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Documentation on Schematic Rock Paintings in Cabeza Del Buey, Spain.

The Sanchez Carrasco I, II, III and IV shelters

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INTRODUCTION

1.1 Objectives, difficulties and the structure

This work regards four new rock art shelters located in the municipality of "Cabeza del Buey", Badajoz region, Spain. The shelters were named after two people who participated in their discovery and who have since passed away, Casimiro Sanchez Iglesias and Angel Carrasco Balsera. The "Sanchez Carrasco shelters (I, II, III, and IV) present schematic figures from the schematic rock art style, a rather typical practice over the Iberian Peninsula thought to have existed from the 6th millennium BCE until the end of the Bronze Age (roughly between the 2nd and 1st millennia BCE) according to some authors (Collado 2016; Garcês 2017).

The main objectives of this work are to carry out full documentation on the field and in the laboratory of the shelter and research on typologies, and technological studies, to approach a chronological frame and to better understand the cultural context and provide insights regarding the state of conservation of the panels and their necessity for protection. Chronological attribution regarding Schematic Art in these shelters will be based on stylistic context due to the lack of elements that could be used for direct dating.

Despite the survey and documentation, there are issues to be addressed such as: a) the lack of archaeometry analysis to determine the mineralogical composition of pigments and their possible organic material as has already been done in other shelters in the area (Garcês, et al. 2022; Gomes, et al. 2013, 2015, 2022); b) there is a lack of other archaeological evidence; c) the result of weathering processes, d) lichens are the primary weathering agents linked with the paintings. Hence, this thesis will also address the conservation problems of these shelters.

This thesis was developed according to the following structure: Introduction, Literature review, Materials and Methods, Results, Discussion and Bibliographical references.

To grasp the genesis of these pictorial expressions and their developmental linkage with cultural contexts, it becomes imperative to comprehend the interplay between the landscape, environment, and the prehistoric societies. The intricate relationship between the populace of antiquity and their respective habitats significantly shaped not only their lifestyles but also the contours of their cultural manifestations. As such, a comprehensive depiction of the geographical milieu, as underscored by Perelló (1993), assumes a pivotal role in this analytical pursuit.

1.1.Geographic, geological, and geomorphological settings of Cabeza Del Buey area

1.1.1. Geographic settings of Cabeza Del Buey area

The Sierra de las Vacas is an 800-metre-high ridge in Extremadura region, Spain, and it lies close to the villages of Cabeza del Buey and the hamlet Almorchón. Cabeza del Buey is a municipality in the province of Badajoz, Extremadura, Spain, 22km northeast of Sierra de las Vacas.

The Cabeza del Buey municipality is administratively part of the Autonomous Community of Extremadura and is located to the northeast of the province of Badajoz, bordering the province of Córdoba to the southeast. In the Autonomous Community of Andalusia, with the province of Córdoba. It is almost entirely within the territory of La Siberia, which is characterized by high aridity and is adjacent to the region of La Serena (Alverez, 2005).

There are located a series of mountain ranges that surround the towns of Capilla, Peñalsordo, Zarza Capilla, Cabeza del Buey, Almorchón and Helechal. These sierras are part of the mountain range known for the generic name of Sierra del Pedroso and that constitues the southeastern limit of the region of La serena, a plain of paleozoic slate in vertical layers, resistant to erosion and with hardly any arable land. Topographically, there are numerous places with unequal altitude, while the average is 621 m. The most significant reliefs are located to the south of the Leaf, caused by the E-W quartzite Sierras. Among these are the Altos del Castillo de la Nava, which reach a height of 856 meters (Buitrera): Sierra de la Moraleja, Sierra del Palenque, Sierra de Agallares, Sierra del Torozo, Sierra de las Cabras, Sierra del Calvario, with 865m; Sierra de las Vacas with 897m; Sierra del Aliso with 743 m; Sierra de la Osa with 841m; Sierra de la Rinconada with 771m and Sierra de Tiros with heights of 961 m. They occupy the southern end of the Extremadura peneplain, between the Guadiana and Sierra Morena, descending its rugged slopes to the Andalusian plain, being in the provincial limits (perello 1993, 1999).

According to (perello 1993, 1999) These are Mediterranean scrubland areas with broom, rockroses, junipers, thyme, mastic, and other plants, as well as some holm oaks, cork oaks, strawberry trees, gall oaks, and conifers and eucalyptus in reforested areas. When the holm oaks and undergrowth thin out, pastures and pasture lands stretch out, with the major crops being rainfed herbaceous crops, barley and wheat, with olive trees and some

orchard regions. Sheep, goats, and pigs are the main livestock, and there is still big and small wildlife in the mountains.

There are some holm oaks, cork oaks and olive trees surrounding the foot of the mountains. From the mountain the view is open landscape with shrubs, very less vegetation and the Zujar river, a tributary of the Guadiana visible from the shelters. The Zujar, a tributary of the Guadiana that has lately been made into a reservoir, flows at the foot of the Sierra de la Moraleja, where the Guadalmez, which originates from the regions of Córdoba. Furthermore, streams and water currents run through the mountain ranges, allowing to produce tiny orchards on their slopes (perello 1993)

1.1.2. Geological settings of Cabeza Del Buey area

The Cabeza del Buey, region number 806 of the National Topographic Map at scale 1:50,000, represents the Hesperian Massif's central-southern region. This area is distinguished by huge vertical folds which makes its own geography, Paleozoic synclines that give the highest reliefs, and extensive depressed extensions where pre-Ordovician detrital minerals appear in anticlinal cores. Erranz et al. (1977) split the Central-Iberian Zone into two sectors: the Toledo Mountains and Alcudia-Alta Extremadura, based on the presence or absence of Cambrian elements. This Sheet is in the Alcudia-Alta Extremadura sector, more especially in the southern portion of the Central Extremadura Anticlinorium, one of the Zone's major structures.

In this area there are three main geological units with a relatively unequal surface extension in the Cabeza del Buey region:

A) The Precambrian materials: The Precambrian materials are found in the Sheet's northern two-thirds. They are part of the Grauváquico Schist Complex, principally of the Domo Extremeo Group, the lower series of CEG, with very few outcrops of the Ibor-Navalpino Group, in contrast to the previous ones. The Lower Group is a relatively monotonous siliciclastic sequence divided into three divisions based on lithological properties and stratigraphic position. The Upper Group is a more diversified series with small lateral variations, featuring conglomeratic sections, ichnofossil-rich sandstone sections, carbonate levels, and shale and sandstone sections. Both sets are structured by the Finiprecambrian, Sarcambrian, and Hercynian orogenies, though the degree of deformation is minimal, with

numerous sectors positioned above the regional shale barrier and lacking regional metamorphism or merely an anquimetamorphism. The many phases have only resulted in the superposition of folds and transcurrent regional fractures, with several re-sets, locally causing ductile deformation with the development of micro-folds and crenulations.

B) the Paleozoic cycle: The southern half of the Sheet contains Paleozoic rocks that are discordant with the two Precambrian groups. The southern mountain ranges from a monoclinal flank, with the entire series up to the Devonian, which corresponds to the northern section of the Sin-clinal of Los Pedroches. They are deformed by the first phase of Hercynian folding in general, with no generalized schistosity or metamorphism, and fragmented by the other regionally identified phases.

