving process, but also the most favourable engraving technique in terms of time investment, like Alvarez and Fiore (1995) and Fiore (2007) did in cases related to the Patagonian rock art.

5.1.2 Production

The methodological and technical aspects of the *chaîne opératoire* of the engravings can be further investigated with the identification of superimpositions, experimental archaeology, macrophotography and GIS (Zilhão, 1997; Aubry et al., 2011; Robert et al., 2016; Forgia and Sineo, 2021). As noted before the Ocreza horse (OCR15) was made by pecking, while the OCR20 panel demonstrates the use of pecking (direct or indirect), incision (single or multiple lines) and abrasion techniques (possibly caused by repeated incisions) (Table 7). Sundstrom (2017) suggests that scratching and incision can be done with stones, bone knifes and gravers,

presenting U- or V-shape cross sections, while for pecking ("stricking") and abrasion have been proposed bone, stone, and wooden tools. Ripoll López (2012a) argues that tools used for incisions could have been burins, or simple flakes or blades. Regarding pecking Baptista (2001) has suggested that the Ocreza horse (OCR15) was made by indirect pecking with the use of a quartzite incisor. Sundstrom (2017) mentions that fine, controlled lines can be done by indirect percussion using a hammer tool and a chisel. On the other hand, experimental results on greywacke supports for the analysis of engravings from Cachão do Algarve, a site on the Tagus Complex with post-Palaeolithic engravings, suggest that indirect percussion does not provide the same level of accuracy as direct percussion (Santos Da Rosa, et al. 2014). Quartzite picks from the Gravettian layers of Olga Grande 4 in Côa were considered as tools for pecking and abrasion by Aubry, Sampaio, and Luis (2011) after an experimental approach (Santos et al., 2015). Thus, further examination using experimental protocols with a focus on the two panels replicating them on another similar schist surface, will be necessary to provide valuable results for Ocreza.

Reconsidering the documentation methods, another beneficial methodological tool that could also apply particularly in the newly discovered panel providing further results on the enhancement of the engravings and the aspect of production is macrophotography. According to Robert et al. (2016) it is a method extremely beneficial for the examination of small details in high resolution digital imaging. It requires macro camera lens. The appropriate parameters (light, depth etc.) selected by the user can lead to microanalysis of the rock art techniques. For example, in the case of engravings, the gestures and their orientation can be identified. Another option to examine the engravings could be by combining a high-resolution DEM created by 3D modelling and manipulated through GIS, like Forgia and Sineo (2021) did. These researchers analysed linear incisions and the technical gestures through the inspection of cross sections.

5.1.3. Interpretations and hypotheses regarding the animal species depicted in Upper Palaeolithic rock art (Use)

The attribution to Pleistocene dates in the earliest discoveries of European palaeolithic rock art, was made due to the representations of animals like bison and reindeer, fauna that was extinct from sites or the wider area (Davidson, 2018). Accordingly, climatic conditions can be proposed considering the usual habitat of these animals. It must be noted though that this type of dating is not precise, as sometimes new data might be controversial. For example, the animals represented were not present in the particular area at the current time, or they could have been depicted by people who migrated. Based on a study on the Cantabria Upper Palaeolithic rock arts sites, Altuna (1994) pointed that the consumption of fauna found on sites with rock art representations does not correspond with the represented species. Furthermore, he argued that in general it is risky to deduce ecological consumption, for example which were the preferred hunted and consumed species, nor the climatic conditions (warm/cold), as additionally animals from far places could be represented. Balbín Behrmann and Alcolea González (2021) agree with this perspective noting that the figures of animals in Palaeolithic rock art cannot be fully trusted as environmental markers. They give the example of Côa where most of the animals attributed to the Gravettian are adaptive species, which are eurythermal. It is obvious that in such attempts a cross examination of the local fauna is necessary. A recent attempt to correlate animal representations and fauna was done with a focus on the Solutrean sites of Southern Spain. The researchers examined the rock art site of La Pileta and the occupation site of Higueral-Guardia, using GIS, Site Catchment Analysis and Species Distribution Modelling (Bolín et al., 2019). They argued that the species with "high habitat suitability" are represented in subsistence strategies and art, while the regional environment and topography tend to interfere with the accumulations. Other general interpretation theories on the zoomorphic figures during Upper Palaeolithic besides the climatic conditions and animal consumption have connected the representations with shamanism, such as spirituality, metamorphism, hunting, healthiness (Glory 1968 *apud* Bahn, 2011; Nash, 2014), communication systems containing ethological and hunting information (Mithen, 1988 *apud* Bicho et al., 2007), and territorial landmarks (Balbín Behrmann and Bueno Ramírez, 2009; Baptista, 2012).

These are approaches to be taken into account in further investigations of Ocreza as, at this point, there are not enough data for any relevant hypothesis on the Ocreza context.

5.1.4. Superimpositions in OCR20 (Recycling)

Breuil (1952) suggested that when one figure superimposes another one, it is made after the former one (Ripoll López, 2012b); basically, this is Nicolas Steno's Law of Superimposion. Palimpsests of superimpositions in iconography are common and the main question is when each one happened as it could have followed straight after the creation of the superimposed graphic unit, some days after, centuries or thousand years later (Ripoll López, 2012b). Sanchidrian (2001) suggested the existence of diachronic and synchronic superimpositions. The latter could have been done even by the same artist and at the same event. This relation can be studied up to a point comparing techniques and using indirect analysis (Ripoll López, 2012b).

At the OCR20 panel exist at least two superimposition cases, between GU2 and GU4 and one between the two techniques of GU8 according to direct tracing and photography. Additionally other two possible cases have been noticed during the inspection of the panel and its photos. The first could involve GU8 and GU6, while the second possibly occurs in the mixed techniques of GU9 (Figure 90). Bellow follows a description from left to right, with the superimpositions to be divided in Superimposition 1 and 2 and Possible Superimpositions 1 and 2:

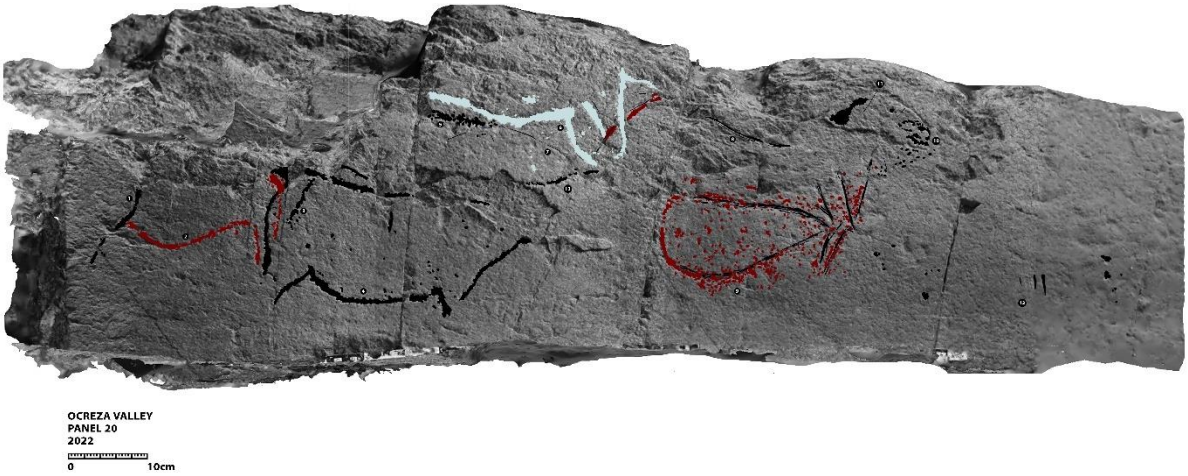


Figure 90: The proposed superimpositions on the graphic units of OCR20. In burgundy are represented graphic units that are older than the black lines. In light blue is traced GU6 whose superimposition is uncertain as it is explained on the text.

Superimposition 1: The back of GU4 superimposes the back of GU2. The latter presents less wide and swallower peckings. On the contrary the peckings of GU4 mark the schist surface in a more profound way, which is also evident on cross-sections with GU2 (Figure 91).

Figure 91: The superimposition part between GU2 and GU4 with the back part of GU2 and the tail like peckings of GU4 (Photos: H. Collado Giraldo).

Possible superimpositions 1 and 2: At a particularly complex area of the panel at the upper part, in what is regarded GU8, between the U-shaped like right part of GU6, during direct tracing was discovered an incised line at the same part with some weathered peckings. The eroded surface makes our view unclear. It is under question if the incised line superimposes the pecking marks or if it was under them. The direct tracing process (although it could have been subjective) and the manipulation of artificial light during a night session seem to be in favour of the latter scenario (Figure 92). Furthermore, the incised line and some peckings attributed to GU8 based on their different orientation and the inclination at the upperpart might also superimpose GU6, but again it is not certain whether a part of the pecking belonged to GU6 or if the marks of GU8 really cross GU6 (Figure 92).

Figure 92: Left image: Detail with the potential superimposition of GU8 above GU6. (Photo: S. Garcês) Right image: Detail with the superimposition found at GU8. Pecking marks might be superimposed by an incised line located between the U like shape of GU6 (Photo: H. Collado Giraldo).

Superimposition 2: The last case of superimposition can be found on the GU9. The superimposition rules suggest that at least some of the incised lines were created after the pecking marks. Based on our view from the photos the limits of the incisions are hard to be defined (Figure 93, Figure 94). At the oval shape incisions and peckings seem to be mostly above the peckings as there are no pecking marks at their cross section, but only around them.On the right part, with the subvertical incisions, this is far more unclear, and the sequence needs further inspection. For all cases a re-examination would be advisable with macrophotography and a high-resolution DEM, as it was mentioned previously.

Figure 93: GU9 Detail with a mix of techniques pecking and incisions. At the upper right part of the oval shape repeated incisions possibly ended up in abrasion of the surface. At the right part with the parallel and straight lines, many incisions seem to superimpose pecking marks (Photo: H. Collado Giraldo).

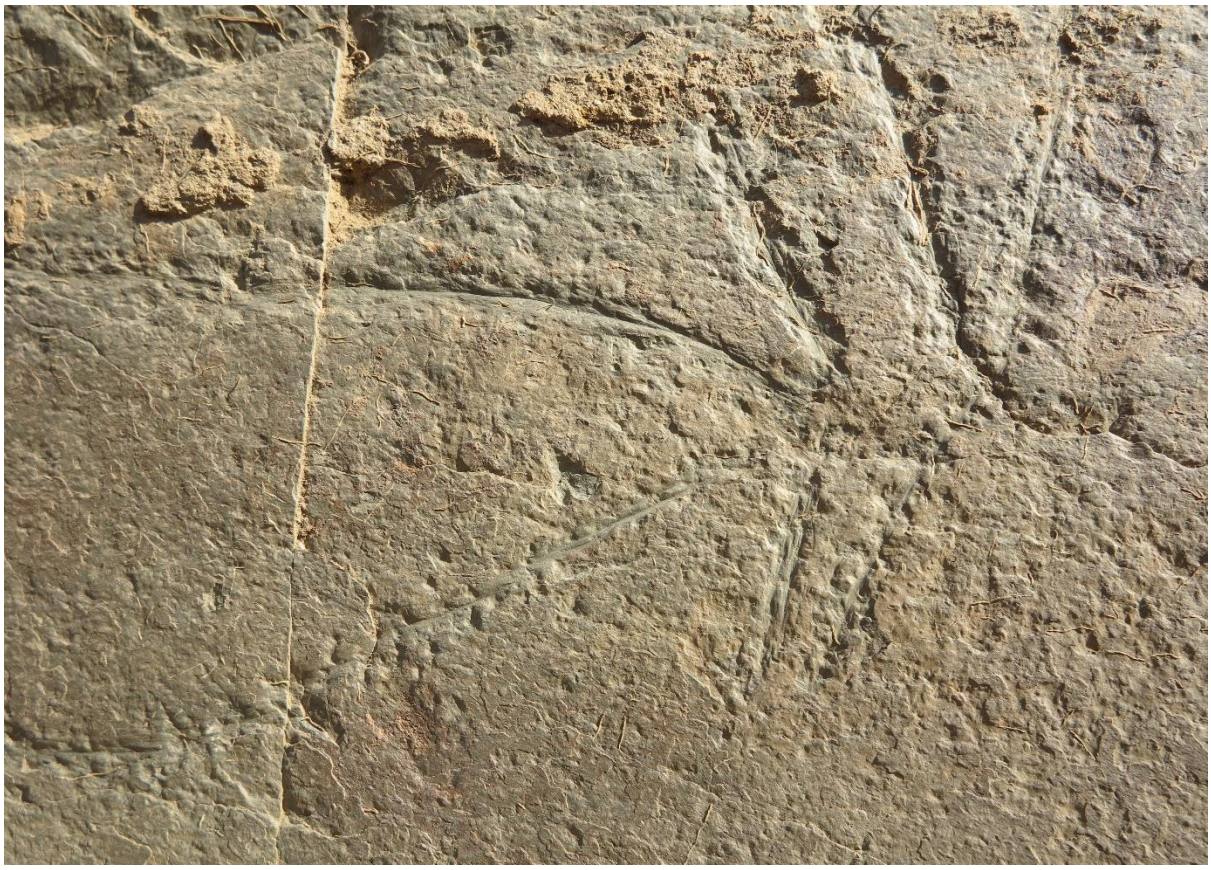


Figure 94: GU9 in zoom, with abrasion to be evident in the upper right part, after the natural fragment of the rock surface (Photo: S. Garcês).

5.2. Different possibilities for the graphic units of OCR20

Figure 95: OCR20 without GU13.

Due to the complexity of the panel (Figure 95) different possibilities and subdivisions for the graphic units are presented:

GU1 and GU2: GU1 could be united with GU2 forming a single zoomorphic figure (Figure 96). Initially it was considered distinct due to a possible resemblance of the GU1 line to the inner part of a back leg and the position of the belly, although there might be an attempt to present the leg in a more robust way or simply differently like in Figure 97, and a difference in the thickness of the peckings. Another option would be this of Figure 98, with the use of the same back line of GU4, but again the problem here is the right line that is found inside the back of GU4 with a different pecking depth. This can it be another superimposition between GU2 and GU4 instead of the previous one, or an attempt to depict a second leg.

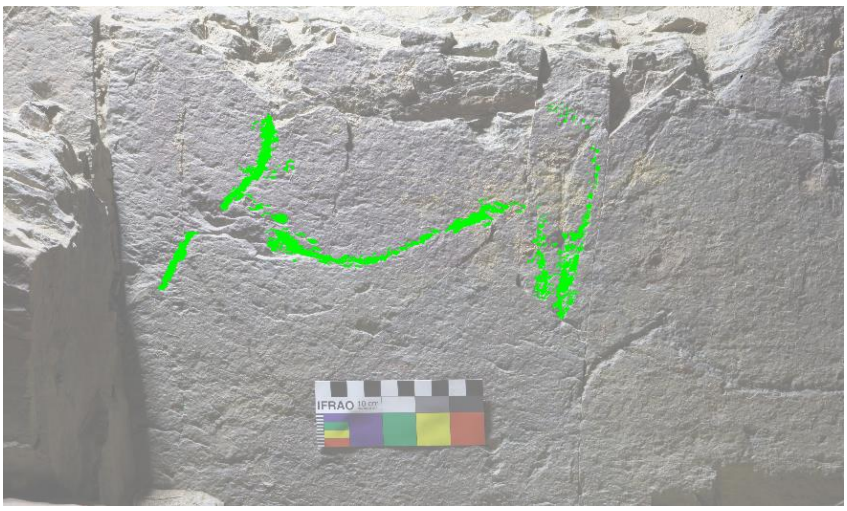


Figure 96: Graphic unit 1 and 2 united.

Figure 97: Rocha 56, Quinta da Barca (Tracing: CNART in Santos, 2012).

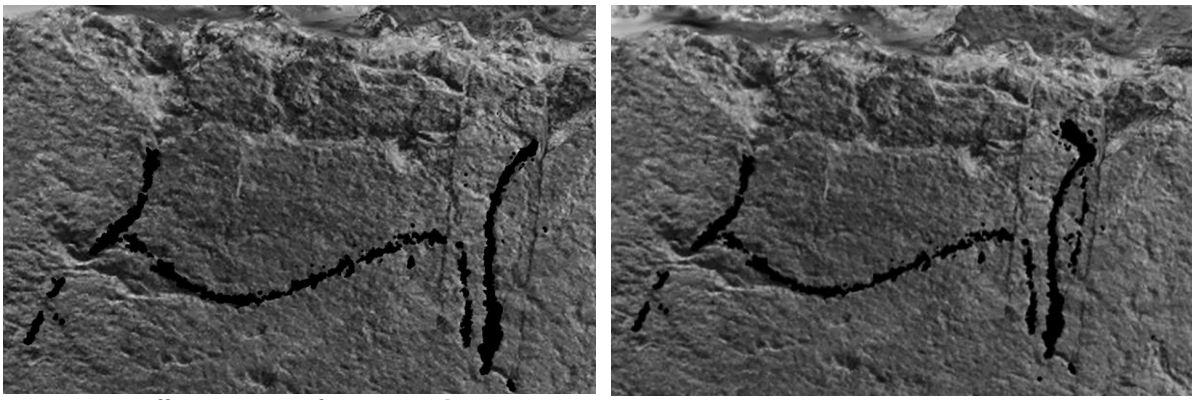


Figure 98: Different options for GU1 and GU2.

GU3 and GU4: The two units could be united creating something similar to body delimitations like in examples from Siega Verde (Balbín Behrmann and Alcolea-González, 2018) (Figure 99). At the upper part a line could continue at the broken surface or it could have been a draft.

Figure 99: Left image: tracing combining GU3 and GU4. Right image: Horse presenting pecked lines and a claviform at its interior part, from Siega Verde (Conjucto 101) (Tracing: Balbín Behrmann et al., 1995).

GU4: GU4 was suggested to have a tail-like triangular form. This part is made by many peckings in the form of dots differing from the rest of GU4. The possibility that there is no

connection with the rest of the body cannot be refused with certainty because the panel is broken between this part and the dorsal line. Nevertheless, it seems rather unlikely (Figure 100).

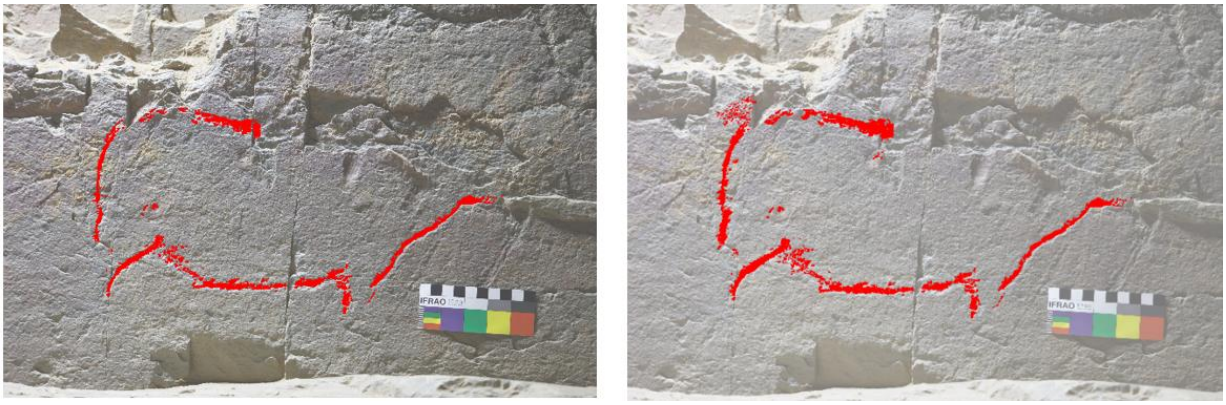


Figure 100: Left image: Hypothesis A. GU4 without tail. Right image: Hypothesis B. GU4 with tail.

GU13: It is not clear if it is natural or anthropic, but it was traced during direct tracing (Figure 101middle and right). It could be either alone, or part of GU4 or GU6 (Figure 102). It is placed at the upper right part of the broken/exfoliated area above GU4, a fact that complicates our view. Both hypotheses of merging with other units do not look competent.

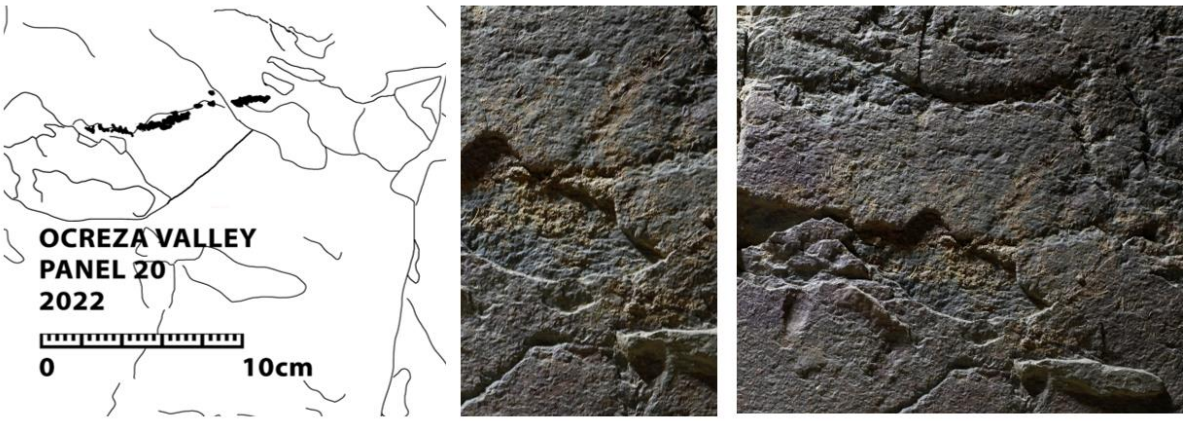


Figure 101: Tracing of GU13 together with two detailed photos (Photos: H. Collado Giraldo).

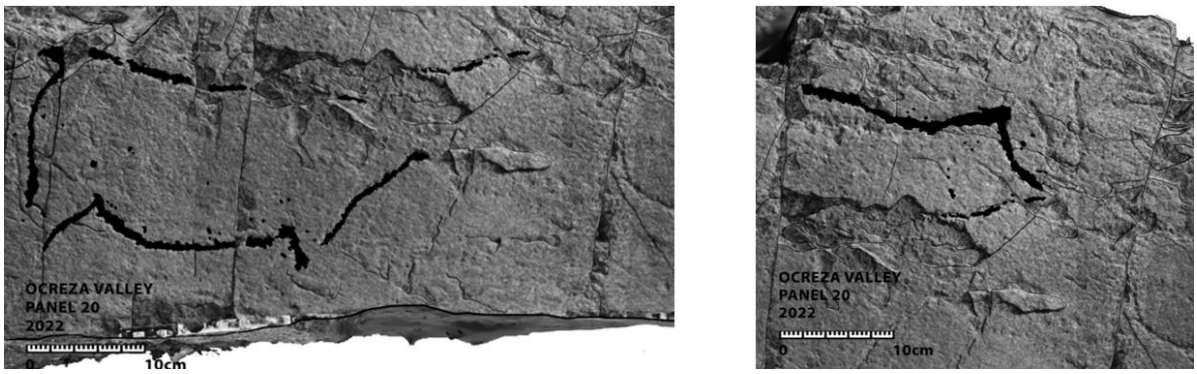


Figure 102: Left image: Hypothesis A. incorporation at GU4. Right image: Hypothesis B. incorporation at GU6.

GU5 and GU6: The units could be merged, with the former to follow the position of GU6 as a draft. Another option for GU5 is that it was related with the broken part of the panel at the left side and a possible continuation (Figure 103).