1.1.3. the granitoids of the Batolito de Los Pedroches: visible in the southwestern corner belong to the Los Pedro-ches Batholith and are late-kinematic with respect to the Hercynian Orogeny (Alverez 2005). Geomorphological settings of Cabeza Del Buey area

This area is an enormous erosion surface that was imbedded and reworked during the Paleogene under a previous surface or initial surface that is now only visible as a level of summits on the Armorican Quartzite Sierras explained by García Abad and Martín Serrano in (1980)**.** which is now only visible as a series of summits atop the Armorican Quartzite Sierras. The Hesperian Massif, which is composed of Precambrian and Palaeozoic slate, greywackes, sandstones, conglomerates, quartzites, and granites of the Pedroches batholith (SW), has unlevelled and compartmentalized both surfaces. To the south, the terrain is Appalachian, featuring multiple ridges and hard layers defined by the most erosion resistant materials that stand out from the surrounding ones. Three distinct morphological domains can be identified:

A) Palaeozoic Domain: It is distinguished by the highest reliefs, which correspond to the continuous and powerful quartzite bars between which more depressed sections are formed by slate packages with sandstone intercalations. This domain is located to the south of the Sheet in an E-W band.

B) Precambrian Domain: It occupies the remainder of the Sheet to the north and is distinguished by softer peneplain reliefs shallowly cut by the red fluvial.

C) Only granites outcrop in the southwest corner, which is distinguished by highly altered granites and a flattened morphology. When it comes into correspondence with Palaeozoic materials, it creates an abrupt topographic step (Alvarez 2005).

The rock art pannels located in this mountain range are part of the mountain chain known by the generic name Sierra del Pedroso, which forms the southeastern limit of the region of La Serena, plain of Paleozoic slates encases vertical, resistant to erosion, and lacking hardly arable ground. The reliefs that stand out in this plenilunar are fundamentally composed of Silurian quartzites, hard, of predominantly light color, with red spots produced by iron oxide, and vertical post (See figure 1 and 2). The Sanchez Carrasco shelters open air sites in the middle of the Sierra de las Vascas Mountain range, these rocks made of quartile and having huge cracks due to their vertical position, and these rocks known as Los Buitres (The Vultures), for their vertical position, access is very difficult, due to the erosion tons of pebbles, uneven shapes are found at the foot of the mountain and slops. The reliefs that stand out in this plenilunar are primarily made of Silurian quartzites, which are highly hard and have a light color with red patches caused by iron oxide.

Figure 1: View of the Sierra de las Vacas. According to Martínez Perelló (1993) the rocks are known as Los Buitres ("The Vultures"), which, due to their vertical position, are the site of shelters, used for schematic artistic manifestations on the walls (Photo: Hipólito Collado, 2023).

Figure 2: View of the structure of mountain in vertical position (Photo: Hipólito Collado, 2023).

Figure 3: Panoramic view of the landscape (Photo: Hipólito Collado, 2023).

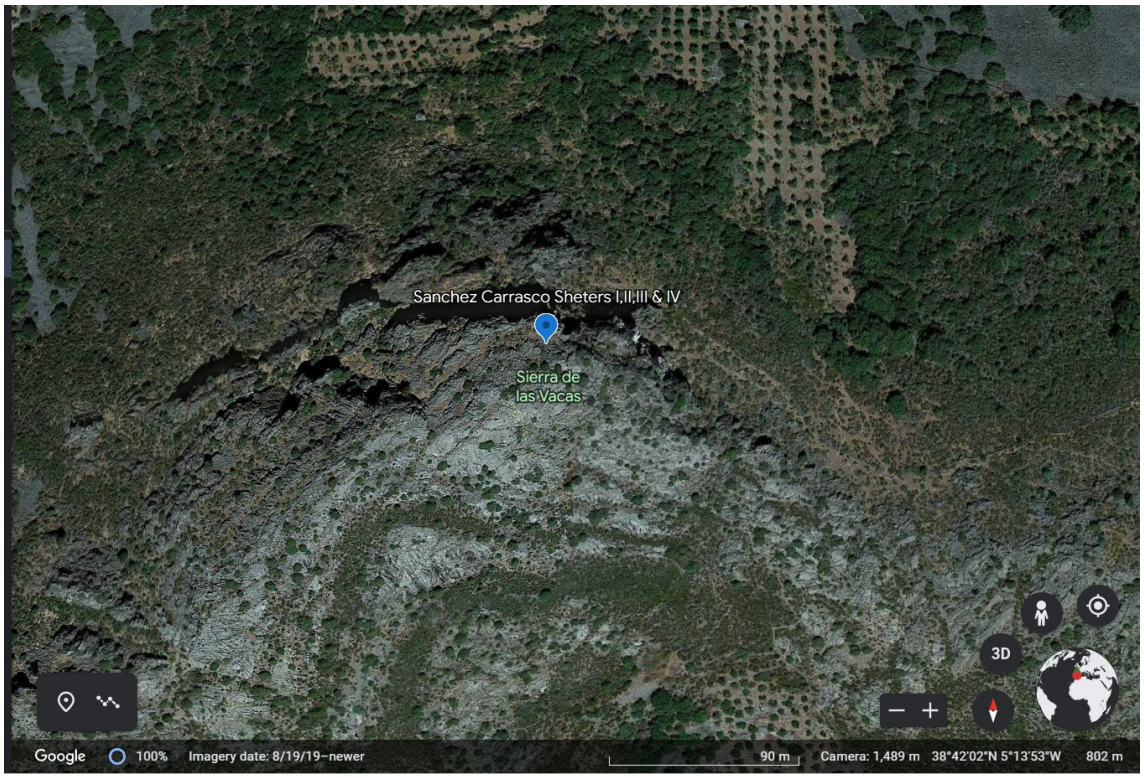


Figure 4:Sanchez Carrasco I, II, III, IV shelters (© Google Earth, 2023).

2 Schematic Art within the Iberian Peninsula context

Post-palaeolithic schematic rock art in the Iberian Peninsula refers to a group of prehistoric graphic representations associated with producing societies from the Neolithic to the Bronze Age that were widely dispersed across the Iberian Peninsula (Collado, 2006).

In 1968, Pilar Acosta introduced the concept of "Schematism." According to her, schematism pertains to the "Stylization and schematization of form, achieved through the progressive degeneration of the existing motifs in autochthonous painting, which directly precedes the schematic style." Additionally, Acosta expounded upon the notion of the "Schematic Phenomenon," characterizing it as the "Outcome and result of the amalgamation of indigenous and imported elements." Remarkably, she delves into an examination of the relationship between Levantine art and Schematic Rock Art, particularly emphasizing its painted manifestations. Some scholars, such as Ripoll in 1968, contended that a direct link existed between the Schematic and Levantine rock art traditions within Spanish territory. Conversely, others, like Beltrán in 1969, argued that there was never a cultural evolution between the two styles, but rather a fracture prompted

by "the introduction of new religious and funerary ideas and a novel conception of life arising from the metallurgy revolution" (Beltrán 1968:72).

Jordá Cerdá, in his work published in 1978, refutes the notion of external influences and instead underscores the autochthonous origins of the creative style. He posits that the origins of this style should be attributed to the Betic System and Sierra Morena regions. Drawing from the evidence provided by three adorned caves - Gruta de Cocina and Gruta de Nerja, Cerdá contends that Schematic Art should not be considered a continuation or derivative of Levantine Art, as suggested by other researchers. In contrast to Beltrán, who situates the emergence of this art form in the fourth millennium AD, Cerdá's perspective takes us further back in time, asserting that the expression of this art first appeared in the late fifth millennium AD.

Pilar Acosta (1968) dates the initial phase of Schematic Art to the Late Neolithic/Early Bronze Age based on an accurate investigation of parallelism with peninsular and Eastern Mediterranean artifacts. Later in 1984, Acosta reconsiders these chronologies, retaining the assumption that Schematic Art had its genesis during an advanced Neolithic period but shifting the event's final moment to the Chalcolithic.

Collado Giraldo (2016) asserted that during the Neolithic period within the Iberian Peninsula, a novel phase of post-Palaeolithic rock art, known as schematic rock art, emerged. This particular style of rock art is believed to have thrived from the 6th millennium BCE until the conclusion of the Bronze Age, encompassing a span roughly ranging from the 2nd to the 1st millennia BCE. Drawing upon over a century of research conducted in Spain, Schematic rock art has been subject to multifaceted interpretations, including religious, semiotic, and sociological perspectives. Collado introduced an interpretative framework, contending that "this rock art style possessed a utilitarian character, serving as landscape markers that reflected intimate associations between the chosen sites for schematic depictions and areas rich in essential resources or communication pathways linking various territories."

Likewise, Martins (2021) describes, that various rock art groups were defined in the post-Palaeolithic period, stretching from the beginning of the Neolithic to the beginning of the Bronze Age (7500 - 4000 BP), especially the Atlantic Art, Megalithic Art, and schematic Rock Art. The various artistic cycles span a wide chronological and cultural range in the

present territory of Portugal, Particularly, on the banks of the major rivers and in the hinterland.

Alves (2021) gave chronological sequence, "*Schematic Art paintings were concentrated towards the east and dated from the regional Early Neolithic, i.e. from the late 6th/beginning of the 5th millennium BC to the end of the Copper Age/Early Bronze Age, in the late 3rd/ beginning of the 2nd millennium BC."*

2.1 The Archaeological Landscape

Lara Bacelar Alves, (2009) explains that sites enclosing schematic paintings may be visible from afar but were probably not visited daily. The rocks were not physically transformed, and the painting process was mostly silent. The constraint felt in these locations suggests that paintings were created by a small group of individuals, occasionally in intimate rituals. The panels were capable of being viewed up close by a limited number of individuals at one time.

Collado Giraldo, (2016) gave more insight into locating the sheltering places with painted rock art. However, Collado and the team were disappointed when they arrived in magnificent sheltered areas, authentic archetypes of sites that should hold rock art according to these below-mentioned categories by researchers, and found no trace of rock paintings or engravings.

- Smooth walls with reddish and yellowish tones, occupied by living lichens in contrast with the greyish tone of the rocks.
- Overhang crags, almost individualized, in the mountain range.
- Smooth walls where the reddish tones stand out.
- Big shelters that are easily seen from a distance

Hipolito Collado Giraldo (2016) adds many areas of Schematic rock art were discovered as their investigation advanced throughout the years, they are:

- Small-scale shelters,
- Cavities or rock projections with modest protected cornices that had nothing or almost nothing to do with the optimum location outlined by those researchers.
- It was evident that the reason those locations were chosen for rock art was more than just picking a spectacular location.

- The shelters were occasionally divided into zones, with the artworks placed in safe areas.
- However, there were large shelters with no graphic content in the same mountain area.

On other occasions, rock art sites of various typologies, with a varying number of panels and a significant diversity of figures emerge along the mountain range, but without obvious geographical criteria that help us understand why this decision was made. Finally, rock art shelters can be found alone or in groups of up to two shelters on prominent slopes (Collado, 2016).

Collado, (2016) classified five primary types of rock art shelters solely based on the morphological characteristics of the locations where schematic rock art was discovered:

A) Big shelters, above 10 m in length, height, and depth. They are easily perceptible in the landscape and their access does not usually present much difficulty.
B) Shelters with certain spaciousness and a variable depth, although not exceeding 10 m. They can be easily used as a shelter for one or more people.
C) Smooth walls leaning slightly. Only this slight inclination allows the preservation of motifs in inclement weather.
D) Sites located in small, protected areas inside big fallen blocks in zones with granite outcrops.
E) Small cavities or cracks of small dimensions, most of the time not even large enough to be a shelter for a man. These sites always require an uncomfortable position inside in order to visualize the paintings (Collado et al.2016).

According to Collado, (2016): the classification for rock art sites regarding their functionality can be organized by:

Concentration sites: These are large enclaves associated to the A type shelter in morphological classification. They occupy an important position in the landscape, with excellent visibility (from and towards the shelter), easy access, and a significant strategic value due to their dominant location in relation to movement zones, particularly in fords, mountain passes, and hills in mountain regions, or in specific access zones to the narrowed beds of the rivers that flow through the territory.

- These locations contain many figurines.

- They are depicted on panels that are placed arbitrarily (ceiling, central panels, outdoors, rock cornices, etc.) at various heights and orientations.
- There are no obvious requirements for a clean layout in these circumstances, but there is a recurring desire to document the use of the enclave by showing as many graphemes as feasible.
- Iconographic series are diverse.
- human and animal depictions.
- A variety of ‘abstract’ figures appear.
- Superimpositions are frequent, as are a wide range of techniques, pigments, and stylistic interpretations.

Figure 5: Juanita Shelter, Oliva de Mérida (Badajoz) (© Collado Giraldo 2016).

Indication sites: These are the most prevalent, along with "movement shelters." Their sizes vary, and they would perfectly fit into the morphological typologies B, C, and D of our shelters. They usually appear on the slope, along the boundary between the forest and the rocky line. They are visible to the naked eye at short and medium distances. The viewing range from its access zone is broad, yet vegetation, undergrowth, or forests can sometimes hinder visibility to and from the shelter. Its territorial layout keeps it away from movement zones and strategic spaces.

- The number of motifs found in these shelters is limited.

- These are depicted on a small number of panels with few figures that are positioned in visible areas inside the rock art shelter.
- When someone arrives or enters this form of rock art shelter, they should be able to recognize the presence of themes.
- The technique applied is not very diverse. Figures are typically created using a regular thick stroke and the same sort of pigment, primarily red.
- Iconography is also simple, consisting primarily of schematic motifs (circles, zigzags, angles, branch forms, spirals, dots, and so on). Human or animal figures appear rarely.
- The lack of figurative superposition and aesthetic consistency suggest a sporadic use of these places.
- Thus, its presence in the territory can be linked to sporadic or circumstantial control over some basic resources that are always located in the immediate vicinity of these shelters, essentials for survival in these mountain zones: water sources, hunting, and even the shelters themselves.

Figure 6: (Badajoz) (© Collado Giraldo 2016)

Movement shelters: This sort of shelter is obviously associated with key locations linked to territorial transit, either along the courses of rivers and streams, or near to mountain passes, fords, or hills, which facilitate connection through mountain lines. Its size varies, as does its visibility range, which should be medium or high, especially for those who

inhabit higher zones. However, those located in incised gullies and/or slotted river banks have a decreased view range. They fit into the B and C shelter categories morphologically, but the second clearly outnumbers the first. Access to these shelters is frequently not difficult, unless when they are coupled with inaccessible locations in incised gullies. where there are shelters that are hanging over the brink, where the access is impossible without climbing equipment.