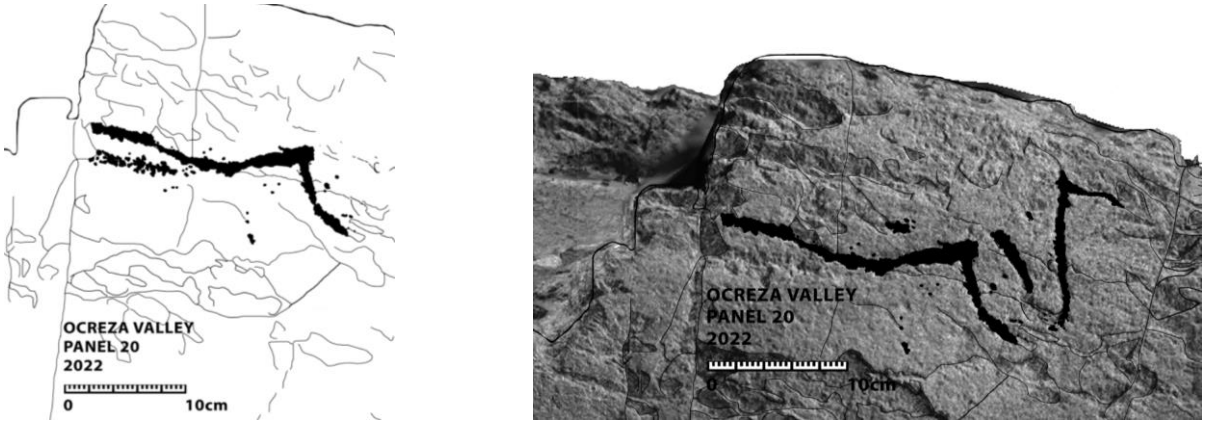


Figure 103: Different options for GU6.

GU6: It is the first of the two very complex areas of the panel. Its unity was proposed based on the thickness and depth of the engravings at the right proposed part (Figure 104). The lower semi horizontal line of GU6 could stand alone as a dorsal or ventral line that continues to the left part. A possible zoomorphic head exists at the right part, but the upper part of the panel is highly eroded preventing a secure species attribution. Another option could be a subdivision in two parts with an optical illusion of two reverse zoomorphic heads (Figure 105). The issue here is the absence of continuation for the rest of the head rising from above. Optical tricks occur in palaeolithic art of Douro for example using superimpositions or repetitions of body parts to depict movement (Figure 105) (Reis, 2021). For Baptista (2012) the illusion of movement with the representation of a second head is attributed to the oldest phase and may also be seen in panels from Penascosa Rocha 3 and Canada do Inferno Rocha 1. Alternatively, the pecked point in the middle was created by chance and nothing exists there.

Figure 104: Left image: Tracing of GU6 highlighting the possibility of the existence of two heads, using the same line in the middle. Right image: Detail of the panel (Photo: H. Collado Giraldo).

Figure 105: Left image: A superimposition of different species heads in Foz do Tua rock-shelter. Reis (2021) suggests that the body and upper head belong to a deer. The lower head was at first that of an auroch's, later transformed into a horse head. (Tracing: Santos et al., 2015) Right image: Optical illusion of movement with the repetition of three horses' heads from Penascosa (Côa).(Image: L.Luis, Parque Arqueológico do Vale do Côa).

GU7: The unit does not follow any other engraved mark on the panel. Probably based on the linear incised technique, it may be coeval of GU8 (Figure 106).

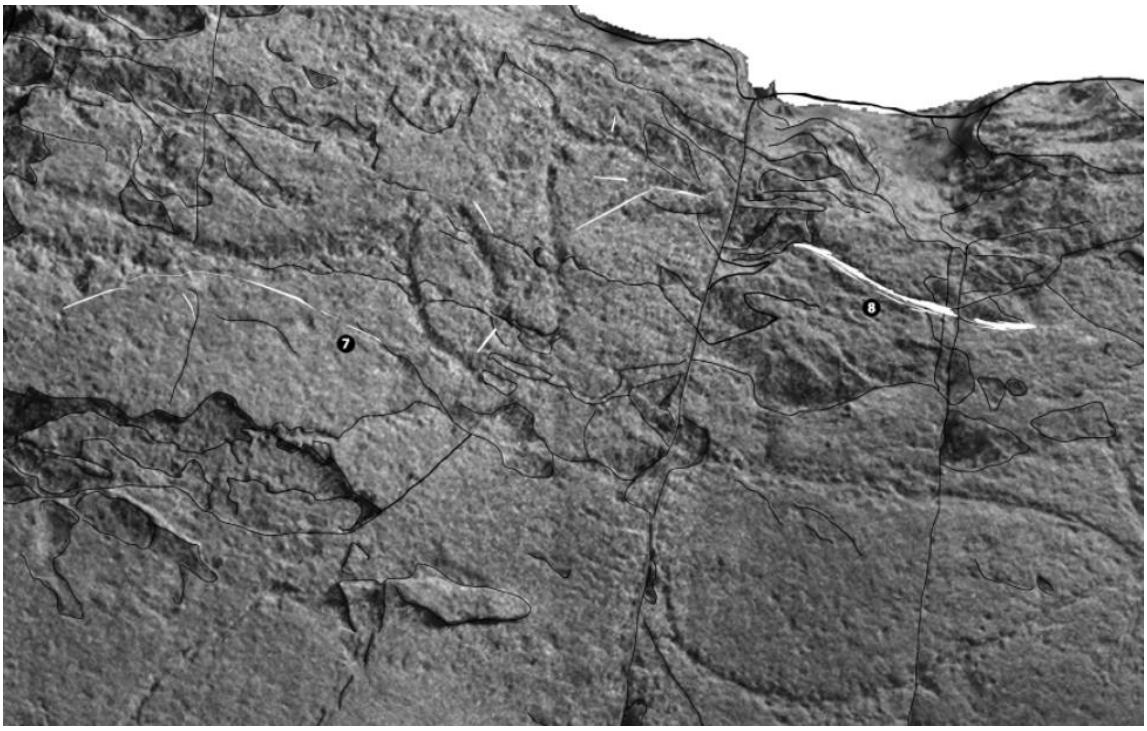


Figure 106: GU7 and GU8.

GU8: could either stand alone or be united with GU10 (Figure 107), representing a large zoomorphic figure. This figure could incorporate also a part of GU9 (Figure 108, Figure 109) but if so, the mix of techniques and their unclear limits (see 5.1.4. Superimpositions) confuse more the possible representation.

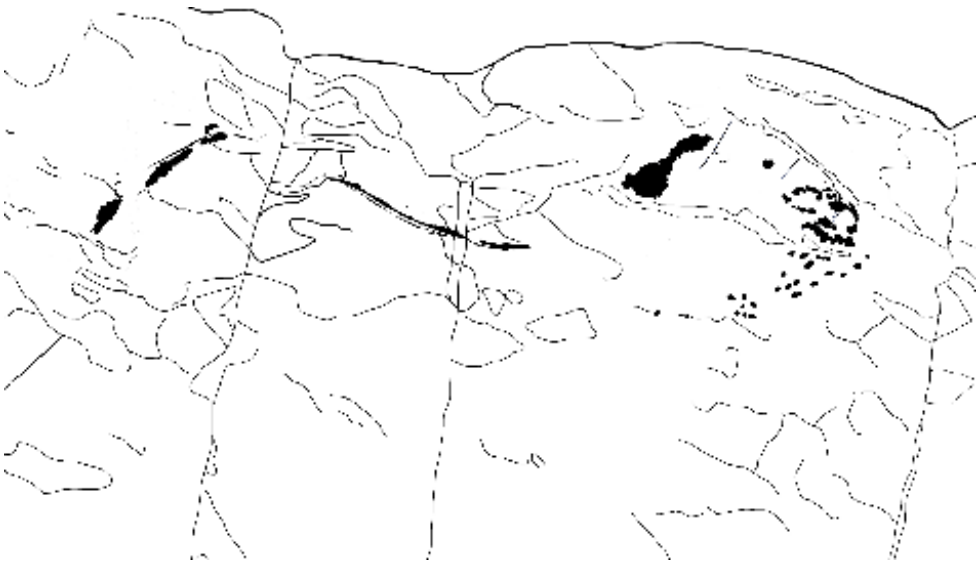


Figure 107: GU8 combined with GU10.

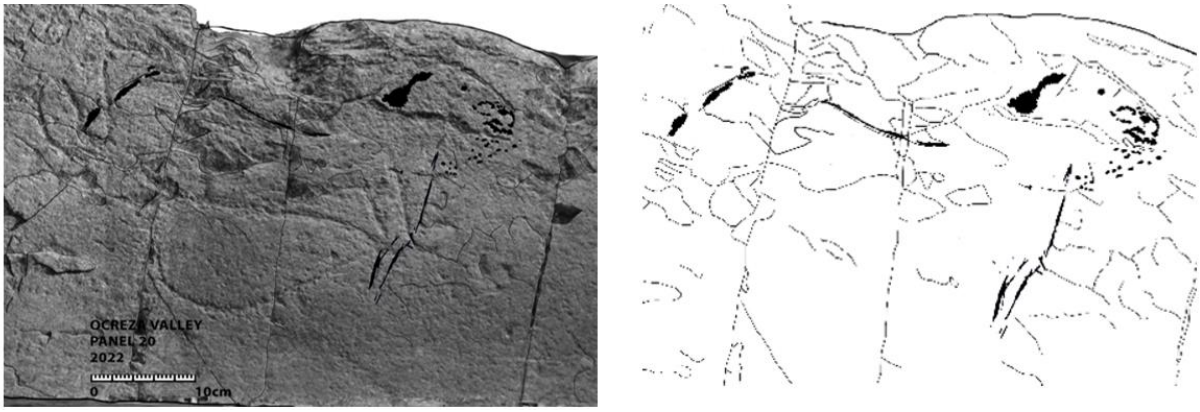


Figure 108: GU8 combined with GU9 and GU10.

Figure 109: Left image: Magdalenian horses with relatively straight frontal line from Parpallo (left) and La Griega (right). (Image: Villaverde Bonilla, 1994). Right image: GU8 combined with GU9 and GU10.

GU9: It is the second most complex area of OCR20, with a mix of the three different techniques. It could be subdivided either according to the techniques used or based on the thickness and depths of the incisions at the right part. In some photographs and the 3D model views looks like there is a differentiation between the lines. Two upper parallel subvertical lines coming from left to right may mean that they were created at the same moment, while one coming from the opposite direction, together with the lower two at a different time, as they are thinner and not that evident (Figure 110). The possibility that the lower two were created prior to the deeper ones, initially belonging to the GU10 and GU8 (similar lines with GU8). Then they were pecked, incised, and abraded to create a schematic zoomorphic figure which incorporates the oval shape created with the same techniques. This is another hypothesis to explain the stylistic differentiation from the rest of the unidentified zoomorphic figures of the panel. Against this hypothesis may be the size that GU10 would have gain and the pecking marks that complete some of its details like the mouth and nostril, again making it unique in stylistic terms among the panel figures. In addition, there is also the possibility of the third opposite line being created to give the illusion of movement of the possible head.

All the above-mentioned require further inspection by macrophotography and another method that could statistically analyse the depth and to define somehow if there is a second stage of superimposition at this graphic entity.

Figure 110: GU9 (Photo: H. Collado Giraldo).

GU10: it was defined on the basis that it represents a zoomorphic figure formed by pecking, completed by the fractures, intentionally or unintentionally, while some incisions at the upper right part, that are not evident enough, were might also used (Figure 111). The left part of the peckings creates a shape that looks like a mane, while at the right part there is a single pecked point like an eye and a little lower series of peckings that create a contour like the mouth of a horse. This image is enhanced by the formation of the rock.

GU11: The incised marks (Figure 111) most probably are related to figure GU10, but again the timing of their creation is under question.

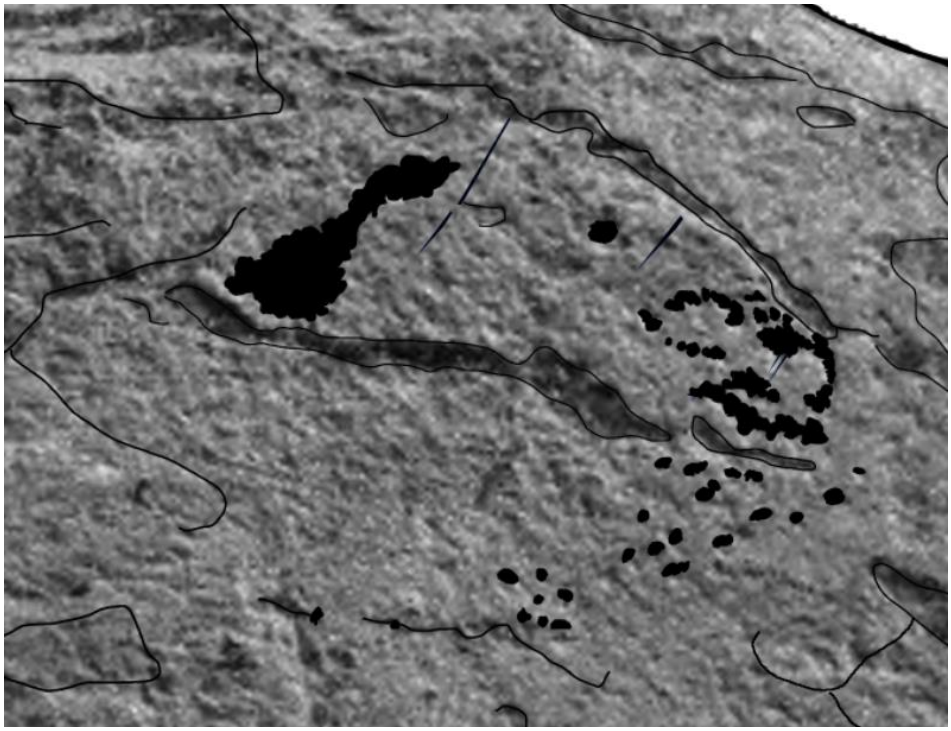


Figure 111: GU10 and GU11.

GU12: The incisions of GU12 (Figure 112) have been repeated in parallels. Possible functional interpretations are suggested as the graphic unit looks isolated from the figurative art of the panel. The incisions could be a draft created by the artist testing his/her tool, a counting method or something that we cannot understand at this point.

Figure 112: GU12 (S. Garcês, 2017).

5.3. Possible taxa of the OCR20 unidentified figures

The depiction of herbivorous species in the Upper Palaeolithic zoomorphic representations of Western Iberia was systematic, with carnivorous species to be nearly absent (Reis, 2021; Vázquez Marcos, 2021). The most common identified in Côa have been wild horses (*Equus ferus*), currently extinct whose closest reminder although not descended is the Przewalski horse of Mongolia, with the mane raised, like zebras (Pigeaud, 2007; Luis, 2008 *apud* 2017), aurochs (*Bos primigenius*), extinct species of the Bovidae family of larger dimensions than the current domesticated, cervids (*Cervus elaphus*) and the caprids Mountain Goat (*Capra pyrenaica*) and chamois (*Rupicapra pyrenaica*) (Figure 113, Figure 114) (Baptista, 2012). Horses are also common figures depicted in other palaeolithic rock art sites in Portugal such as Poço do Caldeirão, Costalta (Zêzere river) and Escoural cave (Baptista, 2009; 2012; Santos, 2017).

Figure 113: From left to the right: Przewalski horse, Deer, Chamois, Pyrenean ibex. (Images via Internet: 1,2,3,4).

Figure 114: Auroch representation (Image via Internet).

For the identification of species and for chronostylistic comparisons in figurative rock art particular features can be valuable (see more: Ripoll López and Municio González, 1999 and Ripoll López et al., 1999; Pigeaud, 2007). This identification can be rather complicated, especially when the animal representations follow a standard way of representation, like it is suggested for the ancient phase of Upper Palaeolithic at least in Côa (Reis, 2021). For example, as it is shown in Figure 115, the bodies of the animals, despite their different species, are enormous with similarities in the contours (enormous bodies and large bellies, one leg per pair, usually without hoofs, at least one horn in straight or oblique biangular profile (Luis et al., 2015). According to Luis et al. (2015) the tails and dorsal lines are very standard, according to each species, although when the figures are incomplete or suffer from erosion like in the case of OCR20 (Figure 116), things become unclear.

Figure 115: Examples of different species' forms from the Côa Valley attributed to the ancient phase (Image: Luis et al., 2015).

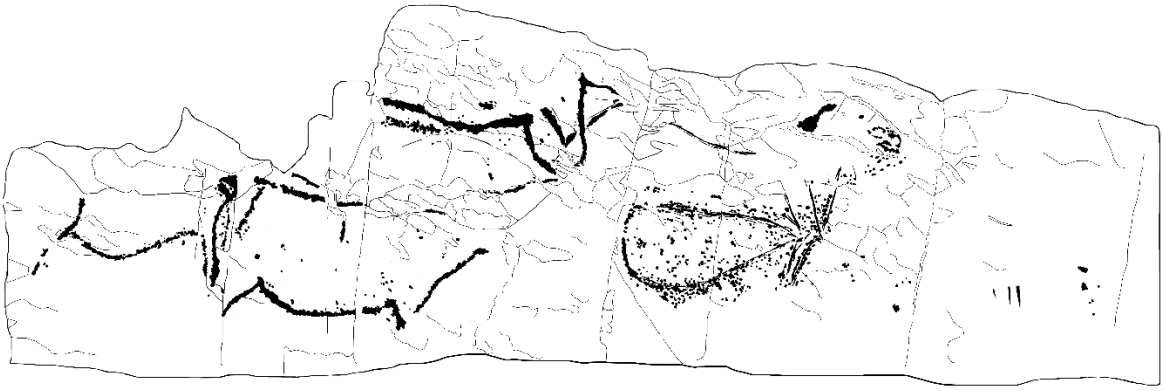


Figure 116: OCR20 panel.

Fernandes (2018) also agrees that animals of the Gravettian-Solutrean phase of Côa follow a "stereotypical" way of depiction regarding the anatomical details (Figure 117). According to him the horses are represented with a "marked round jaw, the muzzle, mane and a long tail, an arched backline and round abdomens". The aurochs have a head that becomes narrow toward the mouth, and a less pronounced jaw than the horses. The horns are usually "lyre-shaped in semi-frontal twisted perspective". The hip bone and the initial part of the neck are noticeable. Caprids have a head in triangular shape, and usually have large or small horns. They are either depicted in complete profile with a single "S-shaped horn" or with two open horns, possibly related to the gender or subspecies. The tails are smaller than the horses and aurochs, depicted with two or three lines. Few chamois, have very curved horns or two lines that intersect and form an angle of 90 degrees. The deer are frequently represented with their antlers, while their tail is consisted of two lines.

Figure 117: 1. Horse from Rocha 26, Canada do Inferno, 2. Auroch from Rocha 1, Canada do Inferno, 3. Goat from Rocha 1, Fariseu, 4. Deer from Rocha 26 Canada do Inferno, 5. Chamois from Rocha 1, Fariseu (Tracings:1. F. Barbosa, assisted by 1. M. Almeida and A.M. Baptista, 2. J.Félix and T. Fonseca, 3. M.Almeida, J. Félix and A. T. Santos, 4. M. Almeida and A. M. Baptista, 5. M.Almeida, J. Félix and A. T. Santos in Fernandes, 2018).

GU1 and 2: The combination of GU1 and GU2 or solely GU2 could possibly resemble the ventral part of a horse (Figure 118), but viewing Figure 119 and Figure 120, only two lines can be very contradictory. The option of another species is also possible.

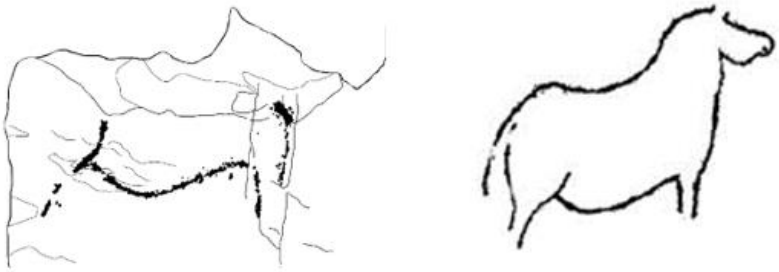


Figure 118: Left image: Tracing of GU1 and 2. Right image: Pre-magdalenian horse from Côa (Image: Luis et al., 2015).

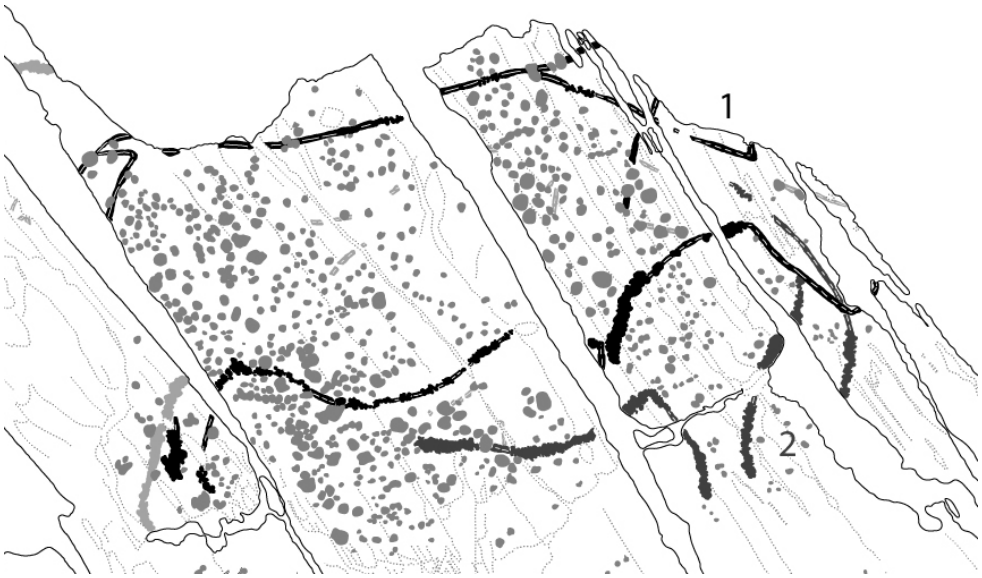


Figure 119: Animal superimpositions from Quinta da Barca (Tracing: F. Barbosa in Santos, 2017).

Figure 120: Left image: Tracing of GU1 and 2. Middle and Right images: Zoomorphic figure from Rocha 15, Foz de Piscos. (Tracing and photo: A. M. Baptista/ PAVC/ CNART in Baptista, 2009).

GU4: Graphic unit 4 mainly reminds cases of aurochs (Figure 121). The tail part, in absence of the head and horns, and a prominent dorsal hipbone (Figure 122), if it was a female, is the most important feature. Again, here our current interpretation is very uncertaint, as a result the chances for a cervid or caprid (Figure 123, Figure 124) cannot be ruled out. Nevertheless, it has to be noted that usually caprids' and cervids' tails usually grow in lower position than aurochs and horses.

Figure 121: Zoomorphic figure with prominent hipbone from Canada do Inferno (Photo: D. Danelatos).

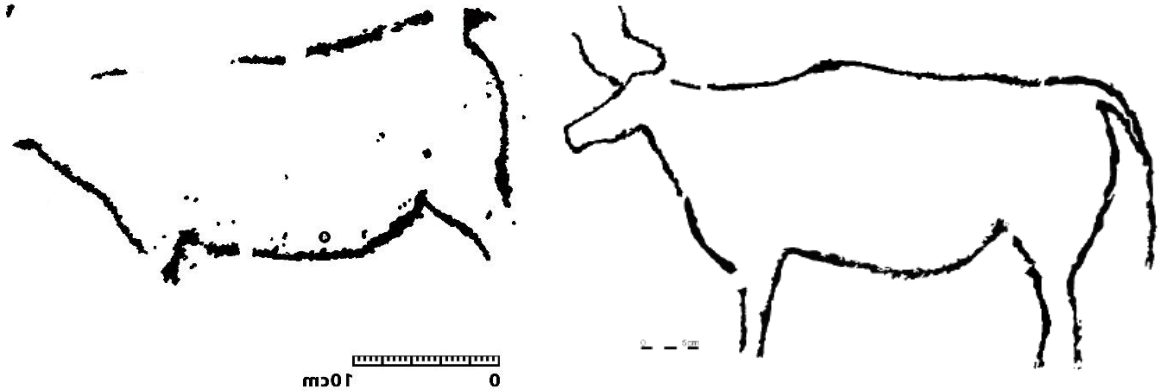


Figure 122: Left image: GU4 with tail ending (Perspective manipulated on purpose to fit with the direction of the right figure). Right image: Canada do Inferno 1 (Tracing: F. Barbosa, assisted by J. Félix and T. Fonseca in Fernandes, 2018).

Figure 123: Left image: GU4 without the tail ending. Right image: Cervids from Reno Cave in Guadalajara (Tracing: J. Alcolea- González in Alcolea-González et al., 1997).