- Technically, there aren't many differences between this group and the previous one: linear strokes and dots are common motifs in these shelters.
- The thick ones predominate, while there are certain patterns painted with delicate strokes (which are more common in this group than in "indication sites"), as well as the employment of only one type of pigment (mostly red).
- Figurative superimpositions are sparse, and the iconography is rather diversified, yet, unlike the previous group, several themes are systematically repeated, particularly alignments of vertical strokes.
- Anthropomorphic motifs and zoomorphic figures are frequently depicted alongside symbolic motifs.
- The compositional outlines range from simple vertical stroke alignments to more complicated ones that are clearly structured and hierarchical representations with the human figure frequently featured.
- Simultaneously, linked figure models are replicated in identical geographical regions.
- One of them appears to be extremely meaningful, connecting a circular or square pattern with a zoomorphic theme (typically with a comb-shaped figure).
- This relationship is extensively recorded in shelters linked with traffic areas, particularly mountain passes and slopes.
- Although they are exclusively employed on the most visible surfaces from the outside, even at significant distances, the topographic distribution of panels in these types of shelters has a decidedly public quality.
- Given that these shelters are clearly linked to communication routes, we could consider them to be genuine landscape marks, indicator signals in mountain passes or tracks associated with minor riverbeds that allowed access to level zones with abundant grazing land, ideal for ranching cabin settlement during seasonal movements.

Figure 7: Friso del Terror. Monfragüe National Park (Cáceres) (© Collado Giraldo 2016).

Intimacy sites: This is the smallest group, and the kinds D and E shelters in the preceding classification are the most prevalent from a morphological standpoint. In general, these places are unsuitable for use as shelters since they are so small that a person can barely squeeze inside. Their visual range is always much decreased, and they may go unnoticed in the surrounding terrain. These sites do not normally include many figurines, which are invariably placed on panels in inconspicuous locations. To examine them, it is important to search carefully on every available surface and even adopt forced poses. The figures were created using a variety of approaches**,** using thick or thin strokes and combinations of both too.

- Figures are filled with solid color (often red, but black and white also exist), and bi-chrome figures (red and black or red and white) are occasionally represented.
- The iconography seen in these shelters is also unique.
- Zoomorphic representations are uncommon; nonetheless, anthropomorphic forms and schematic motifs (particularly sun-shaped figures, bars, and dots) are common.
- Furthermore, there are some unique depictions that do not fit into any accepted typological group.

- Typological relationships have not been fully established, nor have criteria for panel compositions been defined, which typically include a small number of graphemes and make it difficult to detect pictures superimposed.
- In terms of interpretation, we believe that these are extremely precise locations used at very specific times.
- They are often employed in a customized manner and for purposes unrelated to routine living, but rather tied to ritual and magic.
- These could represent points of communication between humans and the supernatural world, with symbolic depictions being an integral aspect of the ritual.

Figure 8: Límite Shelter, Monfragüe (Cáceres) (© Collado Giraldo 2016).

2.2 Painting Techniques and Colour Pigments

According to Perello (1993), Collado (2006), and Garcia (2018) the schematic representations are distinguished by their formal simplification, which is achieved using simple liner strokes that are generally monochromatic and in flat ink. The motifs are

simplified to their core characteristics, often to the point of utter abstraction. The fingers are painted with either strong linear strokes produced directly with the fingertip or delicate strokes made with little brushes made of hair, feathers, or vegetable fibres. The thick stroke is sometimes combined to create the basic figure while the fine stroke is used to add details through more painstaking execution.

The most frequent colour is red, which is obtained from mineral pigments pulverized from iron oxides, limonite, hematite, or ochre and agglutinated with water or some fatty or resinous materials. Black designs constructed with manganese oxide are present in lower proportions, as are white motifs based on calcites or local soil heaps. Figures combining these colors have also been discovered, despite their rarity (Perello 1993 & Collado et al. 2006). The research on pigment analysis from all over the Iberian Peninsula gave scientific insight into pigment used in schematic paintings (Garcês et al.2022) (for example, Gomes et al. 2015; Gomes et al. 2013; Gomes et al. 2022).

2.3 Typologies of Schematic Art

Historically, schematic paintings were thought to be solitary figures that did not form scenes or compositions and lacked dynamics and perspective (Perello 1993, 1999; Garcia 2018) and the depictions are distinguished by their formal simplification, which is achieved using basic linear strokes in monochromatic and flat ink. The motifs are reduced to their fundamental elements, sometimes to absolute abstraction. The diverse variety of schematic figurations contains familiar motifs such as human figures, animals, weapons, or other things, as well as a vast number of abstract figurations that are symbolic and geometric in character, making them difficult to decipher today (Collado et al 2006).

The typology of Schematic Art is Characterised by three stages: (Collado, 2016)

1st stage: Ancient schematic rock art. This stage represents mainly dots, lines, and sun figures.

2nd stage: medium schematic rock art. In this stage it maintains the preceding iconographic foundation while adding a new figurative repertory that dramatically varies the percentage of portrayals, giving prominent significance to human and animal characters in contrast to the symbolism of the previous stage. The scenography of the panels, as well as the novel territorial layout of the shelters, reveal a significant thematic complexity. This distribution prioritizes rock art shelter areas associated with critical locations for territory control and communication lines.

3rd stage: recent schematic rock art. It retains thematic, scenographic, and typology criteria from the middle stage, as well as the proclivity to locate in advantageous locations.

Only the items with an ethnic character obviously associated with the Bronze Age (weapons, horned helmets, chariots, etc.) allow us to attribute themes to this final era.

Martinez Perello (1993), Collado Giraldo (2006, 2015,2016) Martinez Garcia (2018) and Andria Martins (2021) described the typology of the schematic rock art in the same sequences, that have been taken here to explain the typology:

- *Bars (lines):* First and foremost, the most common kind in the majority of the Iberian Peninsula's cave and rock shelters. They are typically vertical and comprise many units. Although they can be found horizontally, in pairs, or even alone. Their measurements are approximately 10cm long and 1 to 2 cm wide, while there are cases with considerably smaller bars and some that are up to 42.5 cm long. The most common association is that of bar-bar, which forms groups. Given the closeness of some of these bars to anthropomorphic silhouettes, these assemblages most likely have an enumerative nature and, on occasion, could be schematizations of human beings. They are related to stilliform, coliforms, tectiforms, ramiform, pectin forms, and anthropomorphic. The association bar-deer is also added in Las Moriscas.

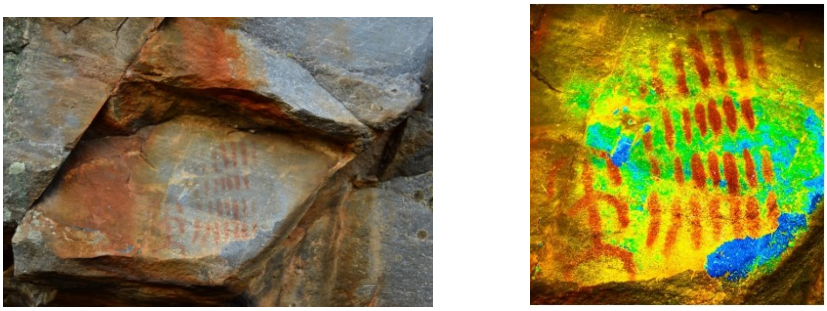


Figure 9: Vertically arranged bars associated with anthropomorphic motif. (Lapa dos Galvos, Portugal. © Andrea Martins 2021)

- **Dots**: Dots or digitations are the second most common form. Most of the time, they are produced with the fingertips, and their measurements are usually approximately 1x1 cm. Dots are frequently related to bars and other dots forming linear groups; they are also associated with circles, tectiforms, and sun-shape figures, being drawn inside them as a single central point or totally filling them. Placed as occulted idols on the lines that symbolize the shoulders or under the lines that correspond to the upper

extremities or the superciliary arches, depending on whether they are interpreted as female figures representing breasts or as occulted idols.

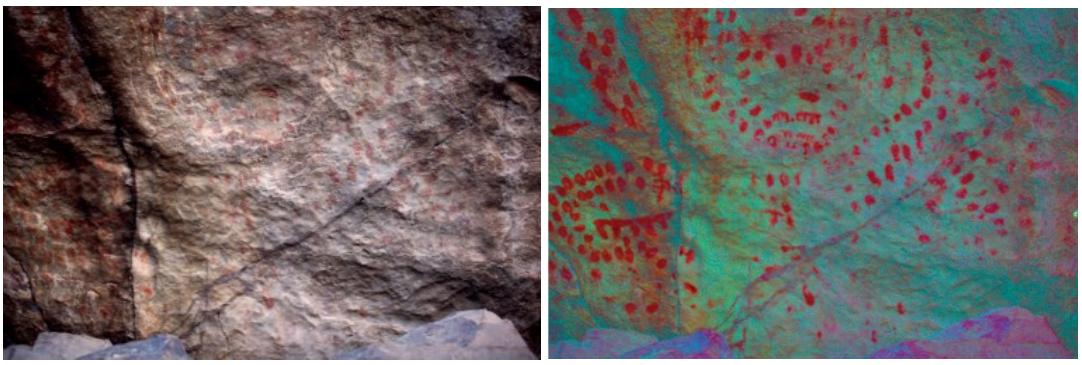


Figure 10: Dots from the shelter of La Calderita, left one is original, right one digital tracing in D Stretch® (Collado 2017)

- **Anthropomorphic:** Anthropomorphic motifs are portrayed in a wide range of typologies. In addition to the bars and anthropomorphized branches, there are schematic images of human people with "arched arms" or swallows. Associated with two points, which would signify the breasts, swallowing breasts, or eyeballs. Anchor form, cruciform, T- shaped type, Greek Y, sometimes known as the one with raised arms in a praying position. The figures with arms in a handle or in “phi”. There are pictorial representations of anthropomorphic characters made up of one or two triangular, Acosta mentioned uni-triangular and bi-triangular idols.

Figure 11:Dots from the shelter of La Calderita, left one is original, right one digital tracing in D Stretch® (Collado 2017)

- **Ramiform***:* The figure of the ramiform type is very frequent in this area, as for their interpretation, these motifs have a polysemic meaning, as they can be taken as palynomorphs, anthropoid-morphs, or as an abstraction of deer antlers. In some cases, it is more feasible to opt for one or the other interpretation, as in the case of the ramiform associated with the zoomorphic of the pectiniform type, which seems to be an anthropomorphic together with several quadrupeds, or as in the case of two ramiform inscribed in asoliform figure. The most numerous associations are ramiform bars, ramiform-ramiform, ramiform-point, ramiform-pectiniform, ramiform-me-stilliform, and ramiform-serpentiform. There is a variant of this type, that of the ramiform inscribed in circles, oval shapes, and rectangles.

Figure 12: Ramiform motif from La Calderita , left one is original, right one digital tracing in DStretch® (Collado 2017)

- **Zoomorphic**: Zoomorphic figures have a great degree of abstraction, making it impossible to identify their species. Their portrayal in the pectiniform shape is the most common. Pectiniform-pectiniform, pectiniform, me-anthropomorphic, and pectiniform-branch morphologies are the most common associations. The "pi" motifs follow this group and differ from the pectiniform motifs in that the horizontal line only joins two vertical lines, whereas the pectiniform motifs join three or more., "pi" are zoomorphic abstractions; perhaps they are human representations of couples or houses. Serpentiform motifs- These include both zoomorphic representations and zigzagging lines or on-dants whose animals are not known.

Figure 13:: Zoomorphic motif from La Calderita , left one is original, right one digital tracing in DStretch® (Collado 2017)

- **Tectiforms or Structures:** Structures are another form of system reflected in this set of rock stations. It appears in all the peninsular schematic art. Other observed correlations include tectiform-sun-shapes-bars, tectiform-bars, and tectiform-anthropomorphic.

Figure 14:Tectiform motif from La Calderita , left one is type 1, right one type 2 (Collado 2017)

- **Petroglyph ides:** Circles and other petroglyphoid forms, as well as stelliform and soliformes, are highly typical motifs of schematic rock painting, although their concentration in specific shelters or on specific hills is remarkable in certain shelters or on specific peaks. As petroglyph themes, consider the wheel-like shapes mentioned below, which are occasionally described below and sometimes coupled with dots.
- **Stilliform:** The circle where the vertical lines begin is filled with dots, and a single central dot is drawn, which is crossed vertically by a central line, making a hybrid figure between the stelliform and the phi figures. The stelliform and the figure in "phi" are either used, or the field is left blank. In terms of its relationship with other themes

- **Escaleriforms**: It is their interpretation that is tricky, especially when we consider that in most cases, these forms appear alone, with no obvious tie to any other pattern. And when they are connected, they appear alongside tectiforms and chariot images. They should most likely be regarded as constructions, traps, palisades, scales, etc.
- **Carts***:* They are rectangular frame carriages with beams connected by crossbeams and two or four wheels with three or four spokes, albeit one is seen closed at the front and with a curved shape.

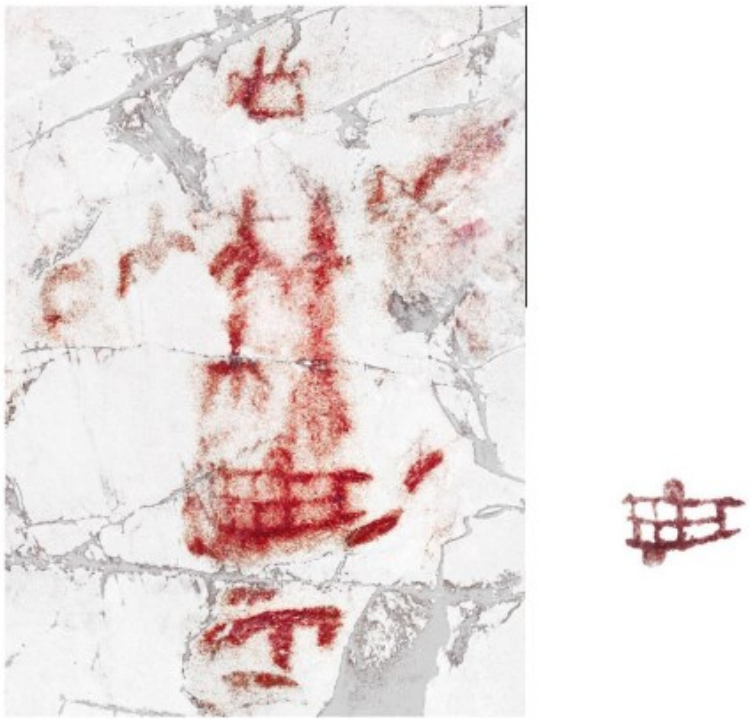


Figure 15:Cart (right). in the shelter of El Covacho (Collado 2015).