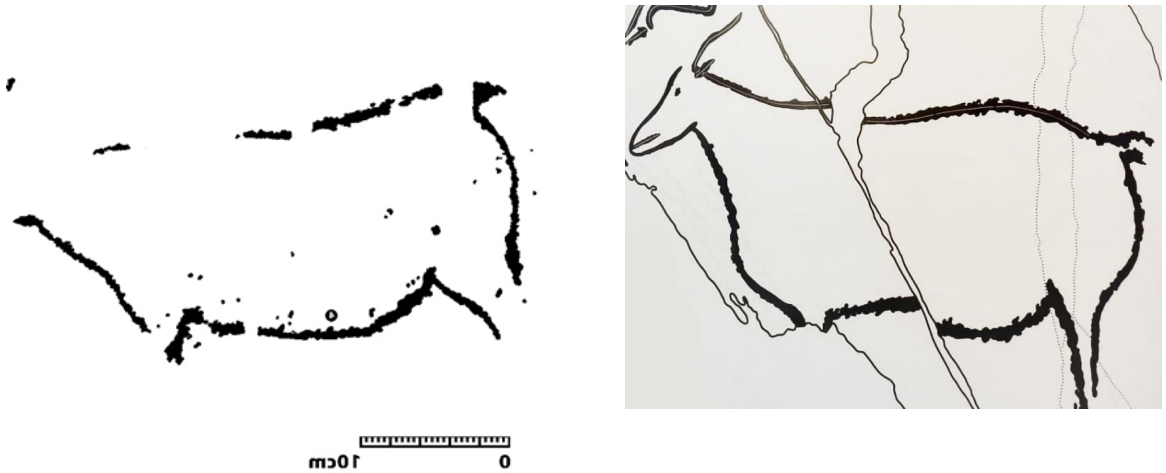


Figure 124: Left image: GU4 (Perspective manipulated). Right image: Rocha 3, Quinta da Barca (A. M. Baptista, F. Barbosa, CNART/PAVC in Baptista, 2009).

GU6: This graphic unit presents one possible zoomorphic head that could depict an auroch as well, based on the horn like line, but again the absence of other formal characteristics and the unusual horn line are not in favour of a more conclusive explanation. Eventually, it can also be another animal, horse or cervid transformed into a different one with the addition of a single detail (Figure 125, Figure 130).

Figure 125: Left image: Detail from GU6 with and without a possible superimposition from GU8. Middle and Right image tracings: details from aurochs from Rocha 1, Fariseu (Blue tracing with perspective manipulated) (Tracings: F. Barbosa, CNART, PAVC in Baptista, 2009).

Figure 126: Left image: Detail from GU6 with and without a possible superimposition from GU8. Middle image: Rocha 9, Quinta da Barca (Tracing: A. T. Santos, assisted by M. Almeida, F. Barbosa, L. Oliveira and F. Pereira in Santos, 2017) Right image: Rocha 12, Canada do Inferno(Perspective manipulated) (Tracing: A. M. Baptista, M. V. Gomes, F. Barbosa, CNART in Baptista, 2009).

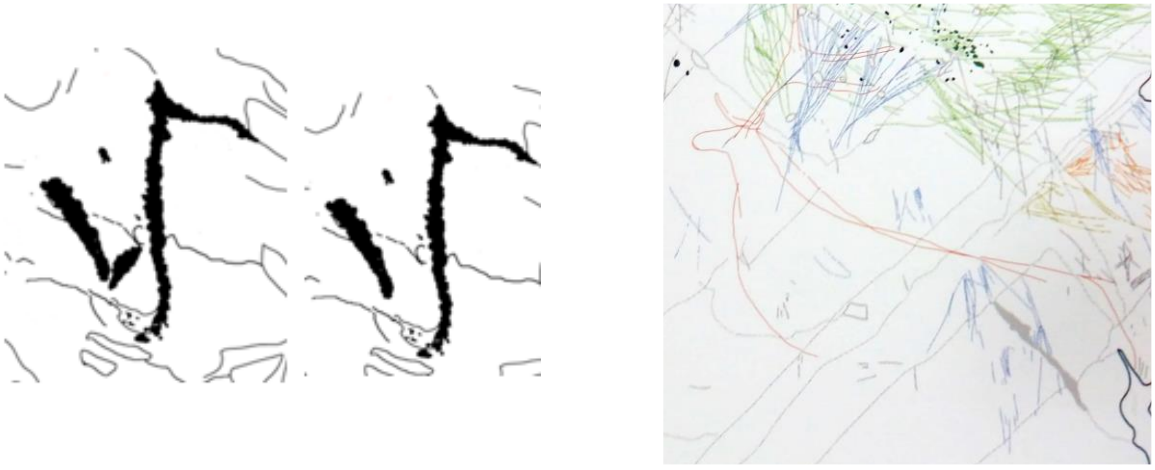


Figure 127: Left Image: Detail from GU6 with and without a possible superimposition from GU8. Right Image: Rocha 20, Canada do Inferno (Tracing: A. M. Baptista, M. V. Gomes, F. Barbosa, CNART, PAVC in Baptista, 2009).

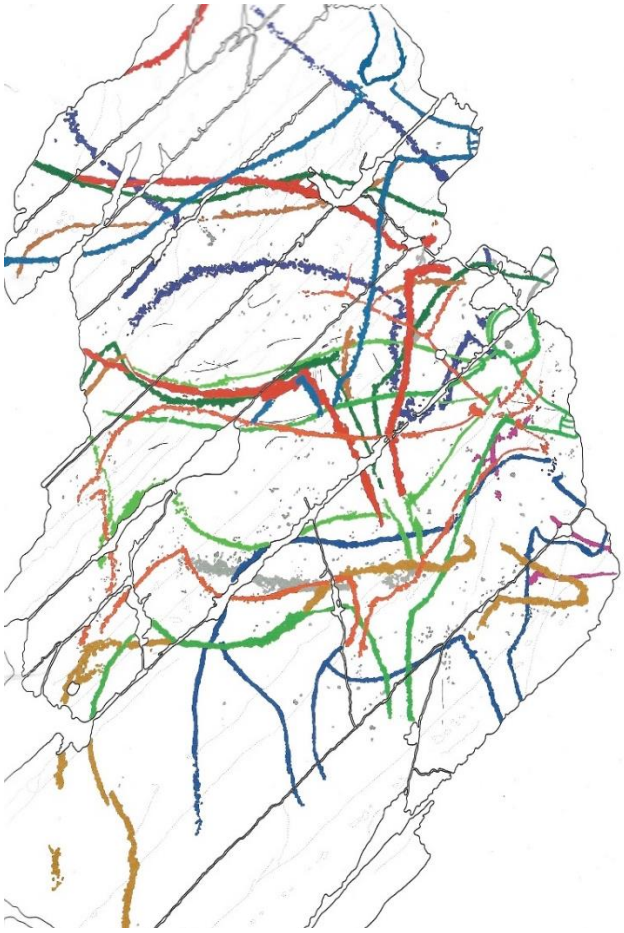


Figure 128: Rocha 3, Penascosa (Tracing: A. M. Baptista, M. V. Gomes,F. Barbosa, CNART,PAVC in Baptista, 2009).

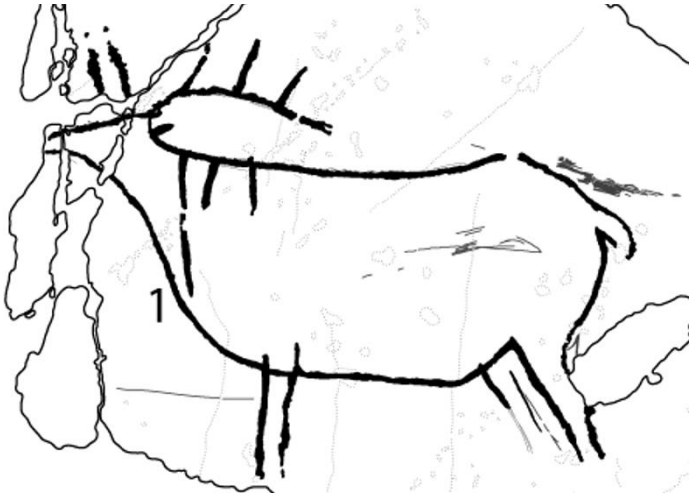


Figure 129: Cervid from Rocha 28, Canada do Inferno (Tracing: F. Barbosa, M. Almeida and A.M. Baptista in Santos, 2017).

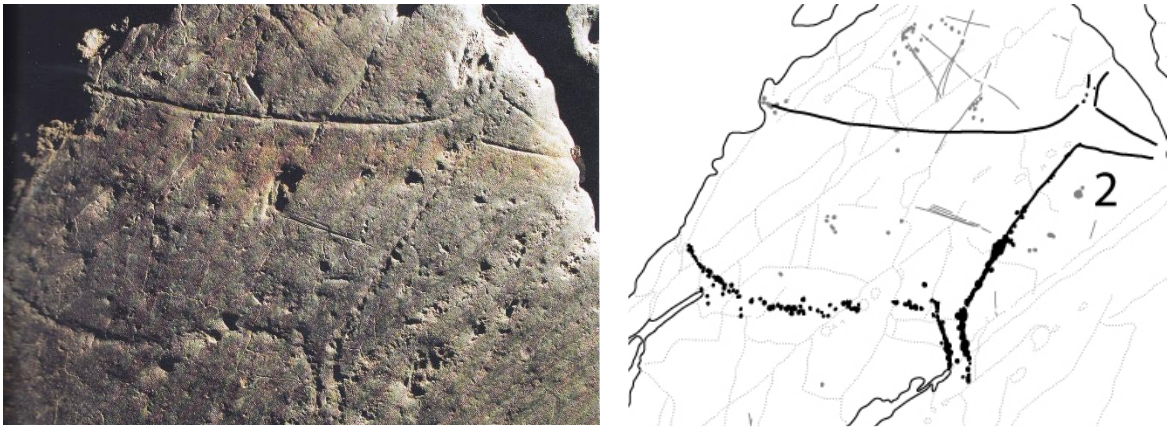


Figure 130: Left image: Zoomoprhic figure from Rocha 31, Canada do Inferno interpreted as a caprid by Baptista (1999) (Photo: Baptista, 1999). Right image: (Tracing: M. V. Gomes, assisted by J. Félix and C. Gaspar in Santos, 2017).

GU9 and GU10: These will be better presented in the following subchapter of style. Nevertheless, GU9, if it really represents an animal, and is not a combination of different features (ovalshape, extremities, or geometric signs), could have been a schematic ibex (Figure 131, Figure 132).

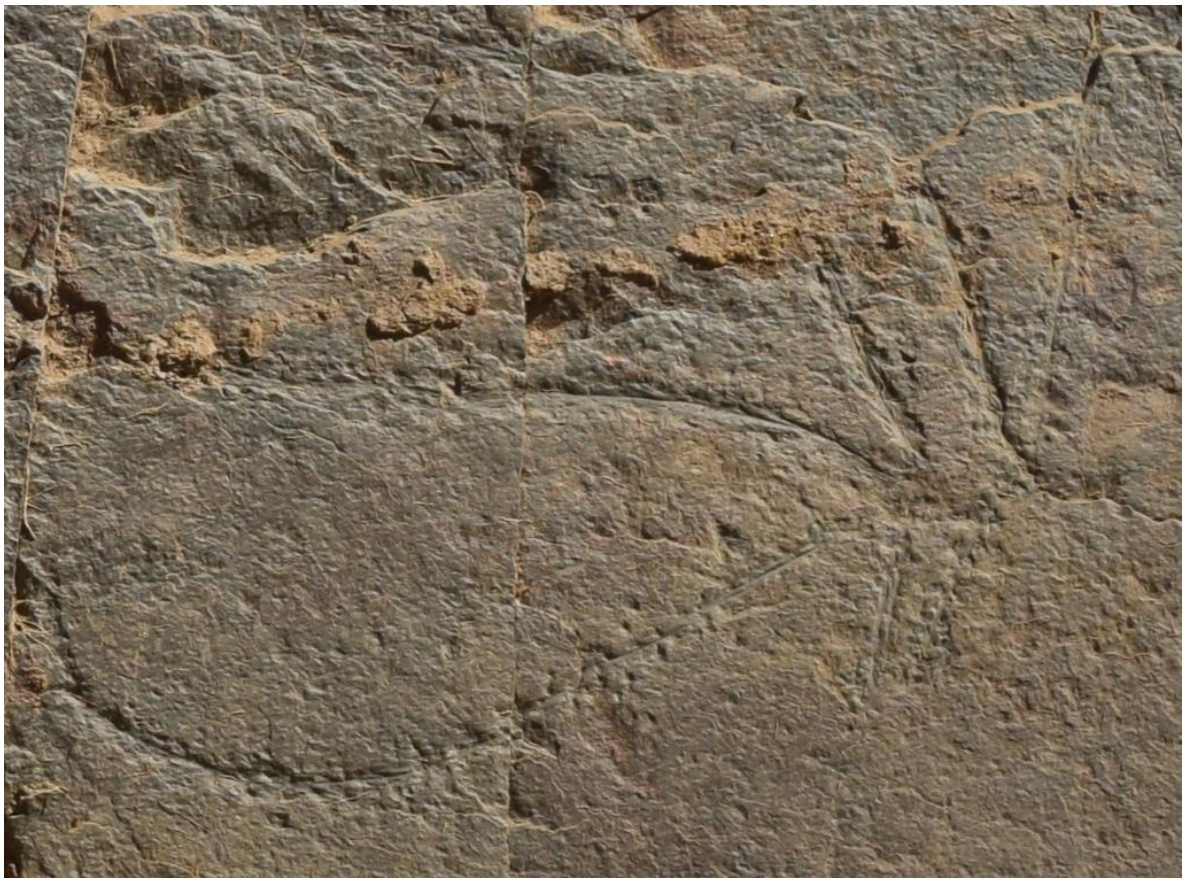


Figure 131: GU9 (Photo: S. Garcês).

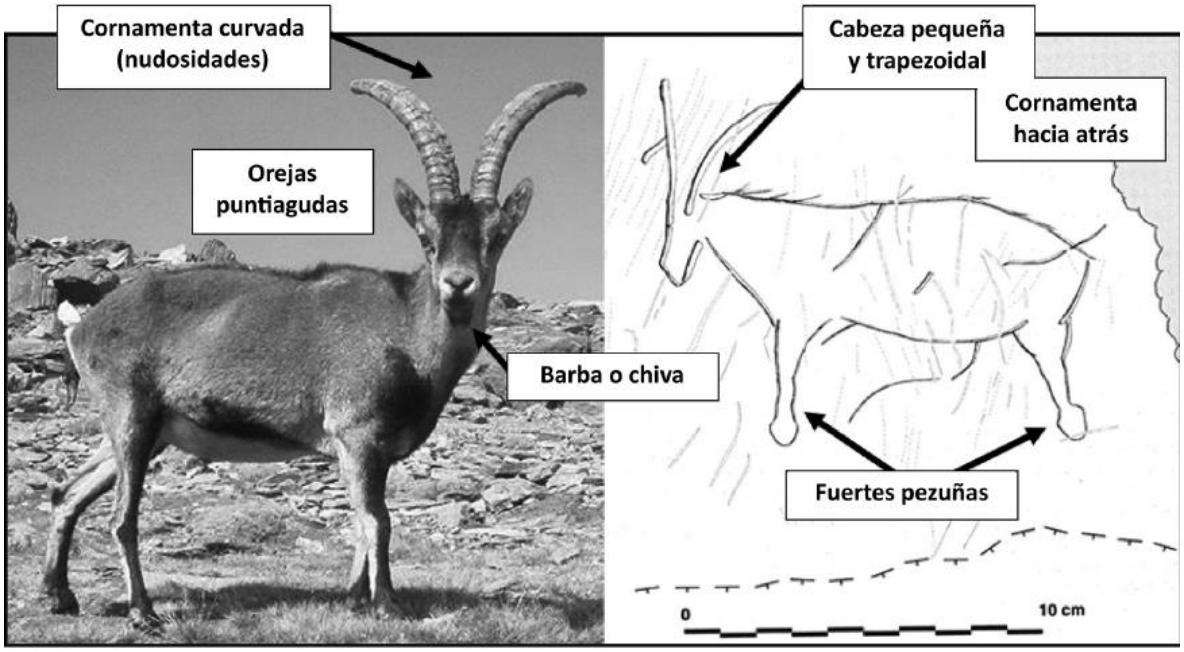


Figure 132: Diagnostic anatomical features in the representations of ibexes according to Hernando Álvarez (2014). The right image represents a Pre-Magdalenian Ibex from Arco A. The image is processed by Hernando Álvarez, 2014 (Photo and tracing: González Sainz and San Miguel, 2001).

GU10: the presumable zoomorphic head seems to depict a horse (Figure 133), with very realistic characteristics. There is a careful depiction the eye, nostrils and mouth. The upper frontal part of the head is represented with a curved line. The jawbone looks different than auroch and ibex species' representations, although the head at this part and its mane is fragmented. The engraved figure is rather atypical in terms of techniques and style when comparing to examples from Côa. Most probably erosion processes have alternated the current view of the graphic unit.

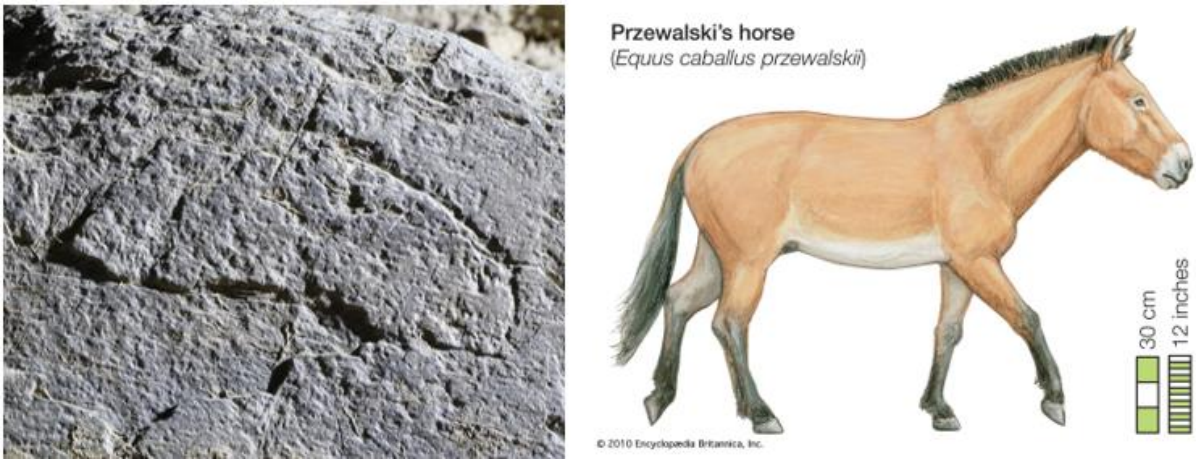


Figure 133: GU10 and sketch of Przewalski horse (Image via Internet: Britannica).

In the absence of absolute diagnostic features, despite the hypotheses presented, all the graphic units are determined as unidentified zoomorphic figures. In addition, we must bear in mind that

Palaeolithic art can occasionally be elusive to our perception. With the addition of even two simple lines the standardized way of depiction gains a new meaning and in cases of incomplete figures due to broken or eroded surfaces their interpretation of the images cannot be secure.

5.4. Style and chronological proposals on OCR20

The acquired date of AMS gave a minimal age for the panel, that is c. 1710-1548 cal BP, which means that the engravings existed since at least Roman times. The shallow nature of the site, its geomorphological position in the valley, the steep cliff, together with phenomena of slope dynamics could suggest that the previous sediments were simply naturally washed away through time. This may have applied to the Upper Palaeolithic occupation(s) associated to OCR20, but also to the adjacent OCR18 (spiral) and the Neolithic-Chalcolithic.

Therefore, the historical radiometric date is not against the possibility of the engravings being far older, palaeolithic. Some stylistic elements argue in favour of such a scenario, despite of the fact that most of the zoomorphic figures of the panel lack clear diagnostic features for the precise identification of species and chronology (Table 8).

Graphic Units	**Head**	**Cervical line**	**Dorsal line**	**Ventral line**	**Legs**	**Tail**
GU1	-	-	-	-	Single	-
GU2	-	-	-	✓	Single	-
GU3	-	-	?	-	-	-
GU4	-	incomplete	fragmented	✓	One-per-pair	incomplete?
GU5	-	-	?	-	-	-
GU6	✓	?	?	?	-	-
GU7	-	?	?	?	-	-
GU8	-	-	✓	-	-	?
GU9	?	✓	✓	✓	?	-
GU10	✓	-	-	-	-	-
GU11	-	-	-	-	-	-
GU12	-	-	-	-	-	-

Table 8: Proposal for details that could correspond to zoomorphic features. Absence (-), Under question (?), Existed feature (✓).

For the time of the graphic units' creation there are two possible scenarios:

a) The entire panel was processed during a single or very short period; or

b) The graphic units were created during different and sparce moments, with possible cultural meaning.

In the graphic units of OCR20, the most important details for stylistic comparison, besides species identification, were the heads (shape, mane, horns), the ventral lines, the legs and their extremities, and the tails (short or long).

There are various studies that have been conducted focusing on stylistic conventions for providing a chrono cultural sequence on the Palaeolithic rock art. For example, Ripoll López and Municio González (1999; Ripoll López et al., 1999) examined "morphometric conventions" on the case of the open-air site of Domingo García. For this analysis they used the end of the muzzle, equid manes, the shape of the upper part of the head, the cervical-dorsal lines, and the shape of the legs (Ripoll López and Municio González, 1999; Ripoll López et al., 1999). In the case of the Côa Valley, Guy (2000) focused primarily on the rear paw and the ventral lines of the zoomorphic figures to assess the palaeolithic age and style of the zoomorphic representations (Figure 134, Figure 135), suggesting a chronological range covering Gravettian and Solutrean with parallels in France and Spain (Guy, 1999 *apud* Santos et al., 2021). Previously, at the same cluster of sites, researchers made chrono stylistic comparisons with different chronological attributions to be suggested (Santos et al., 2021). Following the proposals of Leroi-Gourhan style, without interpreting the superimpositions some of the researchers like Balbín Behrmann (1995), Züchner (1995), Balbín Behrmann, Alcolea-González and Santonja Gomez (1996) attributed the figures to the Solutrean, while González Sainz (1995) to the Solutrean and Early Magdalenian (Santos et al., 2021). On the other hand, Zilhão (1997) and Baptista (1999) based on superpositions, and the Parpalló plaquettes (Figure 136) proposed a "longer diachronic sequence" (Santos et al, 2021). For example, regarding horses it was suggested based on their mane a division on Solutrean and Magdalenian figurative sequence (Figure 137) (Zilhão, 1997). The above mentioned prove the inaccurate nature of stylistic comparisons. Despite this imprecision, the results provided are a starting point for fieldwork investigation. Rare cases such as Fariseu, Parpalló have radiometric dates that corroborate the chronology of the art (Santos et al., 2017; Ochoa et al., 2021). Therefore, the stylistic analysis and the tentative recognition of artistic styles linked to chronological and regional cultures remains a useful approach for open air rock art studies.

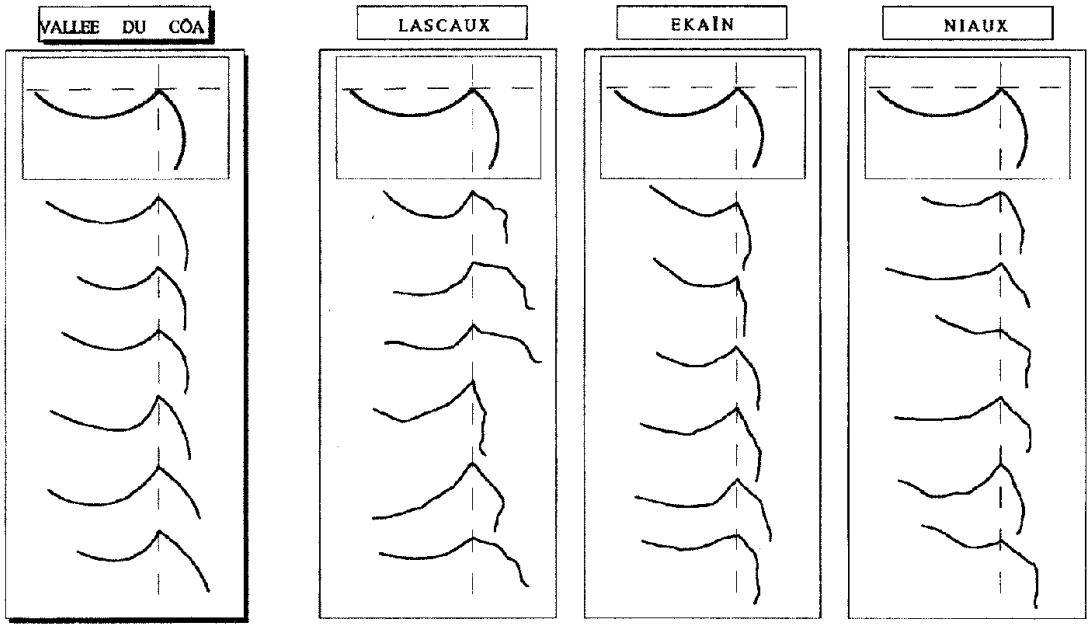


Figure 134: Comparison of the ventral lines and rear paws between zoomorphic figures found in Côa, Lascaux, Ekain and Niaux. (Images: after CNART in Guy, 2000).