- **Wheel**: As part of the carts and wagons, we can view such circular figures with a cruciform motif etched in their interiors as representations akin to wheels.
- **Sleigh**: Sleds or narrias are related to tectiforms, chariots, and scaleriforms.
- These are known as sleds or narrias. These motifs could symbolize any form of structure or construction; therefore, they do not have to be interpreted as genuine sleds.
- **Indeterminate***:* Finally, there is the uncertain group, which contains all of the figures of weird shape and impossible attribution, as well as all of the uneven paint streaks. These uncertain forms, in most situations, correspond to motifs of motifs that are absent or very incomplete.

Thematic analysis: Despite the poor preservation of the figures, the fragmentary state of the panels, and the absolute schematization and abstraction of the motifs and sets, it is possible to determine the presence of some social, warlike religious-ritual, and economic activities of the groups that made these. In a nutshell, we can distinguish between scenarios: such as…

- *Domestication*: Those in which the use of automobiles demonstrates the use of hunting animals, most likely ox

- *Agriculture*: several bi-triangular figures associated with certain instruments of agricultural aspect -a sickle, a trident- and zigzag, agricultural instruments a sickle, a trident- and zigzag lines that could be identified with water.

- *Warlike or hunting:* a human figure of an archer launching his arrow towards a group of anthropomorphized bars, which could represent his foes.

- *Sexual*: pairs of figures with which a close link appears to be developed, which could be sexual in nature.

- *Ritual dances:* a collection of anthropomorphized bitriangular and unitriangular figures, with their arms up in a praying position and very near to each other as if engaged in some type of ritual dance.

- Furthermore, the representations of idols reflect a little fraction of what must have been their spiritual universe.

-The spiritual world in idol representations, (they give the cruciform this character).

- Likewise, details of their clothing are also observable, such as:

-Headdress with plume, Headdress with feathers, Skirts, Ornaments on shoulders and elbows.

Figure 16: Bitriangular anthropomorphic groupings, (it comes under thematic analysis) digital tracing in DStretch® LRE (Collado 2017)

Schematic art also appears in the form of engravings. The best sites for both context and geography related to engraved schematic art are the rock art complexes of the Tagus (Gomes, 2010; Garcês, 2017) and Guadiana rivers (Collado, 2006; Baptista and Santos, 2013). The typologies, chronologies and spatial distribution show many similarities with painted contexts.

Figure 17: Examples of stelae with anthropomorphic figures with swards at their waist: A)Magacela Stele (on display at the National Archaeology Museum in Madrid); B) Zarza Montanchez; C) Benquerencia; D) Cabeza de Buey2; E) Capella 2; F) Capilla 4; G) Capilla 8; I) Chillon; J) Cogolludo; K) El Viso 2; L) El Viso 3; M) El Viso 4; N) Ervidel 2; O) Bienvenida 1; P) Montemayor; Q) Orellana; R) Valdetorres 1; S) Monte Blanco Olivenza; T) Torres Alocaz; U) Setefilla; V) Zarza Capilla 1 (figuras adaptadas de Díaz-Guardamino Uribe, 2010) (Garcês, 2017).

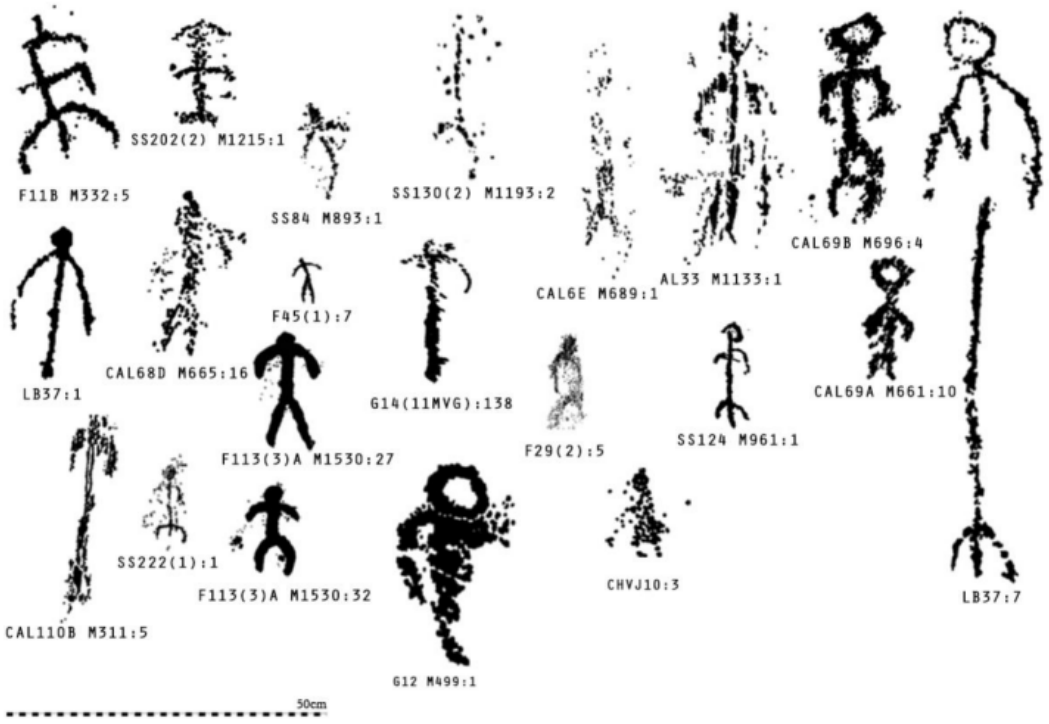


Figure 18:Example of schematic engraved anthropomorphs with curved arms from the Tagus Valley (Garcês 2017)

2.4 Distribution of Schematic rock art

Schematic art, specifically on the Iberian Peninsula, is one of the many ways of visual expression and cultural expressions of the human populations who lived throughout Recent Prehistory. It is defined as a cultural phenomenon widespread in the Iberian Peninsula and other areas in its immediate surroundings, characterized by the representation on natural rocky surfaces of a series of typified figures "understood representations of a thing attending only to its most significant lines." (Hernández Pérez, 2006).

Martins (2021) gave a brief insight into the distribution of Schematic art in Portugal and explained its technical, morphological, and chronologically distinct creative tradition that exists throughout the Iberian Peninsula. It is concentrated in the Serra Morena's central mountain ranges and the Tagus, Guadiana, Guadalquivir, and Douro valleys, but it also appears in the Cantabrian belt, the Meseta Norte, and the entire Levantine area.

Motifs can appear both in paintings or engravings, in an array of locations such as open-air rock panels (vertical and horizontal), semi-protected rock shelters, or even inside

cavities, reflecting prehistoric communities' options for anthropizing the landscape (Martins, 2016).

On the other hand, Collado (2016) explains schematic rock art research in the Iberian Peninsula has a long tradition, indicating towards Extremadura region, southwestern Spain, next to the Portuguese frontier, having more than a hundred years of research history.

For more than twenty years, Collado and team have focused on research of Schematic rock art in this Extremadura region and it has resulted in more than five hundred new sites of schematic paintings or engravings. In the Andalusia region, they have documented the groups of shelters, and those are the most important concentration of post-palaeolithic rock art in the Iberian Peninsula. (e.g., Collado et al. 1995,1997, 2005, 2009, 2010, 2013, 2015).

3 Materials and Methods

Documenting a site, its motifs, and the surrounding environment is vital to rock art research. For decades, researchers have sought systematic approaches to reliably record these components (for an overview, see, for example, Bednarik 2007; Sanz 2014; Loendorf 2001; Clogg. et al. 2000; Mark et al. 2002; Simpson et al.2004; El-Hakim et al.2004; Chandler et al. 2005; Barnett. 2005; Trink.et al.2005; Mark et al 2006; Gonzalez. et al.2006; Mudge. et al 2006; fritz. et al.2007; Gonzalez. et al. 2009; Hesse .2010).

These efforts have resulted in an extensive body of literature (Cassen. et al 2010; Sheker. et al.2010; Sanz. et al. 2010; Art. et al. 2011; Cardenal. et al.2011; Gonzalez. et al.2011; Štular. et al.2012 Plets. et al.2012; Mudge. et al.2012; Antón. et al. 2012; Domingo. et al.2013; Pereira. et al. 2013; Hameeuw. et al.2014; Defrasne. 2014; Lerma. et al. 2014; Ruiz. et al. 2014; Lymer. 2015; Quellec. et al. 2015; Cerrillo. et al.2015; Noya. et al.2015;). relating to the many techniques and strategies accessible to the researcher in their quest to compile as close to a complete, record of a rock art site as feasible (Brady et al.2017).

Domingo (2014, 2015) emphasizes that along with documentation of rock art, it is essential to monitor the deterioration processes influencing rock art assemblages in the short, medium, and long term; trace down for more objective and accurate analysis, for motif recognition and metric reproduction of motifs and the rock surface; and speed up

the rock art recording procedure. Furthermore, computer improvement approaches enable researchers to record, evaluate, and publish severely damaged images that would have gone undiscovered using traditional procedures (for example, David et al., 2001, David, 2004, Pies. et al.2014; Vazquez. et al. 2015, 2016, 2017; Ortega. et al.2016; McDonald.2016; Davis. et al.2017; Fernández. et al.2017; Carrero. et al. 2017, 2018; Hollmann. 2018; Monna. et al 2018; Peña. et al.2019; Ruiz. 2019; Horn.et al. 2019; Cerrillo. et al. 2019; Quesada. et al.2019; Ovidia. et al 2020; Fuentes. et al.2020.

Brady (2017) explained very well when we use the term "context" many aspects can be documented, although, it is not feasible to document each element of a site and its surroundings. Notably, he emphasizes Whitley's (2011:16) suggestion to consider the places with rock art as archeological sites that are part of broader archaeological landscapes, it necessitates a given site is not isolated from its larger geographical context, allowing researchers to gain a greater understanding of the rock art's link to other landscape elements, such as Middens, ceremonial sites, settlements, and so on. While drawing additional attention to this point, he also emphasizes the need to acknowledge that rock art sites are not exclusively of or in the archaeological realm.

3.1 Damaging the Record

Before the documentation, we should know about the causes and prevention of damaging rock art, here we are pointing out some factors, for more details (see Bednarik 2007;99-104, Loendrof 2001;55-58). The growing awareness of the negative consequences that some earlier recording tactics had on rock art has compelled researchers to reevaluate their methods. It is now widely understood that when recording rock art, noninvasive methods must be preferred. The following are the most common types of damage that recorders have been known to inflict on rock art (Brady al. 2017).

Below mentioned list below not only exposes the numerous ways to harm rock art, but it also requires researchers to constantly watch and be conscious of their impact(s) on a site and its motifs while recording. However, because some publications have incorrectly championed some of these now-discredited methods in the past, unskilled rock art recorders must seek counsel before commencing a new recording project and study the literature with caution.

- Rubbing engraved surfaces with different substances (such as wax or graphite) through muslin.
- Cleaning' the painted rock face (e.g., scrubbing with rough instruments)
- Removing the lawn or grass, moss, insect nests, and other obscuring elements.
- Outlining or infilling engravings (and, less frequently, paintings) using various materials (e.g., chalk, paint, crayon).
- Engravings are cast in latex.
- Tracing art surfaces with marking pens over tracing films, causes damage to both the rock surface and the art.
- Wetting paintings or engravings on rock surfaces with water to enhance the art's visibility.

Methods used for document the site context:

- We located the Site using GPS, containing grid coordinates, equipment details, and location of the recording at the site.
- We used a compass bearing for the appearance of the site and panels.
- Measured the Rock shelter, and panels with their length, width (parallel to the dripline) height (maximum height from floor to ceiling), and depth (perpendicular to dripline) for topographic record.
- We draw the plan views and cross-sections, showing the position of decorative panels and other characteristics on graph paper for topographic records.
- We took the description of a site and its surrounding environment, such as describing geological aspects, major natural features, natural and anthropic damage to the site, the motifs, and the environmental setting.
- Cultural details about the site, understanding the culture of the site that belongs to indigenous people or, nonindigenous context.
- Taken the photographs of shelter, panels, and landscape, (see our field sheet for more information).

3.2 Field Sheet

When creating recording forms (field sheets), we should adhere to guidelines established by organizations such as the International Committee for Documentation (CIDOC) and their International Core Data Standard for Archaeological and Architectural Heritage,

whereas others prefer to base their forms on those used by their home institutions or by colleagues. Individual researchers frequently build their forms to fulfill the needs of their research issues. A crucial consideration is whether the data generated will be compatible with regional, national, or international databases, or, at the absolute least, with the database one wishes to use when the project's recording stage is completed (Brady et al.2017).

The 'fields' in a recording form have the potential to be endless, and the fields that we choose for our form should be dictated by the region(s) in which we work and the types of questions we wish to answer. In no order, the following fields are typically included in our recording forms:

- Name of the recorder (s) as well as the date and time of the recording session.
- Site code, an individual code that is specific to the site in question. (e.g the shelter I, II)
- Site name, and if appropriate, alternate site names.
- Site type, whether it is a cave, rock shelter, boulder, or platform.
- Number of panels in that shelter.
- Sketch or photo number, used to associate notes with the appropriate sketch or photograph.
- Location, for example, GPS coordinates, height, accessibility, visibility, distance from the top or bottom of a slope,' and distance from other decorated panels, locations, or important geological features.
- Inclination, the direction that the decorated panel is facing.
- Measurement of the panel.
- Identifying the geological substrate of the shelter and panel.
- Technique(s) whether it is a painting or engraving.
- The number of motifs and subject matter (or motif, element, or figure) defined, with or without additional attributes.
- Colors utilized for pigment-based themes (e.g., red, yellow; monochrome, bichrome, polychrome) and their shades.
- Maximum painting width and height (plus engraving depth, e.g., shallow, medium, deep).
- Overlays or superimpositions.