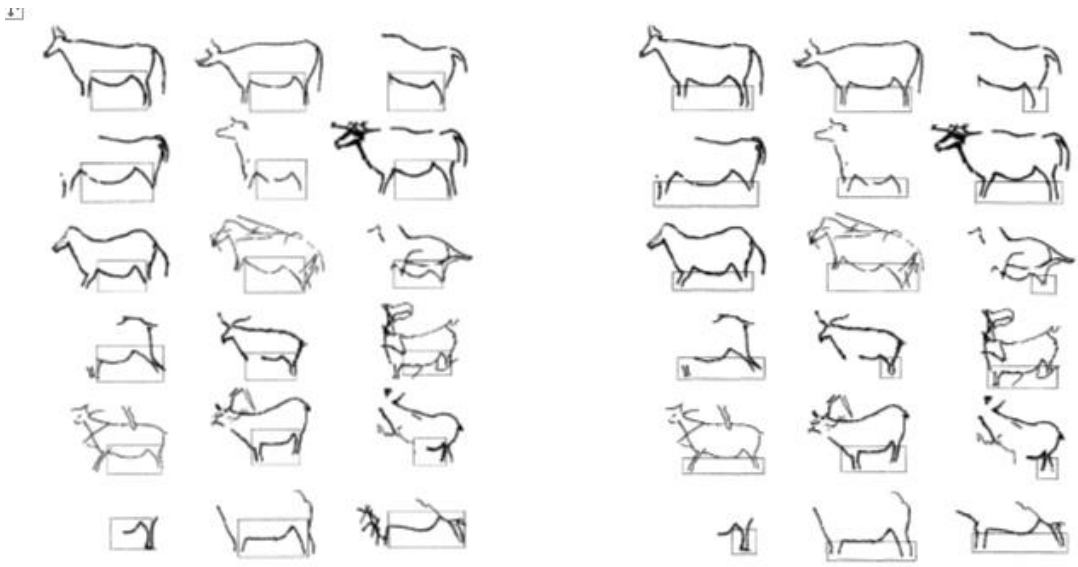


Figure 135: Left image: Tracings of zoomorphic figures from the Côa Valley focusing on the ventral and rear leg. Right image: Tracings of zoomorphic figures from the Côa Valley focusing on the lower extremities (Images: after CNART in Guy, 2000).

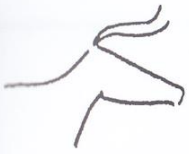
Cabeças de auroque	Gruta do Parpalló (Valencia)	Vale do Côa
	Solutrense médio	**presente** Penascosa (picotado)
	Solutrense superior Solutreo-gravettense Magdalenense antigo	**presente** Canada do Inferno (picotado)
	Magdalenense superior	**presente** Vale de Cabrões (filiforme)

Figure 136: Chronostylistic proposal based on the Parpalló plaquettes regarding the style of aurochs' heads from Côa (Image: Zilhão, 1997).

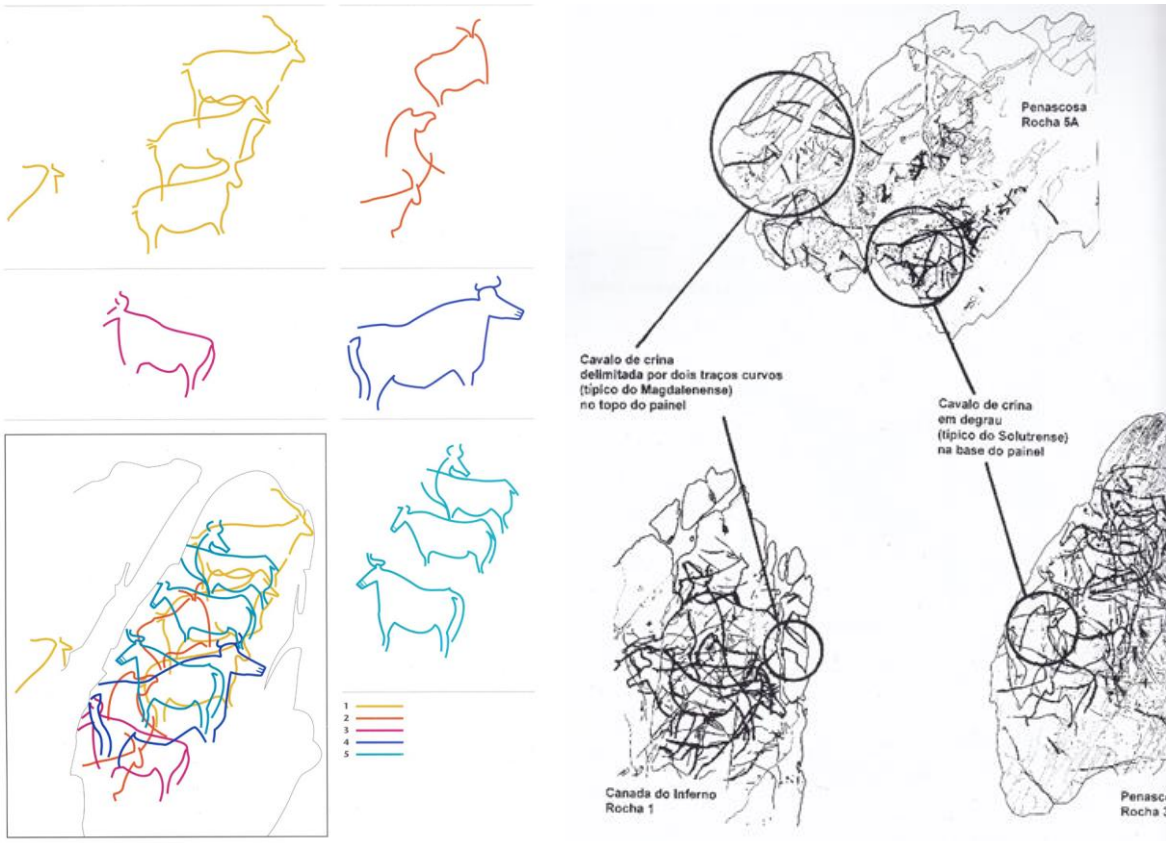


Figure 137: Left image: Proposal on superimpositions sequence from Rocha 3, Penascosa (Image: Zilhão, 1997). Right image: At the left part encircled horses' heads that have their "mane delimited by two curved lines" conventions suggested as typical for the Magdalenian period. At the right part encircled are horses' heads with "stepped mane", considered typical feature for the Solutrean (Image: Zilhão, 1997).

The OCR20 panel has only one relatively clear depiction of an animal head (GU10) whose body cannot be securely attributed. The zoomorphic GU2 and GU4 are acephalus, while the head of GU9 can be highly debated. Acephalous animals or with unfinished outlines are not rare in Upper Palaeolithic rock art (Gomes, 2010; Fernandes et al., 2017). GU4 is the only graphic unit that has a tail, which either is incomplete in case that it depicted an auroch or it is a short one that corresponds to a cervid or caprid. GU6 presents at least a possible head with a line possibly interpreted as a horn that has an unusual curvature. GU8 may present a linear tail. The general picture of the panel shows at least two zoomorphic figures GU2 and GU4 depicted with a naturalistic manner. These, in absolute profile like the Palaeolithic phases of Côa Valley (Baptista, 2009; Santos et al., 2021), are clearly different from the following post-palaeolithic zoomorphic representations of the Tagus Complex.

In the case of GU4 the animal is depicted in "frozen motion", a popular depiction of movement in the older palaeolithic phase of Côa (c. 88%) (Santos et al., 2021), as it is suggested by the open angle that the single back leg forms. The same motion could be also suggested for the case of GU1 and GU2 (if they are a single figure), with the inner leg line of GU1 forming an angle that reminds movement as the leg spreads. This way of depiction was initially suggested by Leroi-Gourhan (1992) for poses that convey motion (Santos et al., 2021). Santos et al. (2021) classifies "frozen motion" within segmental animation where motion is suggested by one of the animal's "segments"-features- (head, tail, ears, mouth, and tongue). In the case of legs, they are further divided in the symmetrical and asymmetrical subcategories, "where the front and or hind legs are stretched and/or flexed (symmetrical), or present different lengths (asymmetrical), suggesting locomotion (gallop, jump, etc.), rest, or a perching position" (Santos et al., 2021).

Some possible parallels and comparisons in stylistic terms for the identified zoomorphic graphic of OCR20 are presented in Figure 138 - Figure 166.

GU1,2: These two units, despite having initially been consider as different, are better investigated as one although the differences in style and depth might suggest different phases of creation or artists. These figures do not have identical parallels with the zoomorphic representations from the cluster of Côa or the other sites examined, although their naturalistic style and technique are very alike (Figure 138 - Figure 141). It is expected that further fieldwork research followed by the processing of high-resolution imagery will provide better answers.

Figure 138: GU1 and GU2 compared with a horse from Rocha 26 Canada do Inferno attributed to the Gravetto-solutrean phase of Côa (Fernandes, 2018) (Tracing: F. Barbosa, assisted by M. Almeida and A. M. Baptista in Fernandes, 2018).

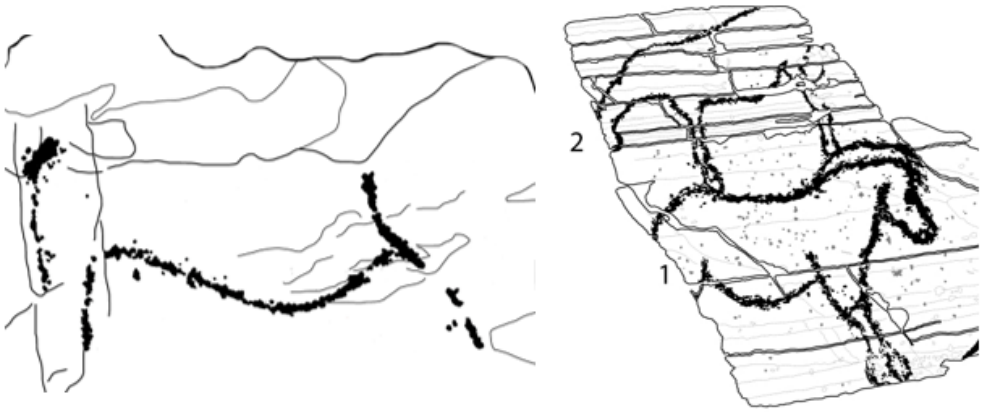


Figure 139: GU1 and GU2 (Perspective manipulated) compared to Rocha 3, Fariseu which is attributed to phase 2 according to Santos et al. (2021) e.g. Late Solutrean/ Early Magdalenian, but could extend in Middle Solutrean/Middle Magdalenian (Tracing: in Santos et al., 2021).

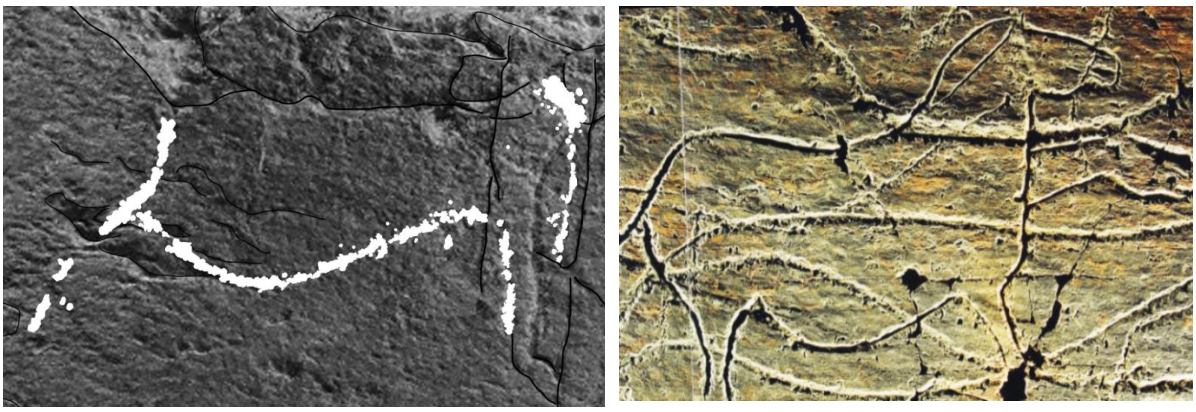


Figure 140: Left image: GU1 and GU2 with white colour on the blackgrey orthophoto. Right image: Horses attributed to the Magdalenian phase (Baptista, 2009) (Photo: A.M. Baptista, M. Almeida, CNART, PAVC in Baptista, 2009).

Figure 141: The initial suggested superimposition between GU2 and GU4.

GU4: At this moment, this graphic unit is the most important one for the attribution of a relative date, as it has the more complete body despite the absence of the tail and head. The contour reminds examples from Redor do Porco and Canada do Inferno, as Figure 142 and Figure 143 suggest, attributed to the Gravettian-Solutrean phase (Santos et al., 2021; Baptista, 2009, Luis et al., 2015). In terms of techniques, it also is in accordance with other examples from Côa (Figure 143 - Figure 146). In Figure 143 the ventral line is depicted in a very similar way. Even if the exact period and phase can be under dispute, the figure clearly fits better in the context of Upper Palaeolithic rock art rather than any other period identified on the Tagus Rock Art Complex (Figure 169) (Gomes 2010; Garcês 2017).

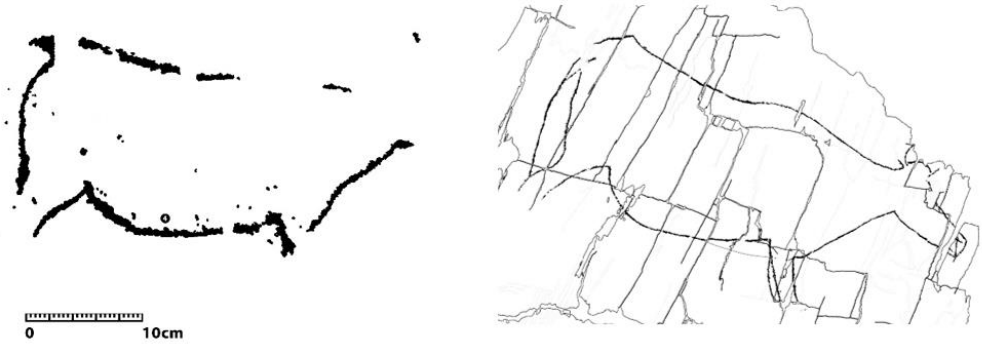


Figure 142: Left image: GU4. Right image: Rocha 1 Redor do Porco (Tracing: F. Barbosa in Santos, 2017).

Figure 143: *An attempt to fit GU4 (Black tracing) on an auroch from Rocha 11A, Canada do Inferno. (Photo via online: postcard by Ministério da Cultura, Parque Arqueológico do Vale do* Côa*, can be found as well in Zilhão, 1997: 263).*

Figure 144: Rocha 17, Quinta da Barca (Tracing: A.T. Santos assisted by M. Almeida, A.A. Costa and S. Figueiredo in Santos, 2017).

Figure 145: Aurochs from Rocha 1, Fariseu (Tracing: F. Barbosa, CNART, PAVC in Baptista, 2009).

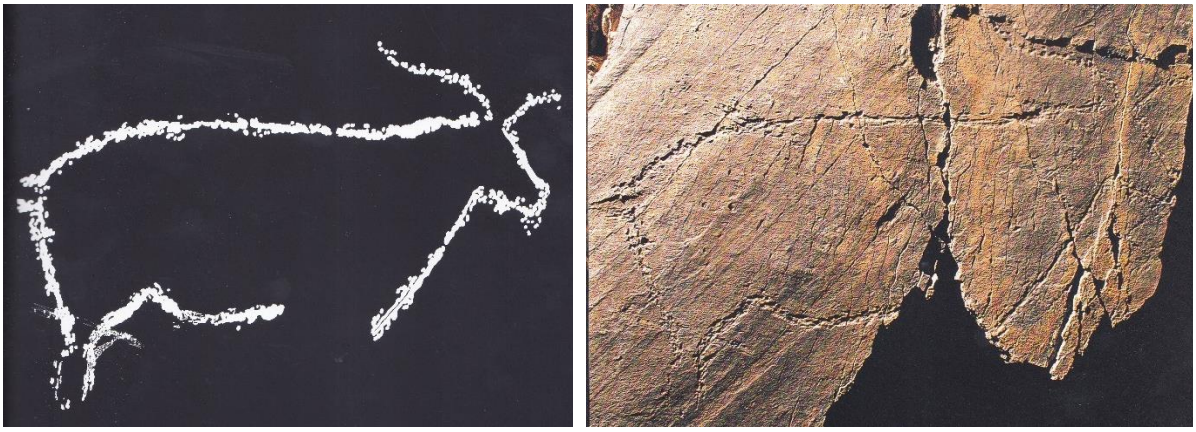


Figure 146: Caprid from Rocha 2, Canada do Inferno, possibly Solutrean (Baptista, 1999) (Photo and tracing in Baptista, 1999).

An important clue for the timing of the creation of GU2, is the superimposition with GU4. This makes GU2 older than GU4 (see subchapter of superimpositions). According to the description provided by researchers on representations with similar conventions previously discussed on the results chapter, the style of GU2 and GU4 is similar to the examples attributed to the Pre-Magdalenian periods of Côa Valley. Complementarily, the absence of extremities on both graphic figures and the "frozen movement" seems to suggest a Pre-Magdalenian age. (Baptista, 2009; Luis et al., 2015; Santos et al., 2015; Santos, 2017; Santos et al., 2021; Reis, 2021). Furthermore, as it is shown in Figure 142 and Figure 143, the stylistic parallels of GU4 suggest a Gravettian-Solutrean date, making GR2 probably at least as old as Gravettian.

GU6: Although it is unclear what exactly is depicted in GU6, an attempt was made to find parallels in Western Iberia. For Baptista (2012) some of the presumably most ancient zoomorphic representations in Western Iberia (Early Gravettian), present this kind of elongated heads, with the two parallel lines figuring the mouth and the nostril, or horns in a twisted front perspective (Figure 147, Figure 149), like Sampaio (Figure 150), Fraga Escrevida, and Mário Reis de Águeda. In the OCR20 case, the parallel lines are straight without the presence of a narrower part before the mouth/nose extremity, like Figure: 148, right image. Considering the plaquettes of Parpalló (Figure 151) (Villaverde Bonilla, 1994) a Pre-Magdalenian age could be suggested.

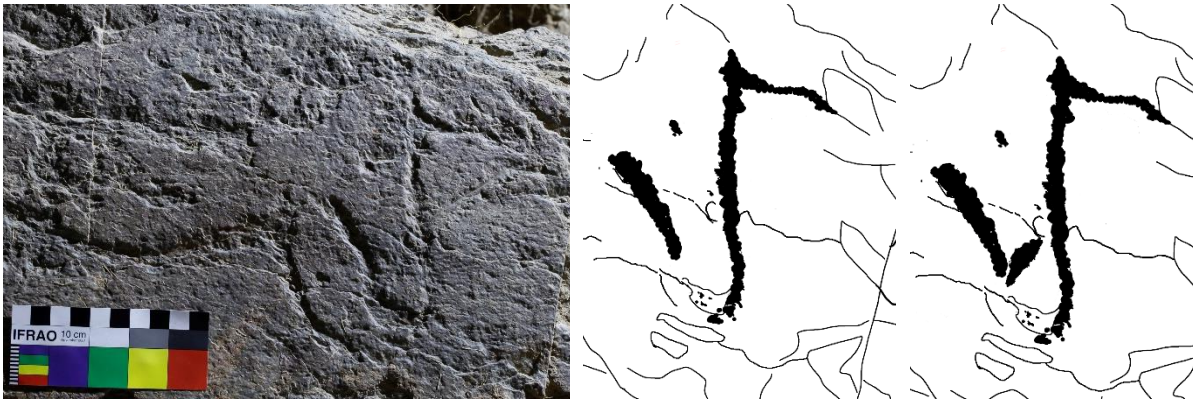


Figure 147: Photo focusing on the possible head of GU6, tracings of GU6 without and with some peckings attributed to GU8 (Photo: H. Collado Giraldo).

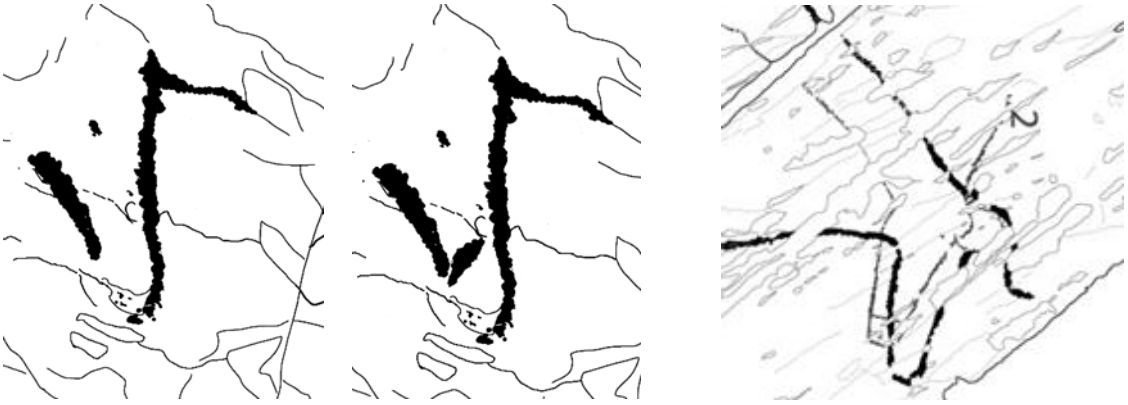


Figure 148: Left and Middle: GU6 without and with peckings of GU8. Right image: Detail from Rocha 17, Quinta da Barca (Perspective manipulated) (Right tracing: A.T. Santos assisted by M.l Almeida, A.A. Costa and S. Figueiredo in Santos, 2017).

Figure 149: Rocha 5, Penascosa (Right tracing: A.M. Baptista, M. V. Gomes, F. Barbosa, CNART, PAVC in Baptista, 2009).

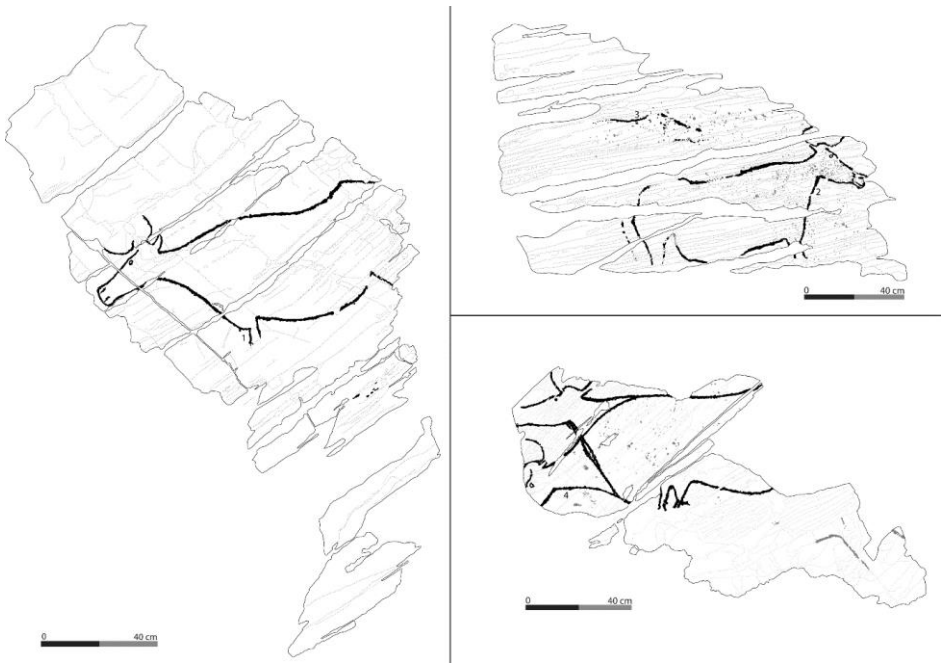


Figure 150: Aurochs from Sampaio (Tracing: F. Barbosa assisted by M. Almeida, J. Félix and E.Guy in Santos, 2017).

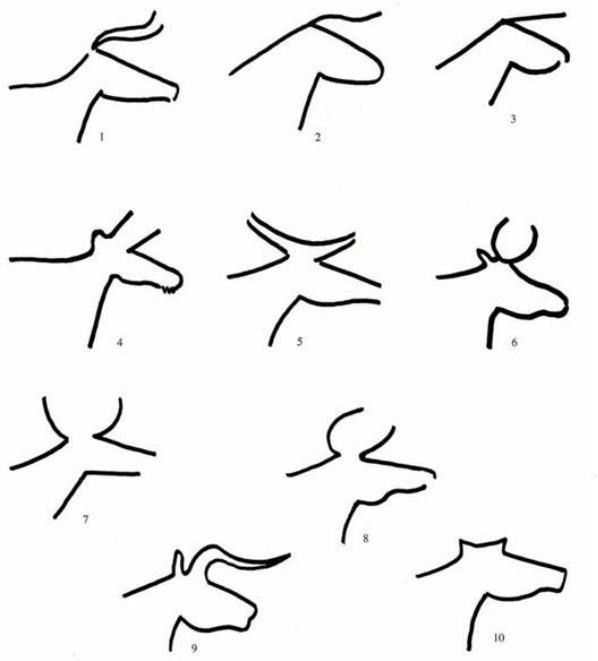


Figure 151: Different ways to represent a bovid in the Parpallo plaquettes: 1.V lineal and S, 2. Lineal in S, 3. Lineal, 4. Parallel vertical lines, 5. Naturalistic U, 6. U lineal, 7. Open U lineal, 8. U forward, 9. Normal S, 10. Without horns (Image: Villaverde Bonilla, 1994).

GU10: The realistic depiction with marks forming the eyes, mouth and nose of the animal, plus the fragmented mane reminds examples of horses attributed to the Magdalenian at Parpalló, Villalba, Domingo García Tito Bustillo, (Figure 152, Figure 155). Nevertheless, in this case, there is no clear connection with Côa (Figure 156, Figure 157). This may mean a shift in the cultural influence of the inhabitants of Ocreza after the Last Glacial Maximum.

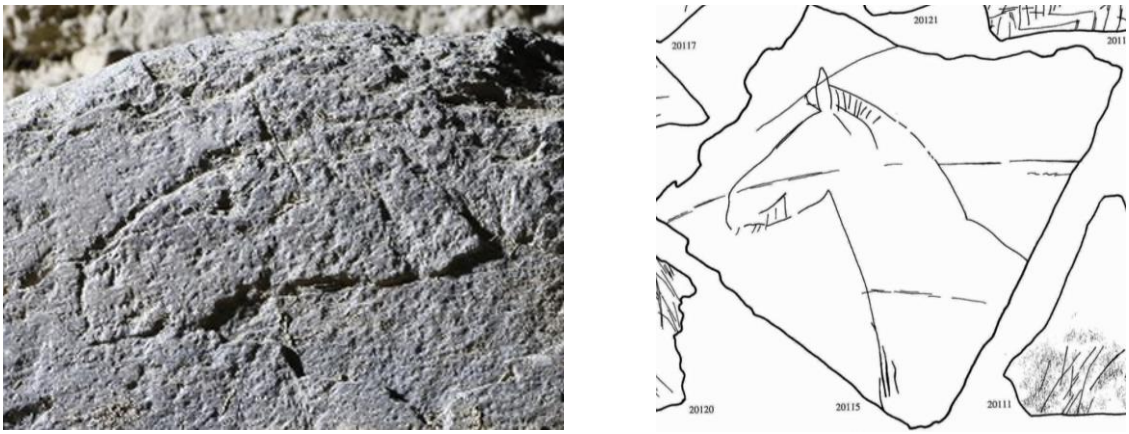


Figure 152: GU10 (Perspective manipulated) and horse representation from the Parpalló plaquettes attributed to the Magdalenian (Villaverde Bonilla, 1994) (Tracing: Villaverde Bonilla, 1994).

Figure 153: GU10 (Perspective manipulated) and zoomorphic representation from a plaquette from Villalba attributed to the Magdalenian (Balbin Behrmann et al., 2016) (Photo: R. de Balbín in Balbin Behrmann et al., 2016).

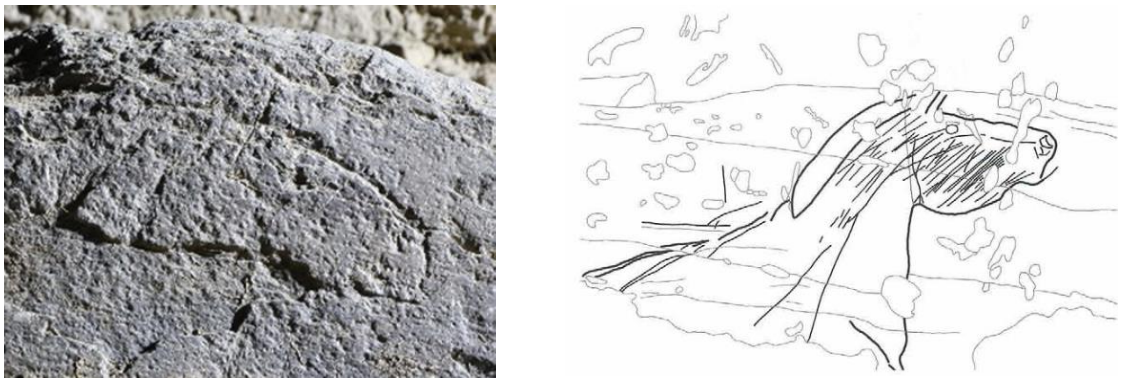


Figure 154: GU10 and a horse from Roca 37, panel C in Domingo García attributed to Magdalenian (Ripoll López and Municio González, 1999) (Tracing: in Ripoll López and Municio González, 1999).

Figure 155: GU10 and Magdalenian horse from Tito Bustillo (Photo via Internet: Tito Bustillo Centro De Arte Rupestre).

Figure 156: Left image: Rocha 3, Penascosa attributed to Magdalenian (Baptista, 2009) (Photo: A.M. Baptista, M. Almeida, CNART, PAVC in Baptista, 2009). Right image: Horse from Rocha 14, Canada do Inferno attributed to the Magdalenian (Baptista, 1999)(Photo: J. P. Ruas in Luis and Fernandes, 2009).

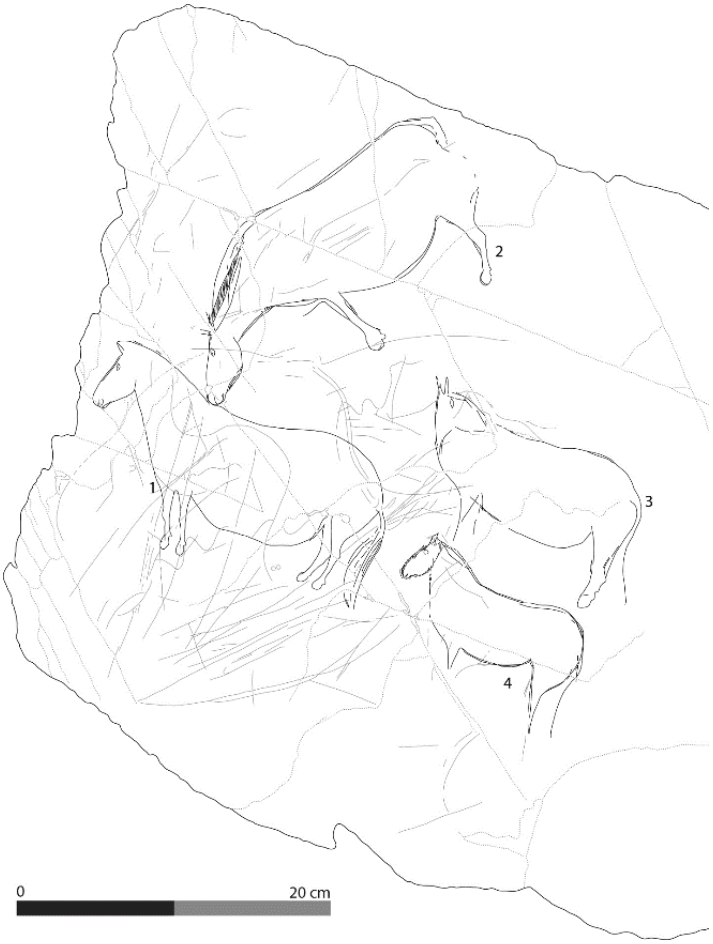


Figure 157: Horses from Rocha 3, Ribeira de Piscos attributed in Magdalenian (Baptista, 2009)(Tracing: F. Barbosa, assisted by M. Almeida and A.M. Baptista in Santos, 2017).

If the OCR20 panel was made during a single phase, this would imply strong differences at an individual level in formal representation within each period and region. Could this be related to the hypothesis of variability in the forms of the earlier phases of European Upper Palaeolithic rock art as it is suggested in Petrognani (2015)? Petrognani stands in favour of formal variability during the oldest phases of Upper Palaeolithic zoomorphic representations, arguing about a remarkable increase in formal rigidity, particularly during the Magdalenian (Figure 158). In this case, chrono-cultural attribution through style becomes further disputed. Presuming that this can be a horse head, examples of Palaeolithic horse heads were searched (Figure 159, Figure 160), but the comparison did not retrieve sufficiently close parallels. The fractured area does not allow us to proceed in a single secure proposal for the dating of the GU10. The naturalistic style of the zoomorphic head, with the particular level of realism in the details of the facial characteristics, is clearly different from the examples of zoomorphic figures from the Tagus Rock Art Complex that are proposed to be created on the post-palaeolithic times (Garcês, 2017) (Figure 161).

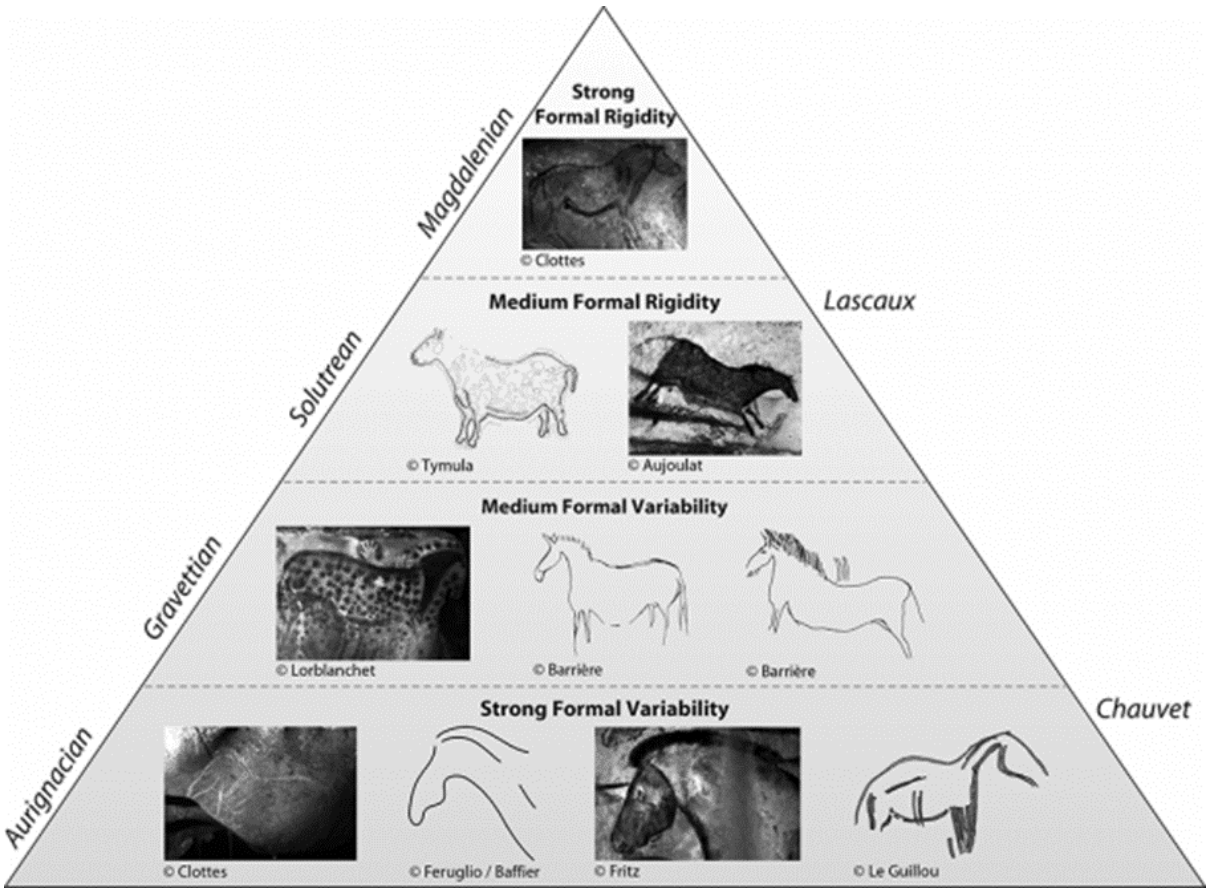


Figure 158: Scheme suggested by Petrognani regarding formal variability during Upper Palaeolithic art (Image: S. Petrognani, 2015).

Figure 159: Horse heads from Parpallo. 11. Stepped mane, 12. Open stepped mane, 13. Without stepped mane (Image: Villaverde Bonilla, 1994).

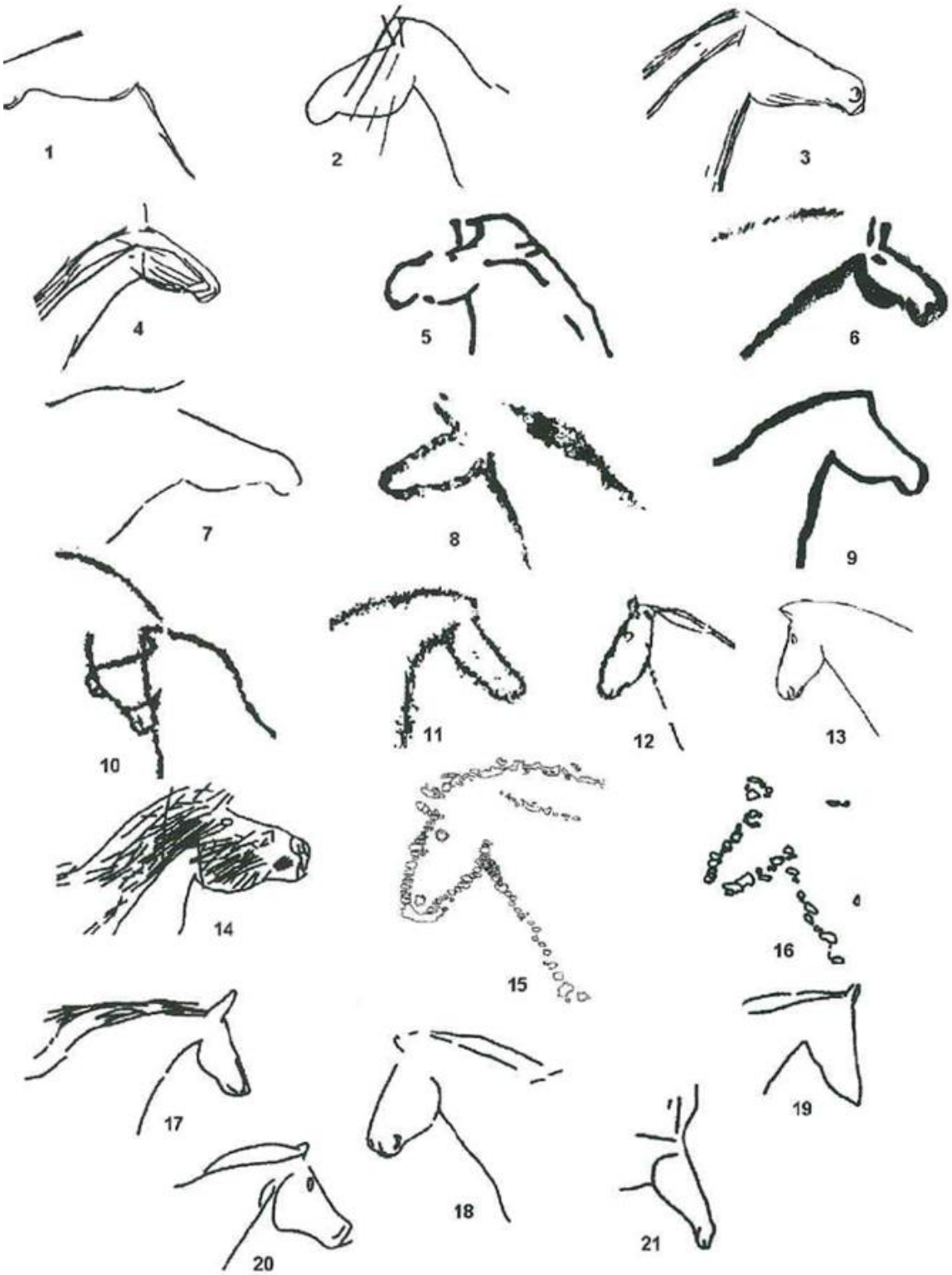


Figure 160: Equids: 1-4. Parpallo, 5. Fuente el Trucho, 6. La Pasiega, 7. Trinidad de Ardales, 8. Ambrosio, 9. La Pileta, 10-13. Foz Côa. Horse number 10 is attributed to the Pre-Magdalenian phase (Baptista, 2001; 2009) while 12 and 13 are attributed to the Magdalenian (Baptista, 2009), 14-21. Domingo García (Image: Ripoll López et al., 1999).

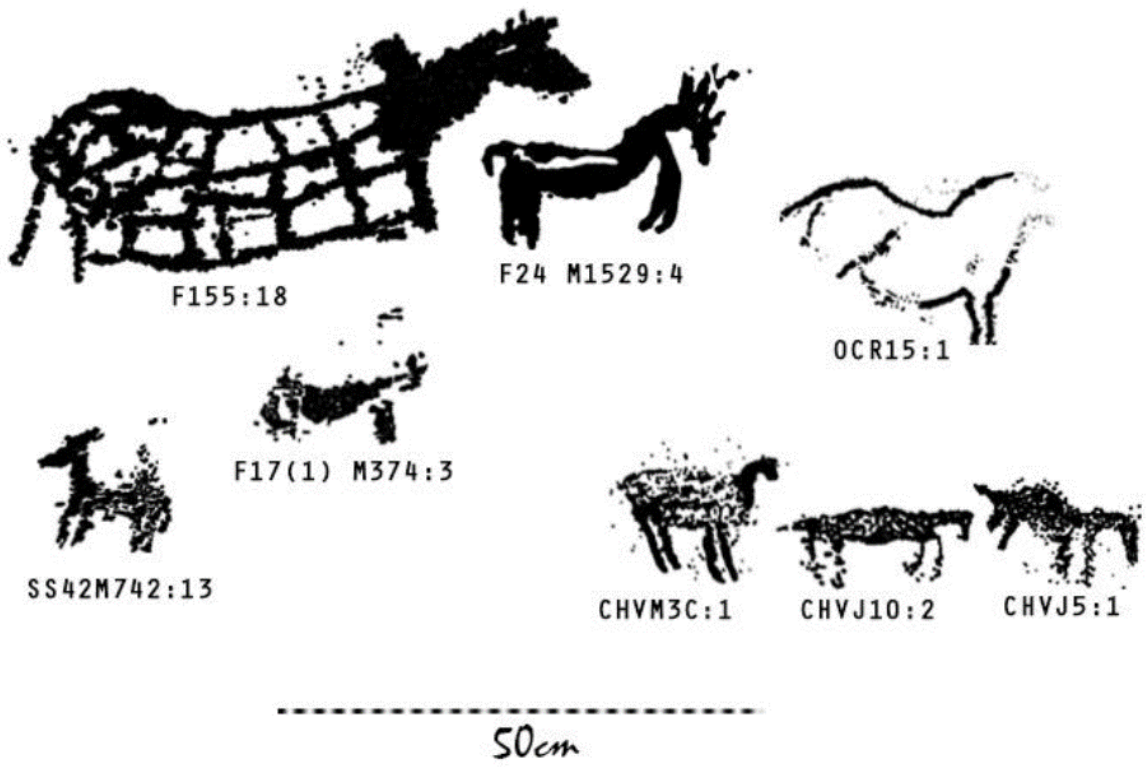


Figure 161: Horses from the Tagus Valley Rock Art Complex, the only exception in naturalistic style but acephalus the OCR15 (Tracing: Garcês, 2017).

GU9: Could the same hypothesis of formal variability apply to GU9? In case the figure is an ibex, the closest parallels identified is from Arco-A Cantabria attributed to the Pre-Magdalenian phase (Figure 162, Figure 163) (González Sainz and San Miguel Llamosas, 2001, 2010; González Sainz and Garate Maidagán, 2006; Hernando Álvarez, 2014).

Figure 162: Left image: GU9 (Perspective manipulated) (Photo: H. Collado Giraldo). Right image: Ibex from Arco-A attributed in Pre-Magdalenian (González Sainz and Garate Maidagán, 2006; González Sainz and Llamosas, 2010; Hernando Álvarez, 2014) (Photo: in González Sainz and San Miguel Llamosas, 2001).

Figure 163: Left image: Tracing of GU9 and scalebar of 10 cm (Perspective manipulated). Right image: Tracing of the ibex from Arco-A González Sainz and San Miguel Llamosas, 2001).

Major differences between them are the absence of legs, tail, and the detailed depiction of the fur at the upper part. On the other hand, the schematic representation of the oval shape up to a point reminds zoomorphic figures from the Tagus Valley Rock Art Complex (Figure 164, Figure 166) (Garcês, 2017). According to Garcês (2017) the zoomorphic figures of this period cease showing the naturalism of palaeolithic art and follow a schematic convention that reaches its peak when pastoralism and agriculture are fully established. By many researchers, this artistic phase is called pre-schematic as it differs from the naturalism of the previous period and the schematism of neolithic (Beltrán, 1989; Collado Giraldo, 2004 *apud* Garcês, 2017; Collado Giraldo, 2006; Bueno Ramírez, Balbín Behrmann and Alcolea González, 2009). It must be noted that in the spatial context of the figures, the ones from Ocreza are found in lower altitude, next to the river and on a subhorizontal panel contrary to the OCR15 and OCR20 that are in a higher position and in vertical (OCR20) and sub-vertical (OCR15) slabs. Likewise, with GU10 an absolute answer stills elusive.

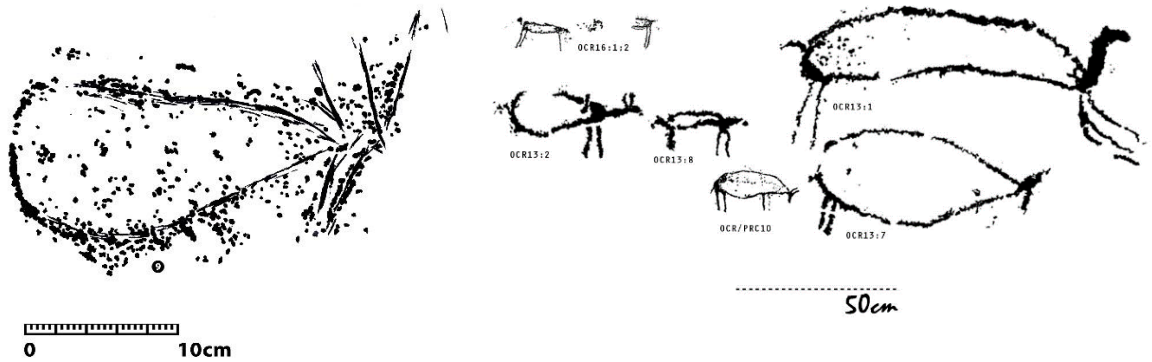


Figure 164: Left image: tracing of GU9. Right image: Post-Palaeolithic zoomorphic figures with oval shaped body from Ocreza (Garcês, 2017).

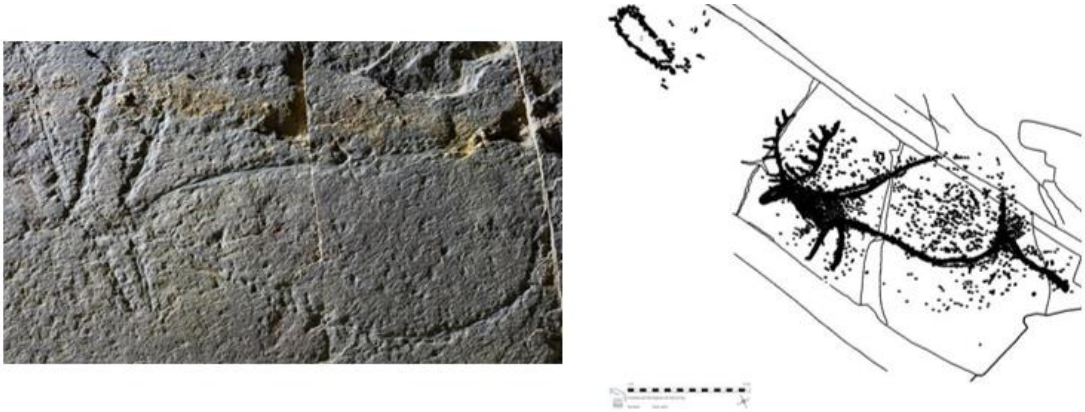


Figure 165: Left image: photo of GU9 (Perspective manipulated) (Photo: H. Collado Giraldo). Right image: Tracing of a Post-Palaeolithic cervid from Sao Simao, adapted to Gomes, 2010 by Garcês, 2017).

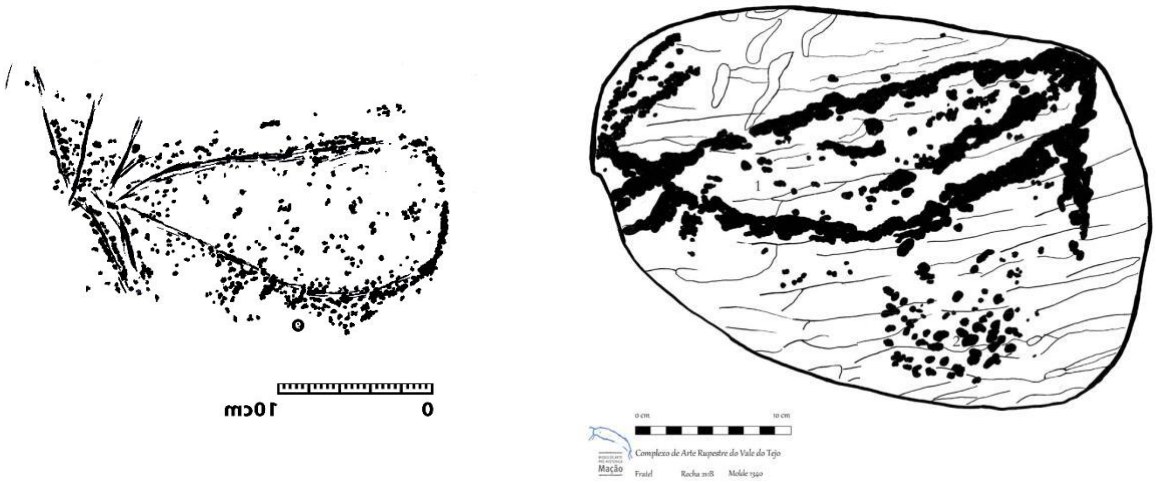


Figure 166: Left image: tracing of GU9 (Perspective manipulated). Right image: Tracing of Post- Palaeolithic figure from Fratel (Tracing: Garcês, 2017).

5.5. Investigating the time of creation of the panel based on techniques, superimpositions and style

The panel of OCR20 (Figure 167) was made either the same period, or even day or during at least two different events that could be in different periods. As for the technical aspect, the depth and thickness of the engraved traces propose differences that could be explained by a creation during different periods or the involvement of more than one artist. Weathering factors could also have intervened though. For example, peckings of GU2 are less thick and wide than GU4. GU 5 and 6 peckings are more profound than GU8. Half of the incisions of GU9 seem to be thicker and more worked than the other half (Figure 110, Figure 131), yet it cannot be securely stated if it is a matter of technique, superimposition or erosion. In addition, the increase

of dispersed pecking marks at the right part and the isolated abrasion at GU9 raise further questions (Figure 131).

Figure 167: OCR20 (Photo: S. Garcês).

Regarding the hypotheses related to the superimpositions, they are largely depended on the interpretations of the graphic units and their contours, which can be highly debatable at this point of the research. For example, the incisions of GU8 are above and not under GU6, and GU8 belongs to GU10. This zoomorphic figure could be younger, but how much younger?

Some interesting notions regarding the use of specific engraving techniques through the various periods have been proposed in Côa (Figure 168). The most common techniques during the ancient period phase (Gravettian-Solutrean) were pecking and abrasion, while incisions existed but in small numbers (Santos et al., 2015). On the contrary, the main technique during the Magdalenian phase, became incision, although pecking and abrasion did not completely disappear. According to Alcolea González and Balbín Behrmann (2012) "contour pecking" is one of the classic palaeolithic techniques, traced in caves and rockshelters. Until the end of the previous century, it was suggested that this technique was related to post-glacial representations, but now it is a common phenomenon in the palaeolithic open air rock art, although the number of incisions in Côa often is higher (Baptista, 2008 *apud* Alcolea González and Balbín Behrmann, 2012). In the Tagus Valley Rock Art Complex, the main technique for the post-Palaeolithic art is pecking (Garcês and Nash, 2022), although cases of abrasion (four panels) and some direct incision (six panels with filiform, *apud* Gomes, 2010) exist in smaller number (Garcês, 2017). The above-mentioned show that techniques as age indicators could

probably work out better in clusters with high numbers of representations with the same style, although again nothing seems to exclude individual innovations or differentiations.

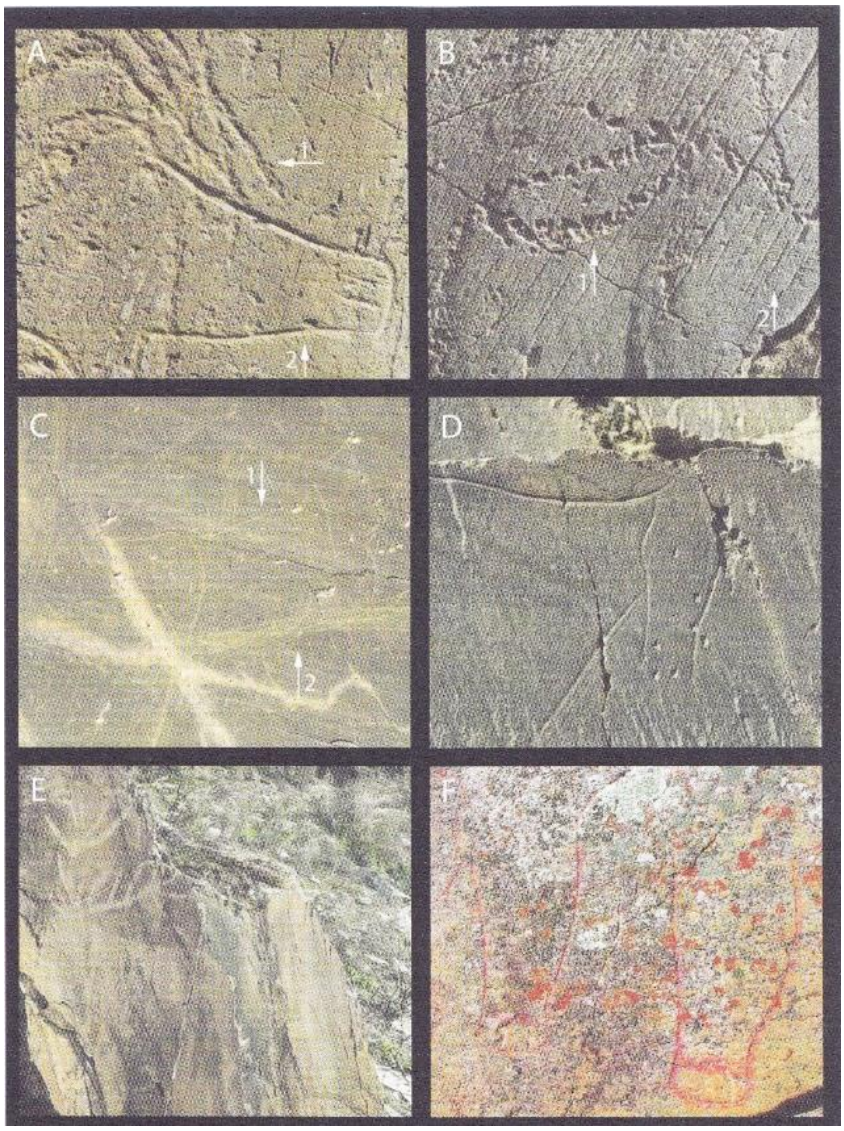


Figure 168: The techniques identified in Côa Valley. A1: pecking, A2: abrasion, B, B2: striated incision, C1: simple incisions and striated incisions. C2: Multiple incision, D: Repeated incision, E: Scaping, F: Engraving and painting. (Photos and text: Santos et al., 2021).

Considering the style, could GU6 be Gravettian-Solutrean and GU10 Magdalenian? And again, how do we know that there was not a different artist during the same day? The style of the figures argues that there are either at least two phases or a single phase of artistic production, with some atypical elements on GU9 and GU10. GU2 and GU4 (possibly GU6) argue in favour of a Palaeolithic, most probably Pre-Magdalenian, age of creation. Both subnaturalistic style and the schematic style that follows Palaeolithic in the Tagus Valley Rock Art Complex are significantly different as it can be seen on the chrono-stylistic sequence of the proposed by Garcês (2017) (Figure 169).

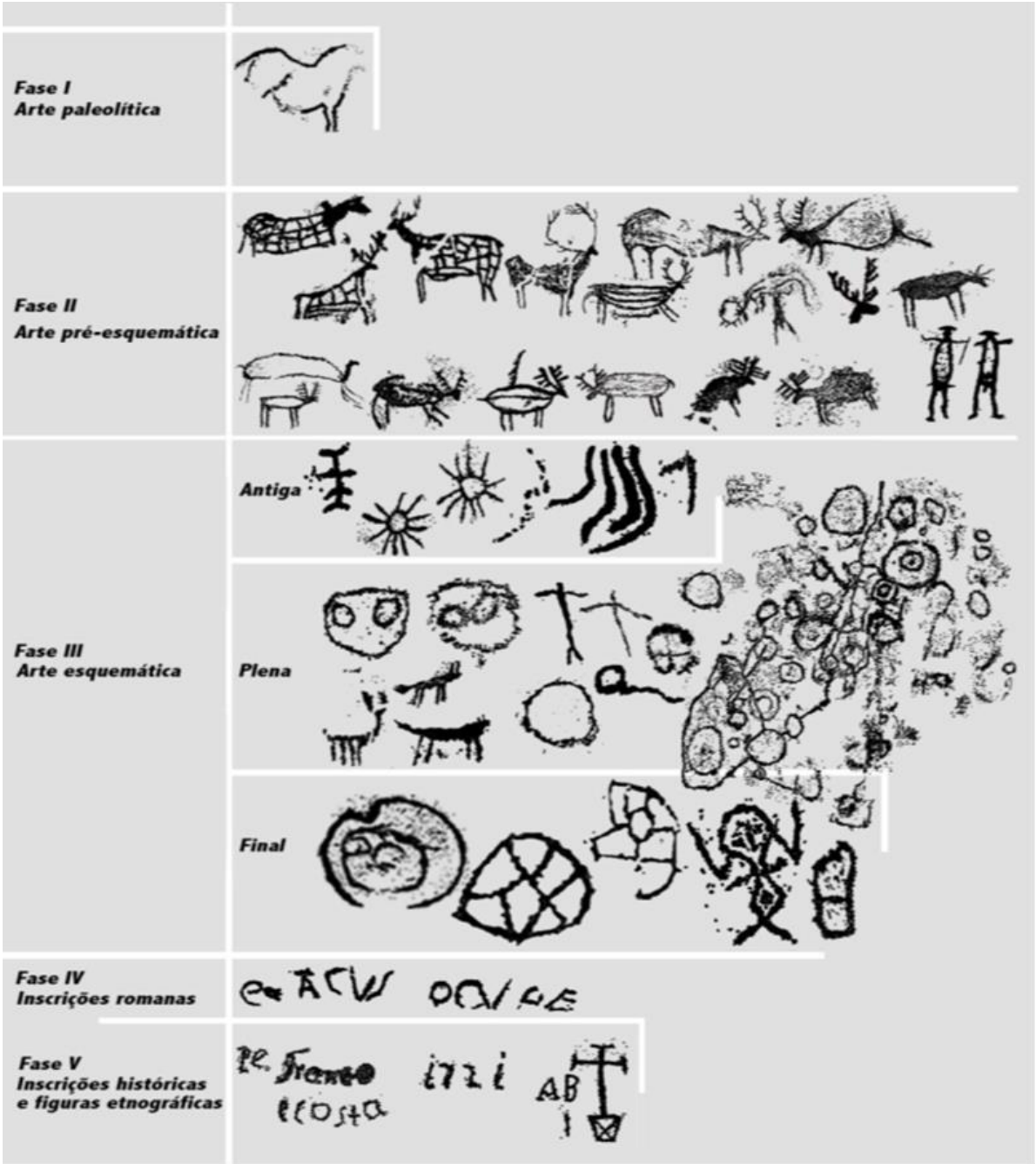


Figure 169: Chronostylistic sequence of the Tagus Valley Rock Art Complex proposed by Garcês (2017).

GU9 on the other hand is depicted on a schematic manner, which could be related to the next artistic period of the Tagus Valley, that is the Pleistocene-Holocene transition and the hunter-gatherer-domestication economy, although any strong parallel was identified. Lastly, the zoomorphic figures from the two panels, OCR15 and OCR20 (Figure 170) stand in favour of a wide chronological synchroneity. Clues that stand in favour are the naturalistic manner of depiction of the Ocreza horse and GU2 and GU4, the relatively small size of the representations, the pecking techniques, also considering the frequent use of peckings in Côa during the ancient phase (Santos et al., 2021). Nevertheless, it is impossible to know if the three

figures, the Ocreza horse OCR15, GU2, GU4 were made during the same day, year, century, or millennium, while regarding the Pre-Magdalenian and Magdalenian division, there is not a great precision at this stage of the research.

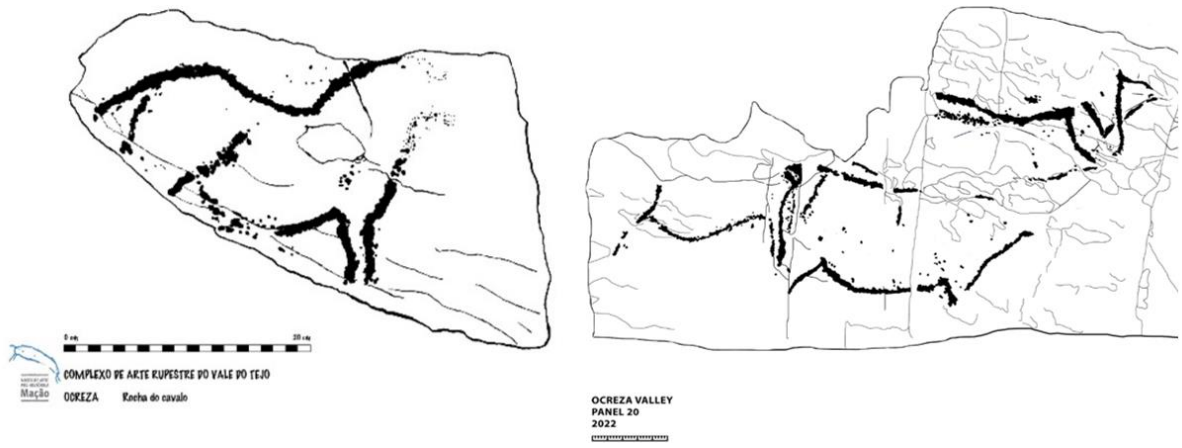


Figure 170: OCR15 and OCR20 (Left tracing: G. Nash and S. Garcês).

5.6. Possible related sites and Iberian contacts

As shown, the Upper Palaeolithic rock art from Ocreza presents similarities particularly with the Côa Valley (Figure 171), Siega Verde (Figure 172), and Pre-Magdalenian Cantabria (Figure 173) namely with El Rincón (González Sainz and Garate Maidagán, 2006). The similarities are in style, technique, and theme. The closest open-air rock art sites with similar technique and zoomorphic representations are in the Zêzere Valley, a tributary to the Tagus, at Costalta and Poço do Caldeirão (Santos, 2017). According to Baptista (2009), the Costalta horses remind examples from Siega Verde and could possibly be Magdalenian (Santos, 2015). Other zoomorphic figures from Poço do Caldeirão interpreted as mountain goats from Baptista (2004; 2009) or deer according to Santos (2017), who suggests that they could correspond to the Pre-Magdalenian phase of Côa with parallels in Ardales and Pileta. The caprid/cervid of Figure 174 and Figure 176 looks very similar in both style and technique with the GU4 (Figure 175, Figure 176). The closest cave site with paintings and engravings comparable in style is Escoural (Figure 177), whose phases are still under dispute (Reis, 2021).

Santos et al. (2015) argues that Pre-Magdalenian rock art in Portugal is “very homogeneous” with morphological features having direct parallels with French and Spanish sites as it was proposed by Guy (2000) (Santos et al., 2015). That could imply interactions from Western Iberia with South France according to Zilhão (2003), expressed by a specific codification

system of animal figures (Guy, 2003) (Santos et al., 2015). Zilhão (2003) advocated that the reason behind the homogeneity was the Pleniglacial period with cold conditions forcing social interactions to be intense (Santos et al., 2015). When the climate became milder after this period, a regionalization in rock art appeared with the decrease of the previous interactions (Santos, 2012). Considering the palaeolithic occupations, Bicho et al. (2007) proposed a relation between climatic conditions, art and social cohesion (territoriality, ritual activities, information storage, etc.) particularly during Gravettian in Portugal, the Solutrean in Mediterranean Spain and early Magdalenian in Cantabria. During the Solutrean in Portugal and Mediterranean Spain an artistic "explosion" would have occurred accompanied by an increase of camp sites at these areas related to their use as refugia during the Last Glacial Maximum (Bicho et al., 2007). In reverse, during the Magdalenian, occupations seemed to decrease in Andalucía, and increase or retain the same numbers in Levante and Portugal with rock art at the South to be limited in numbers without a clear explanation (Bicho et al., 2007), possibly not yet discovered. For Santos (2017; Santos et al., 2021) the Pre-Magdalenian phase of Côa shows more affinities with the figurative art found at the southern part of the Peninsula compared to the following phase. Nevertheless, the parallels attributed from the Gravettian to the Middle Solutrean identified by the authors show possible connections covering a great geographical area from Portugal and South Spain to Cantabria and France (Figure 178) (Santos et al., 2021). During the Magdalenian phase an increase was suggested on parallels among sites from Côa and Northern Spain, particularly Asturias, and no connections with South Iberia (Phase 3 of Côa) (Santos, 2012; Santos, 2015; Santos et al., 2021). The proposal of climatic effects on social networks could explain the relations between Côa and Siega Verde with Cantabria during Magdalenian and the absence of interactions with southern Iberia, while Escoural and Guadiana were linked with southern and easter Iberia during this period (Santos et al., 2015). According to the same researchers during the late Dryas, the return of extreme cold conditions, led again to the creation of networks and resulting in a new homogeneity in rock art, under style V, this time in various sites around Iberia. Reis (2021) argues that as the findings are yet scarce regarding Upper Palaeolithic rock art at the region of central Portugal around Tagus River, it can only suggest a broad influence from both North and South Iberia. This suggestion is reasonable, larger assemblages are needed to establish these connections, particularly when art follows standardized forms. The confirmation or rejection of the above proposal stand upon fieldwork targeting more rock art in the Tagus River, following the recent discoveries.

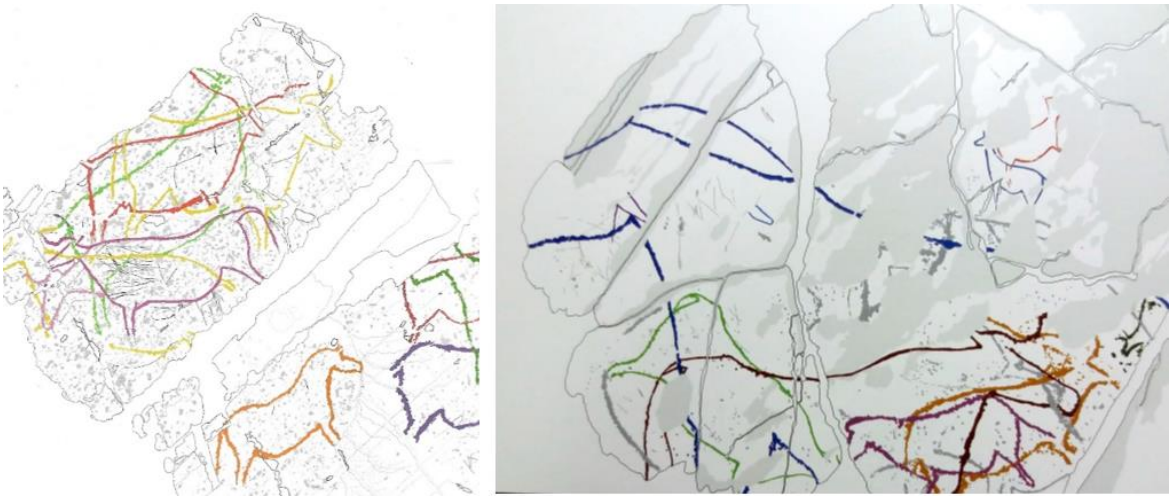


Figure 171: Left image: Rocha 16, Canada do Inferno (Tracing: A.M. Baptista, M.V. Gomes, F. Barbosa, CNART, PAVC in Baptista, 2009). Right image: Rocha 5, Penascosa (Tracing: A.M. Baptista, M. V. Gomes, F. Barbosa, CNART, PAVC in Baptista, 2009).

Figure 172: Auroch from Siega Verde. Attributed to the oldest phase of Siega Verde, Solutrean according to Alcolea-González and Balbín Behrmann (2006) and Pre-Magdalenian according to Vasquez Marcos (2021). (Photo: Vasquez Marcos and Reis in Vasquez Marcos, 2021).

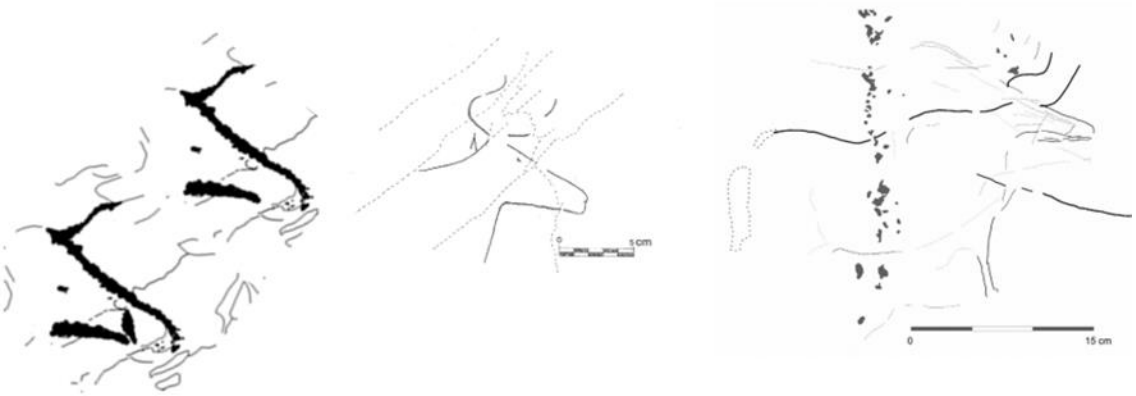


Figure 173: Left image: GU6 with and without peckings of GU8. Middle: Auroch from Conjucto II, Siega Verde (Tracing: in Balbin Behrman et al., 1995) Right image: Pre-Magdalenian auroch from el Rincón (Tracing: in González Sainz and Garate Maidagán, 2006).

Figure 174: Panel from Rocha 2, Poço do Caldeirão (Photo: in Baptista, 2002).

Figure 175: OCR20 (Photo: S. Garcês).

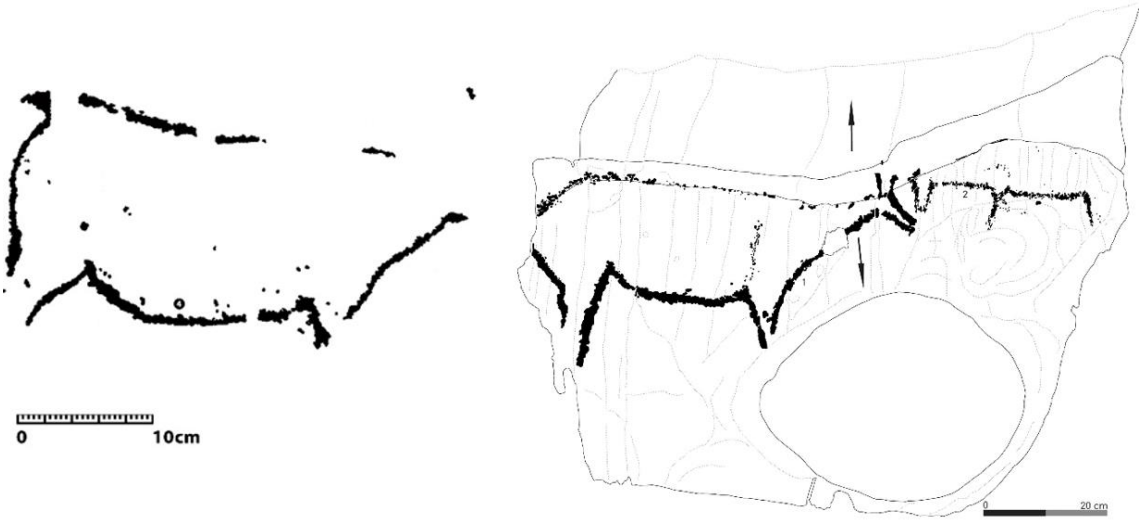


Figure 176: Tracing of GU4 and cervids/caprids from Rocha 2, Poço do Caldeirão (Tracing: F. Barbosa, assisted by M. Almeida, A. M. Baptista and J. Félix, altered and processed by Santos, 2017).

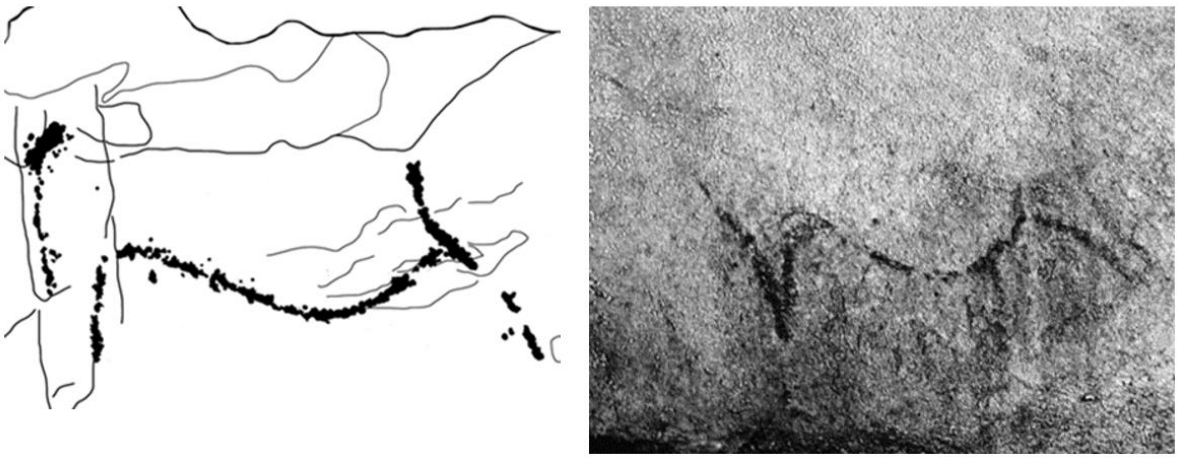


Figure 177: Left image: GU1 and GU2. Right image: Zoomorphic figure with black pigment from Escoural (Photo: F. Jordá in Corchón Rodríguez, 2008).

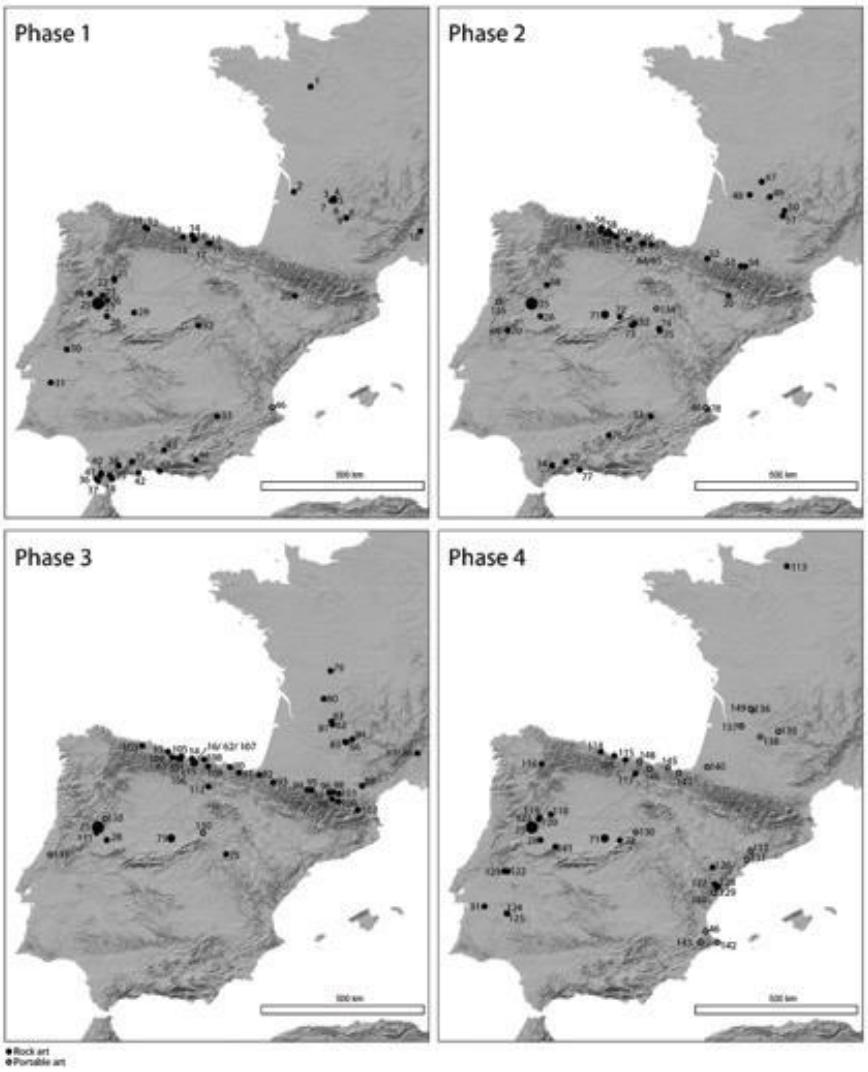


Figure 178: Maps presenting sites with parallels of the four different identified phases in Côa Valley by Santos et al. (2021).

Despite the fact that Tagus has been diachronically important for hominin groups since the Lower Palaeolithic (Almeida et al., 2008; Gomes, 2010; Cunha et al., 2019), the surrounding area of Ocreza has only a few cases of Upper Palaeolithic occupations, most probably due to the absence of systematic surveys. The closest sites with Upper Palaeolithic remains are Tapada do Montinho (Almeida et al., 2008), Vilas Ruivas and Porto do Tejo II (Gomes, 2010). In Tapada do Montinho, were found prismatic and pyramidal cores to produce blades made on flint (Almeida et al., 2008; Gomes, 2010). In Vilas Ruivas the Upper Palaeolithic occupation was attributed to the Magdalenian and includes flint burins, scrapers and cores (GEPP, 1978 *apud* Gomes, 2010). The lithic industry from Porto do Tejo II is on quartzite and dated to the final Palaeolithic and the beginnings of Holocene (GEPP, 1978 *apud* Gomes, 2010). More recently Monte da Revelada and Alto da Revelada also retrieved EpiPalaeolithic occupations (Monteiro et al., 2018; Pereira et al., 2017).

Further survey will most likely provide valuable results for this prehistoric period, while the identification of Upper Palaeolithic rock art in schist outcrops is only a matter of time.

5.7. The symbolic use of schist during Upper Palaeolithic in Western Iberia

The Iberian Peninsula is characterized by sedimentary and meta-sedimentary rocks, with "chert-rich" limestone to be evident at the eastern part, and the central and western to be distinguished by their siliciclastic bedrock (Figure 179) (Pereira and Benedetti, 2013). Common rock types of western Iberia are schist, marble, greywacke, quartzite, granite, quartz, and chert rich limestone (Ribeiro et al., 1979; 1987; Daveau, 1995; Almeida et al., 2000; Ferreira, 2000; Dinis et al., 2008 *apud* Pereira and Benedetti, 2013).

Schist surfaces for rock art had been used diachronically in Western Iberia and the Tagus Valley Rock Art Complex, as the evidence from the various archaeological periods suggests (Gomes, 2010; Garcês, 2017; Reis, 2021). As some of the figures in Ocreza are stylistically estimated to be Palaeolithic, we are currently trying to understand this relationship further taking as a starting point the examples from the Palaeolithic of Western Iberia. Since back then, most of the sites with open air rock art are found in schist outcrops (Jordá Pardo, 2012; Garate Maidagan et al., 2016; Balbín Behrmann and Alcolea González, 2021; Reis, 2021; Vázquez Marcos, 2021) (Figure 180). At the Portuguese territory most of the schist supports used surfaces with big vertical and subvertical panels with fractures (Jordá Pardo, 2012). It is most likely that this phenomenon is an adaptation to the geological context of the Peninsula (Djindjian, 2013), highly associated with preservation issues (Garate Maidagan et al., 2016; Fernandes et al., 2017; Balbín Behrmann and Alcolea González, 2021), but also the occasional use of surfaces with adequate morphology and fractures that could provoke the artists' fantasy (Fernandes et al., 2017).

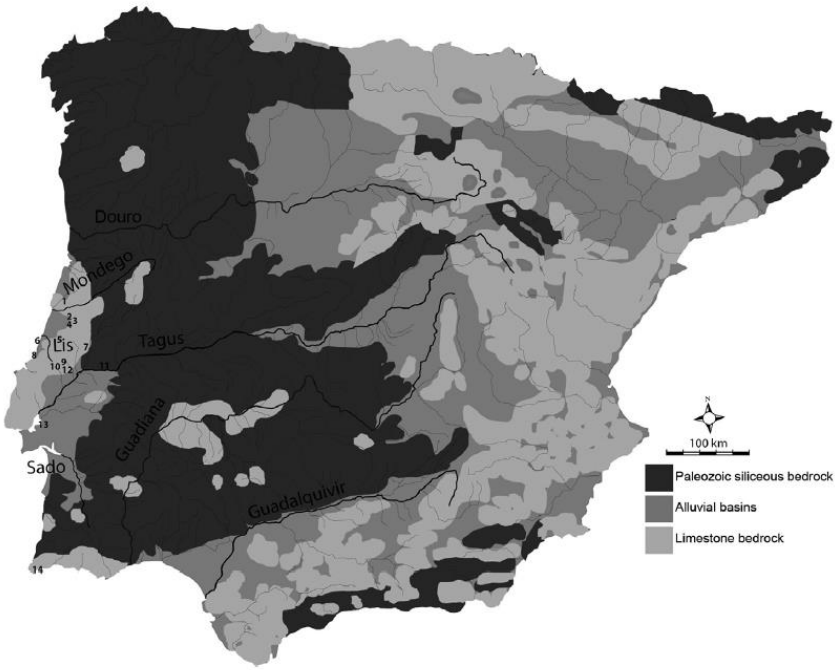


Figure 179: The three major geologic settings of the Peninsula and major rivers of southwestern Iberian margin (Map: Pereira and Benedetti, 2013).

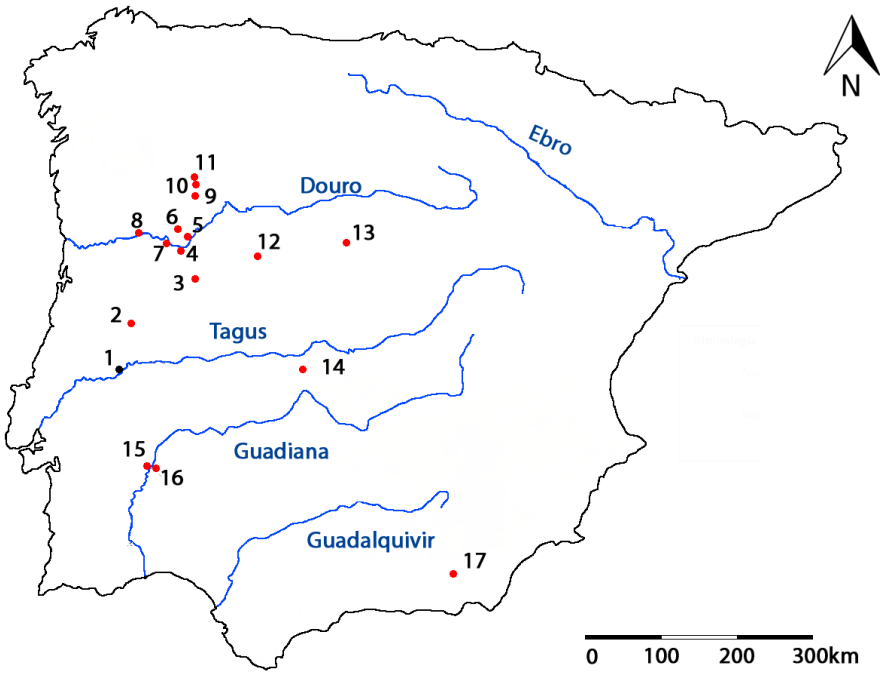


Figure 180: Map with open air Upper Palaeolithic rock art sites and major Iberian rivers. 1.Ocreza 2.Costalta; Poço do Caldeirão 3.Siega Verde 4.Redor do Porco; Arroyo de las Almas 5.Mazouco 6.Ribeira da Sardinha; Pedra de Asma 7.Côa Valley 9.Foz do Tua 9.Fraga Escrevida 10.Pousadouro 11.Sampaio 12.La Salud 13.Domingo García 14.Arroyo del Manzano 15.Porto Portel; Moinho da Moinhola 16.Molino Manzánez 17.Piedras Blancas. Based on Reis (2021) and Vázquez Marcos (2021).

The nature and morphology of the rock surfaces are being investigated in the Upper Palaeolithic rock art studies as note by Jouteau et al. (2019) under the idea that they could "stimulate, facilitate and force adaptations or constrain the techniques and the artistic processes" (Aujoulat, 2002; Ferrier et al., 2017; Feruglio et al., 2015 *apud* Jouteau et al., 2019). The hardness and texture of the outcrop most probably influenced its selection from the artists. As Fiore (2007) notes depending on how hard the surface is, the engraving with the lithic tools requires more or less time and physical effort. If the outcrop is soft and easy to be engraved, the representation usually presents higher risks of decay, especially in the open-air sites. Equally implications exist for the application of pigments and their conservation on corse-grained and small grained rocks (Rosenfeld 1988; Bednarik 1994 *apud* Fiore, 2007). Bueno Ramírez and Balbín Behrmann (2021) argue that the absorption of pigments in sandstone and limestone is greater than in schist, thus it could influence their preservation. The presence of pigments outside enclosed karstic environments might have been usual, possibly even over the engravings, but weathering process did not allow their preservation (Baptista, 2012; Balbín Behrmann and Bueno Ramírez, 2009). Despite that, possible cases have been suggested at the granite rock shelters of Faia (together with the sole case of open-air Palaeolithic engravings on this rock support) (Baptista, 2009; Santos et al., 2021, Reis et al., 2022), Santiago de Alcantara in quartzite (Bueno Ramírez et al., 2011; Balbín Behrmann and Alcolea González, 2021) and Cueva de Ambrosio, in limestone (Martínez García, 2009). In general, grain sizes, their angularity and matrix affect the hardness of the rocks, but variability can be between rocks of the same kind (Sundstrom, 2017). The possible acknowledgement of the conservation of the produced images and the selection of the rock surface within the artistic mindset cannot be excluded, especially if "image durability was indeed a relevant factor within the cultural values of the producing group" (Fiore, 2007). An interesting clue for Western Iberia that might be related to the above mentioned is the fact that in the current Portuguese territory schist was the favourable raw material during Upper Palaeolithic for parietal art and portable art. This proposal is based on the evidence from plaquettes and pebbles from the sites of Cardina, Fariseu, Foz do Medal (Figure 181), Caldeirão, Buraca Grande, and Vale Boi (Figure 182) (Reis, 2021). Other rock sources for portable art have been quartzite and granite but their numbers are (at least at the moment) limited (Reis, 2021). Interestingly, findings of fragmented schist artifacts from the Côa Valley, in the sites of Cardina 1 and Olga Grande 4 and Fariseu, have suggested a more "functional", sensu stricto, use of schist as a raw material, for tool production during the Magdalenian (Appendix Figure: Figure 197) (Aubry, 2009b). The small

numbers currently do not suggest a scenario with strict relations to this raw material acquisition and the production of rock art on the schist panels.

Figure 181: Slate plaque MD.45 from Foz do Medal attributed to the Magdalenian. 5cm scalebar. (Photo: Soares De Figueiredo et al., 2020).

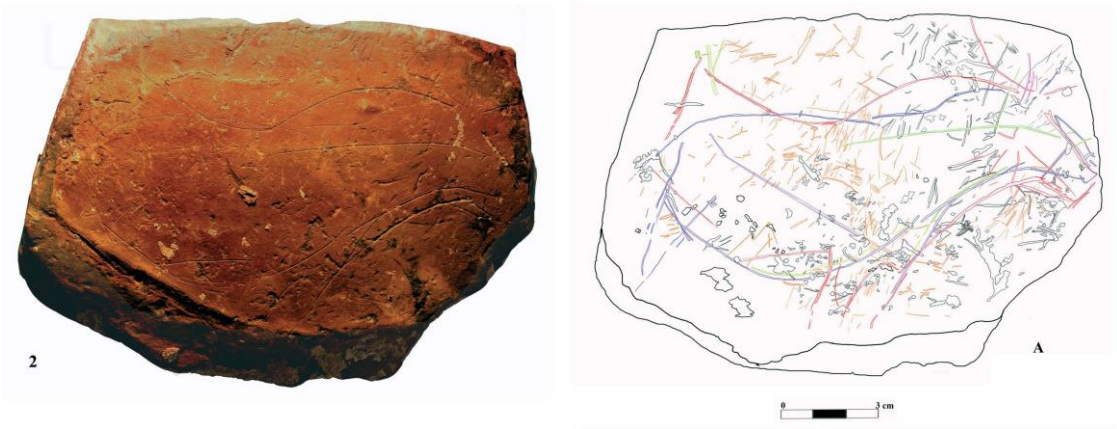


Figure 182: Schist plaquette from Vale Boi with zoomorphic representations attributed to the Solutrean (Photo and tracing: Bicho et al., 2012).

The use of the rock morphology and the fractures in Upper Palaeolithic Western Europe rock-art has been noted since the early studies of Alcalde del Río, Breuil, and Sierra (1912) (Fernandes et al., 2017). Clottes (2018) examining the selection of sites and panel by the palaeolithic artists advocated in favour of the potential role of the artists imagination "projecting mental images". The shape, texture, cracks, and reliefs of rock surfaces could remind specific animals to the artists, enhanced by illumination systems (torches, lamps) in caves. According to him, this might be the answer why frequently some parts of the figures were left undone, or why the contours were completed by fractures, and the illusions of shape dimensions using the rock relief. Some researchers highlighted the fact that the use of the natural relief and the fractures in the open-air panels found on schist and slate supports is not as common as in the limestone surfaces of the caves, due to geomorphology (Bicho et al. 2007). Fernandes et al. (2017) presented examples from the sites of Côa Valley and Siega Verde that

show such use on schist and slate outcrops. The numbers in the total assemblages examined was relatively low, though substantial 18/88 in Côa and 25/85 in Siega Verde. The researchers defined five groups (Figure 183). The first, shows a use of the outer limit to complete the representations. The second, the placement of motifs on a “convex/concave area”. The third, focus on the integration of a fissure/ fractures/ kink band to the representation. The fourth group was described as motifs “establishing a connection with fracture”. Finally, the fifth group had motifs created in different surface planes.

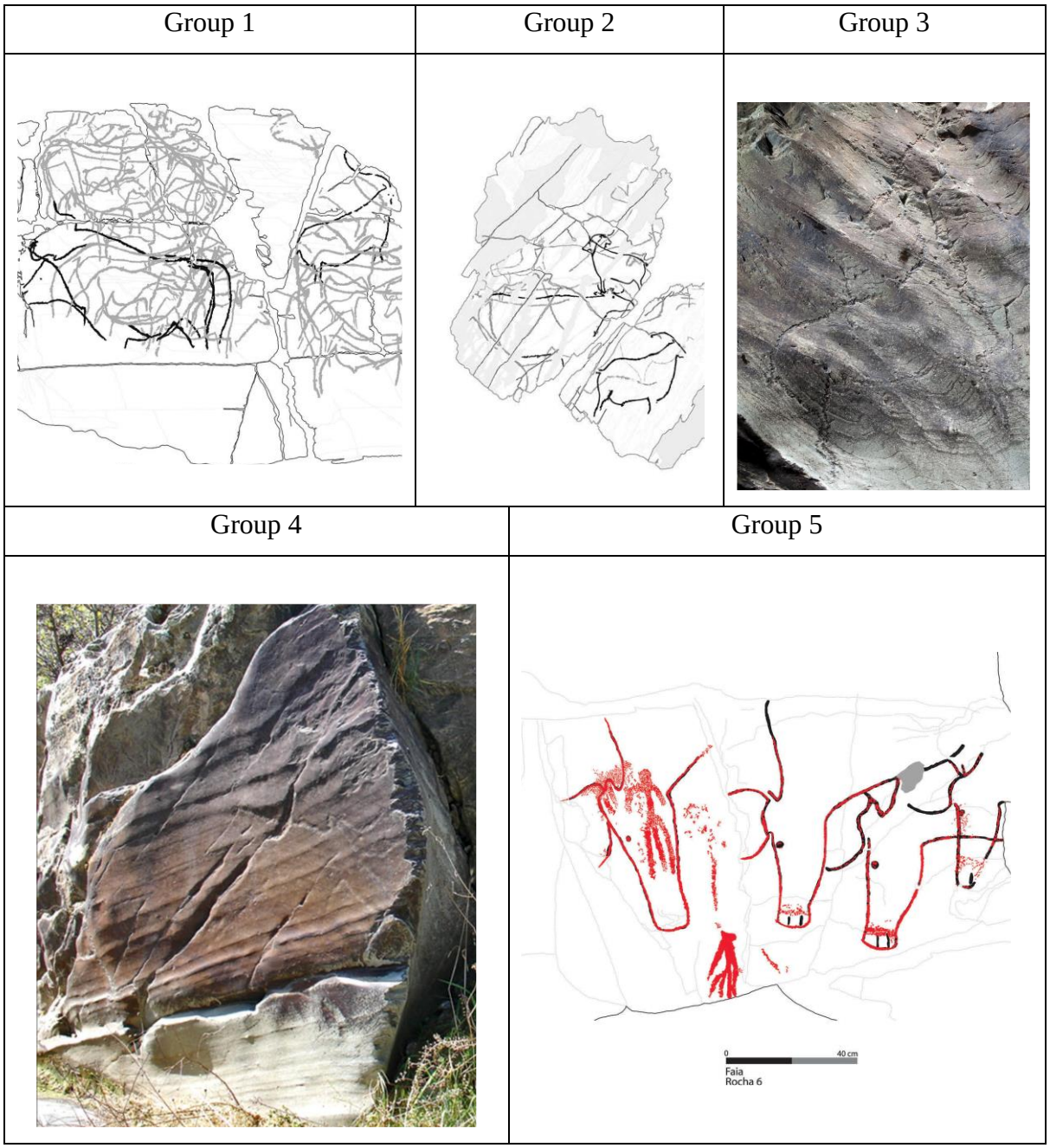


Figure 183: Examples suggested by Fernandes et al. (2017). Above from left to right examples of: Group 1, Rock 1 Fariseu, Group 2, Rock 5 in Penascosa, Group 3, Panel 45 in Siega Verde (Photo: Pedro Guimarães). Below, left image example of Group 4, Panel 7 in, Siega Verde (Photo: Carlos Vázquez Marcos) and on the right example of Group 5, Rock 6 in Faia (Tracings: CNART in Fernandes et al., 2017).

To distinguish the anthropogenic traces on the panel, the possible use of fractures and of the rock formation was also examined. The panel is highly affected, especially at the upper part by various weathering process, either natural or anthropic. The only potential case where the fractures could have been used for the depiction of the figure is GU10. The head of the figure seems to be completed by the fractures (Figure 184).

Figure 184: Left image: Digital tracing with GU10. Right image: Photo focusing on GU10 (Photo: H. Collado Giraldo).

However, the biggest problem here is the timing. We do not know when these fractures were created, and how. Against this hypothesis could be said that as they were traced at the upper part of the panel, the fractures were caused by later weathering, either natural or by mechanic pressure or impact considering that the panel was below the sediments, large pebbles were scattered in the vicinities, and it is on the trail path. Regarding the upper part of the proposed head, there is also the possibility of an incised line created for the delimitation of the shape (Figure 185), whereas for the broken part below (Figure 186) there are high chances that it could have resulted during the artistic process similarly to the other broken surface above GU4, as they are located in crucial parts for these graphic units. Furthermore, despite being a “trend” during Upper Palaeolithic, there is no proof against the possibility that an individual could have acted similarly during the following millennia using the fractures of the outcrop. As a result, the question of the use of fractures for artistic purposes remains open for Ocreza.

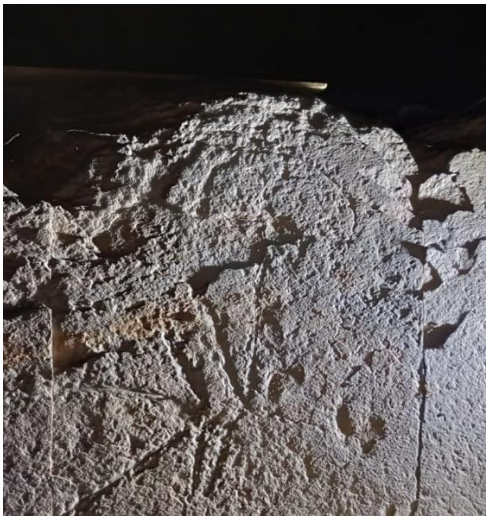


Figure 185: Capture with artificial light manipulation (Photo: H. Gomes).

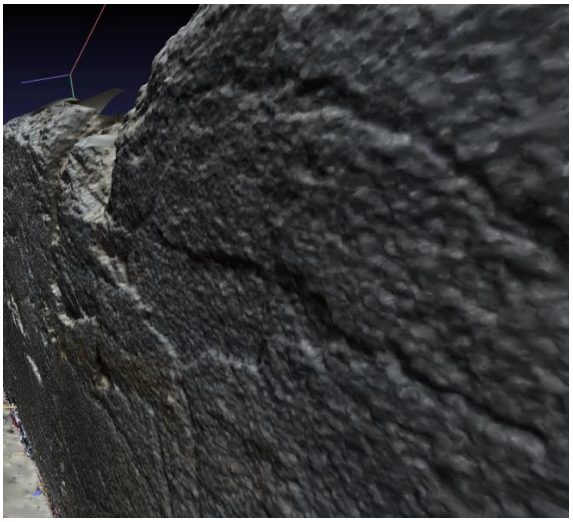


Figure 186: Capture of the 3D model focusing on the broken surface.

5.8. Location of the panels and spatial interpretations

Djindjian (2013) suggests that specific landmarks played crucial role in the navigation of the hunter-gatherers through the territories. They could have mnemonic use, and even symbolic. According to him some examples could be impressive rocks, confluences of rivers, cliffs, canyons, natural bridges, mountains, fords, lakes, valley terraces, rock shelters, mines, and caves. Clottes (2018) gives as examples in relation to Palaeolithic rock art the Chauvet cave and the natural bridge of Pont d'Arc (Figure 187, Left Image) and the mountain formation of El Castillo. Bicho et al. (2007) argued in favour of such cases as well. The importance of a similar natural landmark has been highlighted in past studies concerning the rock art of the wider area of Tagus by Gomes (2010) and Garcês and Oosterbeek (2015). Portas do Ródão (Figure 187, Right image) is a UNESCO geological monument that should have been a recognisable landmark in the landscape located at the upstream sector of the Portuguese Tagus Basin, c.25 km from the Ocreza sites (Garcês, 2017). The narrow canyon was created as Tagus River was cutting the quartzite massive for thousand years currently reaching 180 meters high (Cunha et al., 2009 *apud* Garcês, 2017. Considering the aforementioned, the proximity of Ocreza and the existence of the two palaeolithic panels in the valley, might not be a coincidence.

Figure 187: Left image: Pont d'Arc. (Photo via Internet: E. Cwpe) Right image: Portas do Ródão. (Photo via Internet: R. Rosa).

The position in Ocreza Valley could be also related to the abundance of the bedrocks available, and how the human groups perceived their importance in functional-technical or more symbolic way, accessibility or inaccessibility, and the cost of energy required to the creation of the engravings, like Fiore (2007) has proposed for other rock art cases.

The location of OCR15 and OCR20 could have affected the selection of the slabs. The site could have been selected due to the importance of the river. Jordá Pardo (2012) informs that open-air palaeolithic rock art sites tend to be found in two contexts, either associated with river courses like Côa and Siega Verde or on outstanding reliefs such as Domingo García, Piedras Blancas and Fornols-Haut. The existence of rock art panels in Côa and Siega Verde near the bottom of the river course or at slopes near fords and confluences indicate the use of rivers as a crossroads and paths during prehistory (Aubry et al., 2001 *apud* Garate Maidagan et al., 2016). This can be further assisted by the hypothesis of Pereira et al. (2022) that during climatic crises rocky plateaus would have been arid and drier, with reduction of vegetation and forests, creating an adequate space for large game animals like horses and aurochs. Canyons would present remnants of forests and vegetation accompanied with biotic diversity (Pereira et al., 2022). If we also think rivers as major points of the economic life of prehistoric people, suggestions about the relation between rock art, territoriality, and viewpoints over economic resources on the landscape could also apply (Bueno-Ramírez et al., 2003; Martínez García, 2009; Balbín Behrmann and Bueno Ramírez, 2009; Baptista, 2012; Bahn, 2015; Alcolea-González and González-Sainz, 2015). Garcês (2017) agrees that rivers, like Ocreza (Figure 188), could have been areas of economic and cultural importance, used as means of communication or territorial barriers.

Figure 188: Capture from the Ocreza River (Photo: F. Preka).

On an intra site level, the right margin of Ocreza seems to be a favourable position for rock art placement, as other 20 post-palaeolithic panels have been similarly discovered at the same side of the river (Baptista, 2001). This fact is possibly influenced by the sun orientation, considering the steepness of the valley. Coincidentally this point was examined during the methodological approach applied on OCR20 for the tracing process. Initially a hypothesis was made that night tracing would provide a better enhancement of the grooves and pecked marks because of the artificial light manipulation. The results between the highest quality 3D model (2.) that was created with photos captured around 8:45 a.m. in the morning (Figure 189, Left Image) and the ones of 3D model (3.) that was created with night photos (Figure 189, Right Image), prove that during the that the engravings are shown better during the first hours of the day. That was cross-examined placing the latter 3D model at the Meshlab setting. Using the digital artificial light manipulation on the virtual model (3.) and following the same trajectory with the sun from East to West, the view of the panel was transformed with details to be highlighted during the alteration of the shades particularly at the first stages of the trajectory (Figure 190).

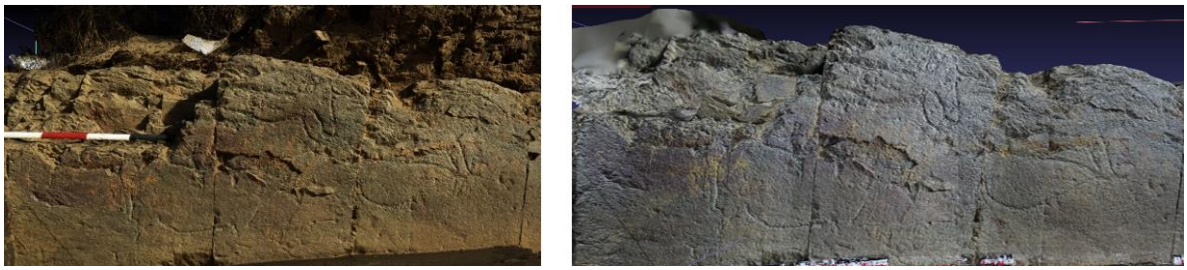


Figure 189: Left Image: View of the 3D model. (2.). Right Image: View of the 3D model (3.).

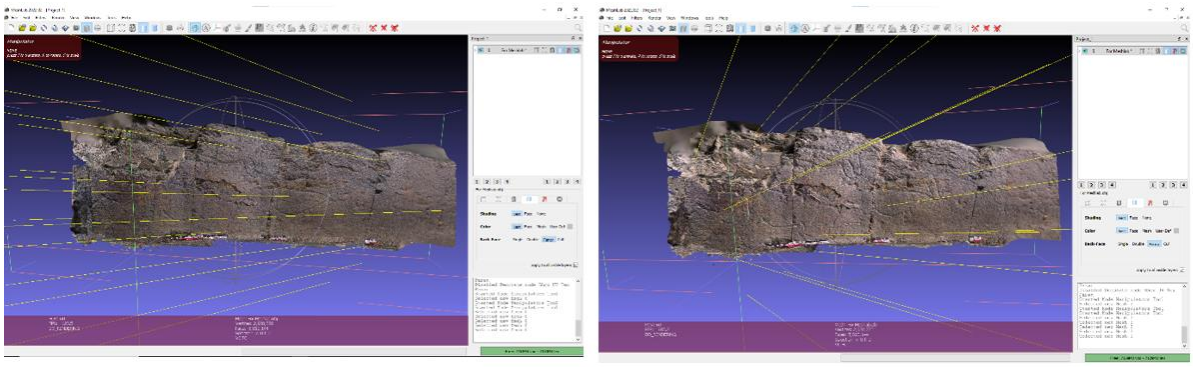


Figure 190:Left image: Artificial manipulation of the light pointing from West to the East using Meshlab. Right image: Artificial manipulation of the light pointing from East to the West using Meshlab.

Although it cannot be excluded complications caused by the quality of the 3D model (3.) and the cameras used, both 3D models provided good results. Both cases highlight the importance of light in the analysis of the panels' graphic units. The 3D model created at the specific time of the day probably provides better results for some of the anthropic marks, but this might not be an absolute solution. Other engravings might not be that visible due to conservation reasons or an on-purpose position selected by the artist. A configuration by night tracing, as happened here, is beneficial. It is important to bear in mind, not only for reasons of the rock art analysis, but also for survey, that during specific hours the sun might affect the perceptibility of the rock art. Considerations about the role of the light and the position of open air rock art can be found for Côa Valley in Fernandes (2010; 2012) and Bahn (2015) where the vast majority of Pleistocene rock art is positioned facing east-southeast (Santos et al., 2021), likewise Ocreza, and Tagus (Garcês, 2017). This issue requires careful examination as conservation and other reasons might affect our current perspective (For more: Aubry et al., 2012; Fernandes et al., 2017).

A location might be important regarding the public/ open or private/hidden role of the rock art (Bahn, 2011). Baptista (2001) suggested that representations like the Ocreza Horse, and figures from Ribeira da Sardinha and Piedras Blancas due to their small dimensions would not be visible from long distance. The relatively small proportions of OCR20 could point to a more private/hidden role, while the position of OCR15 (Figure 191) could have a more public/ open character. In addition, both panels seem to be easily accessible if there were no obstacles created by sedimentation or the river level. These issues can be investigated with GIS viewshed analysis focusing on the visibility and perceptibility between the engravings and the viewer regarding their position (e.g. Rodríguez-Rellán and Valcarce, 2016; Bourdier et al., 2017).

Figure 191: The OCR15 panel outstanding with its colour in a relatively easy accessed area (Photo: S. Garcês, 2017).

Lastly, another factor could have been the role of sound. For the potential role of produced sounds while engraving the rock surfaces exists a proposal concerning Côa's superimpositions (Blake and Cross, 2015). For the Ocreza Horse, researchers suspected that the selection of the position this time was related to the watercourse sounds (Garcês and Nash, 2017). The geomorphology of the valley could reflect various sounds, but archaeoacoustics can be a highly debated topic that requires analytical work with the relevant technological equipment (Danelatos, in press). Again, GIS via sound shed analysis (Díaz-Andreu et al., 2017) could possibly provide further information if sounds played any role in selecting the position of the panels.

6. Conclusions

This dissertation is the outcome of the author's training on rock art documentation, analysis methods and interpretation. The case-study is the new palaeolithic rock art panel from Ocreza Valley, Portugal.

The study of the engravings, incorporating an updated methodological approach for the rock art documentation and a proposal for the age determination, was a necessary step to provide a better view of the new panel and the use of the site through time. In absence of available radiometric dating, the only available data to propose a chronology was the artistic style, despite its imprecise nature and potential errors. Obviously, this approach requires intense familiarization with the artistic styles attributed to each prehistoric period.

The main indicators for a Palaeolithic age of some graphic units of OCR20 are the naturalistic style and the representation of zoomorphic figures depicted using methods and techniques found in reliable Palaeolithic contexts such as the representation in absolute profile and "frozen motion". In addition, their partial depiction with the unfinished contour, the open extremities/ absence of hoofs, and the pecked technique suggested mainly affinities with examples from the Pre-Magdalenian phase of the Côa Valley. The naturalistic phase of the Tagus Complex at Ocreza currently presents at least a single horse figure (OCR15) and at least two unidentified figures in the new panel (OCR20). The Upper Palaeolithic rock art from Ocreza can be generally attributed to the Gravettian-Solutrean phase, although the possibility of a later dating for some units from the new panel cannot be excluded. Our current view of the panel is the final product of an interplay between natural and anthropic causes. Natural are considered the exfoliation processes of the schist outcrop resulting in cracks and fractures, and the possible erosion caused by the water and wind. To the mechanical weathering can be added the physical pressure from the human trail when the panel was covered. The possibility of the use of the natural rock fractures and of the rock formation by the artists – while there are possibly two broken surfaces as a result of the creation of the rock art – is under research. Chemical weathering by forest fires cannot be addressed.

It seems that there are almost no limitations to the interpretation of rock art. On the one hand it is inevitable to avoid attempting to explain it, because this is part of the scientific research. Symbolism in prehistoric societies is a matter of great complexity especially considering the possibility of synchronic polysemy, as there are even cases where a symbol can have a different meaning "within a single semiotic system", as it has been found in recent rock art examples

from Australia (Green, 2014; Munn, 1973 *apud* Davidson, 2018). In the absence of written records nothing proposed can be truly secure.

This necessary post-processualist intellectual work must be done, nonetheless, substantially supported on processualist field and laboratory work to ensure the quality material for the post-processualist phase. Therefore, of primary importance is to continue the excavations in the area around the panel, until the schist outcrop will be completely exposed. There are high chances of finding more Palaeolithic and post-Palaeolithic rock art engravings, as the number of examples indicate that Tagus was a noteworthy passage throughout the millennia, eventually linking the hunter-gatherer community between the Atlantic to southern France, and the Douro to the Southern coastal part of the Iberian Peninsula. Consequently, it is also necessary to extend field surveys, and excavations into the wider area around Ocreza related with the Tagus Valley Rock Art Complex. This will retrieve new finds and their better contextualization with human occupations, economy, fauna, flora, and geomorphology. Additional data will allow feeding a database for reliable predictive models for the region. Despite that we can firmly say that the general pattern in Western Iberia of open-air sites located on rivers and schist outcrops exists besides Côa and, thus, many other panels are waiting for their discovery. Due to the fact that precise parameters (texture, grain size, hardness, colour) probably influenced the raw materials used for the rock art production, further experimentation in variations of schist and the other rock types found in the Iberian context would be valuable in the future providing a more complete approach, instead of a hypothetical proposal (Table 9).

Rock surfaces	**Resistivity***	**Preservation**	**Morphology**	**Open air cases**
Sandstone	Soft	Extremely Poor	?	Unknown
Limestone	Medium/Hard	Poor	Adequate	Unknown**
Quartzite	Very hard	Good?	Irregular?	Limited ***
Schist	Medium	Good	Adequate	Most****
Granite	Hard	Medium?	?	Limited *****

*Table 9: Hypothetical qualitative table with the potential rock surfaces used for rock art (Based on Jordá Pardo, 2012 Sundstrom, 2017), *their resistivity during the engraving process (Sundstrom, 2017), their potential preservation on weathering processes (Sundstrom, 2017; Aubry et al., 2012; Garate Maidagan et al., 2016; Fernandes et al., 2017) **Only in rockshelters and caves ***Only paintings on the rockshelter of Santiago de Alcantara (Bueno Ramírez et al., 2011), **** (Baptista, 2009; Jordá Pardo, 2012; Garate Maidagan et al., 2016; Fernandes et al., 2017; Balbín Behrmann and Alcolea González, 2021),***** Only in the rockshelter of Faia (Reis et al., 2022).*

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Appendix Figures

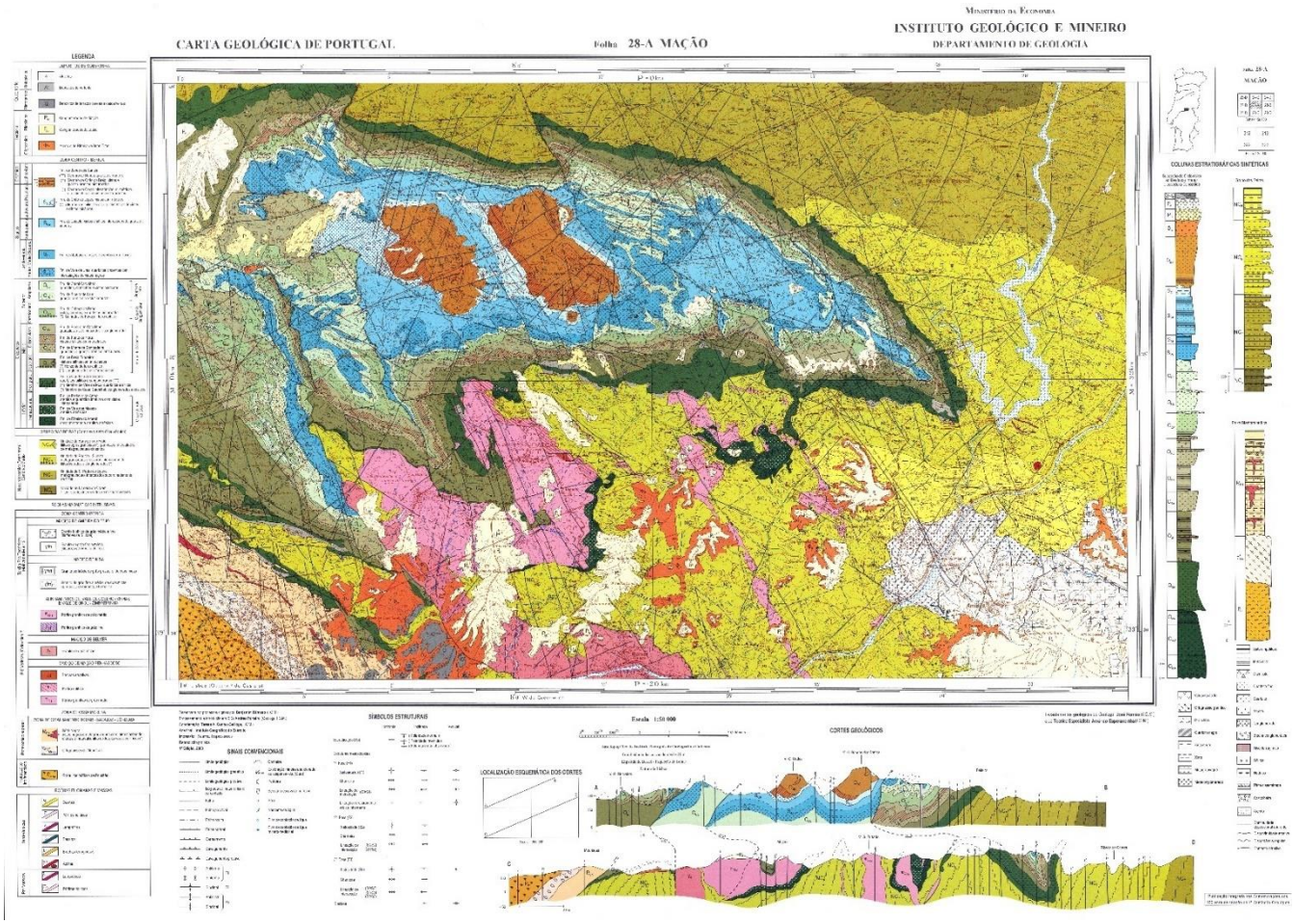

Figure 192: Geological Map of Portugal, [Folha 28-A – Mação]() by Romão J. M. and Esperancinha A., (2000).

Figure 193: The bridge of A23 highway above the Ocreza river (Photo: F. Preka).

Figure 194: The excavated area located exactly above the trail path at the place where S. Garcês, at the right with the white hat, points (Photo: D. Danelatos).

Figure 195: Spiral OCR18 (Photo: S. Garcês).

Figure 196: Capture from drone with the excavation square (Photo: J. Diogo).

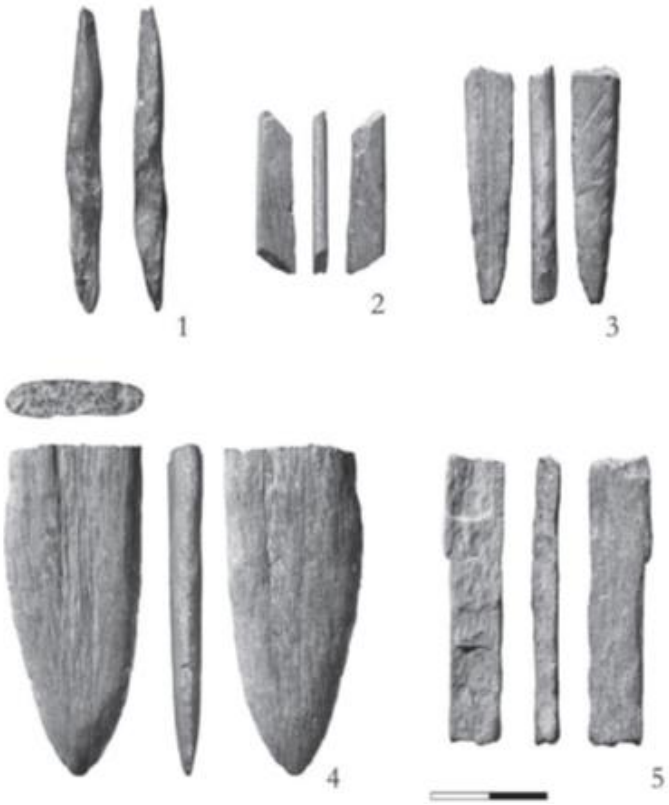

Figure 197: Fragmented tools made of shist from Magdalenian occupations in the Côa Valley, 1, 2: Cardina I, 3, 4, 5: Olga Grande (Image: Aubry, 2009).