- Image juxtaposition, including so-called scenes composed of separate 'pictorial units' this field may include information on natural stains, forms, and rock cracks/fissures.
- The panel's and motifs' state of preservation (e.g., good, medium, poor), as well as facts about threats to the site's preservation.
- Relative patination of engravings (for example, using a scale of 1-5, with 1 being extensively patinated and 5 being unpatinated and seeming fresh).
- Archaeological remnants discovered on the site's surface (e.g., lithics, faunal remains, charcoal, shell material, metal) and whether subsurface deposits are known to exist.
- Other comments (a potentially big section for freehand notes, doodles, and so on.
- If possible, identify the 'style" (Brady et al.2017).
- Sketches of the panel.

Table 1: Field Sheet Format.

<table>
<tr><td colspan="2" rowspan="3">Name of Rock Shelter:</td><td rowspan="3">Coordinates</td><td colspan="4">X:</td></tr>
<tr><td colspan="4">Y:</td></tr>
<tr><td colspan="4">Z:</td></tr>
<tr><td colspan="2" rowspan="5">Municipality:</td><td rowspan="5">Type of rock shelter:</td><td colspan="4">Cave:</td></tr>
<tr><td colspan="4">Shelter:</td></tr>
<tr><td colspan="4">Vertically inclined wall:</td></tr>
<tr><td colspan="4">Small room:</td></tr>
<tr><td colspan="4">Dihedral Vertical walls:</td></tr>
<tr><td colspan="2" rowspan="3">Mountain:</td><td rowspan="3">Dimension:</td><td colspan="4">Length:</td></tr>
<tr><td colspan="4">Height:</td></tr>
<tr><td colspan="4">Depth:</td></tr>
<tr><td rowspan="3">Rock shelter visible</td><td>Entrance:</td><td rowspan="3">Intervisible with:</td><td>Shelters</td><td></td><td colspan="2">General Orientation:</td></tr>
<tr><td>Medium:</td><td>Villages</td><td></td><td colspan="2">Open HACIA</td></tr>
<tr><td>Far:</td><td colspan="4"></td></tr>
<tr><td colspan="3" rowspan="14">Panel sketches</td><td colspan="5">Visibility from the shelter</td></tr>
<tr><td colspan="3">Large:</td><td colspan="2"></td></tr>
<tr><td colspan="3">Medium:</td><td colspan="2"></td></tr>
<tr><td colspan="3">Reduced:</td><td colspan="2"></td></tr>
<tr><td rowspan="5">Panel no.</td><td colspan="2">Color</td><td colspan="2"></td></tr>
<tr><td colspan="2">Orientation:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Clino:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Altitude:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Anch (width):</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">Alt Suelo:</td><td colspan="2"></td></tr>
<tr><td colspan="3">Conservation</td><td colspan="2">Factor/ cause:</td></tr>
<tr><td>Good</td><td></td><td colspan="2" rowspan="3"></td></tr>
<tr><td>Regular</td><td></td></tr>
<tr><td>Bad</td><td></td></tr>
<tr><td colspan="5">Localization of the panel</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5">Number of figures</td></tr>
</table>

	Type:		Anthropomorphic:
			Zoomorphic:
			Schematic:
	Color/es		
	Superposition		Yes No
	Conservation		Cause
	Good:		
	Regular:		
	Bad:		

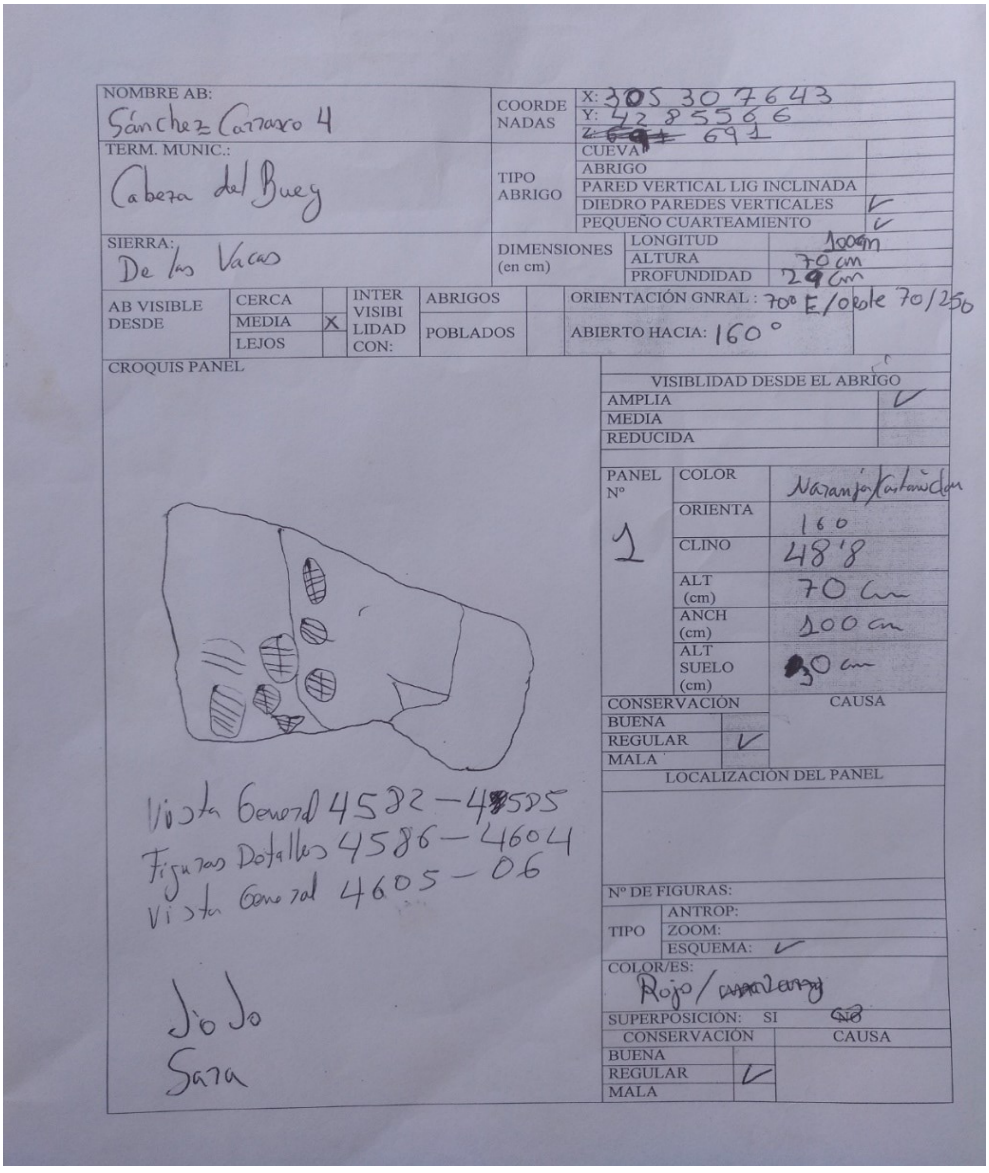


Figure 19: Field sheet filled with details from the Sanchez Carrasco IV, (© Hipólito Collado Giraldo, 2023).

3.3 Topographic record

Due to the fact of Nemours of site types where rack art can be found (e.g., rock shelter, cave, exposed boulder, pavement/ platform), a measuring and mapping program will be required for customized locations (Brady et al.2017). Here we measured shelters with their height and depth (perpendicular to the ground), width (Parallel to the dripline), and height (maximum height from floor to ceiling) using measuring tape, laser Range Finder Measuring tape, and compass to check the north direction. We draw the plan view and cross-sections, with decorated panels and other features, on graph paper.

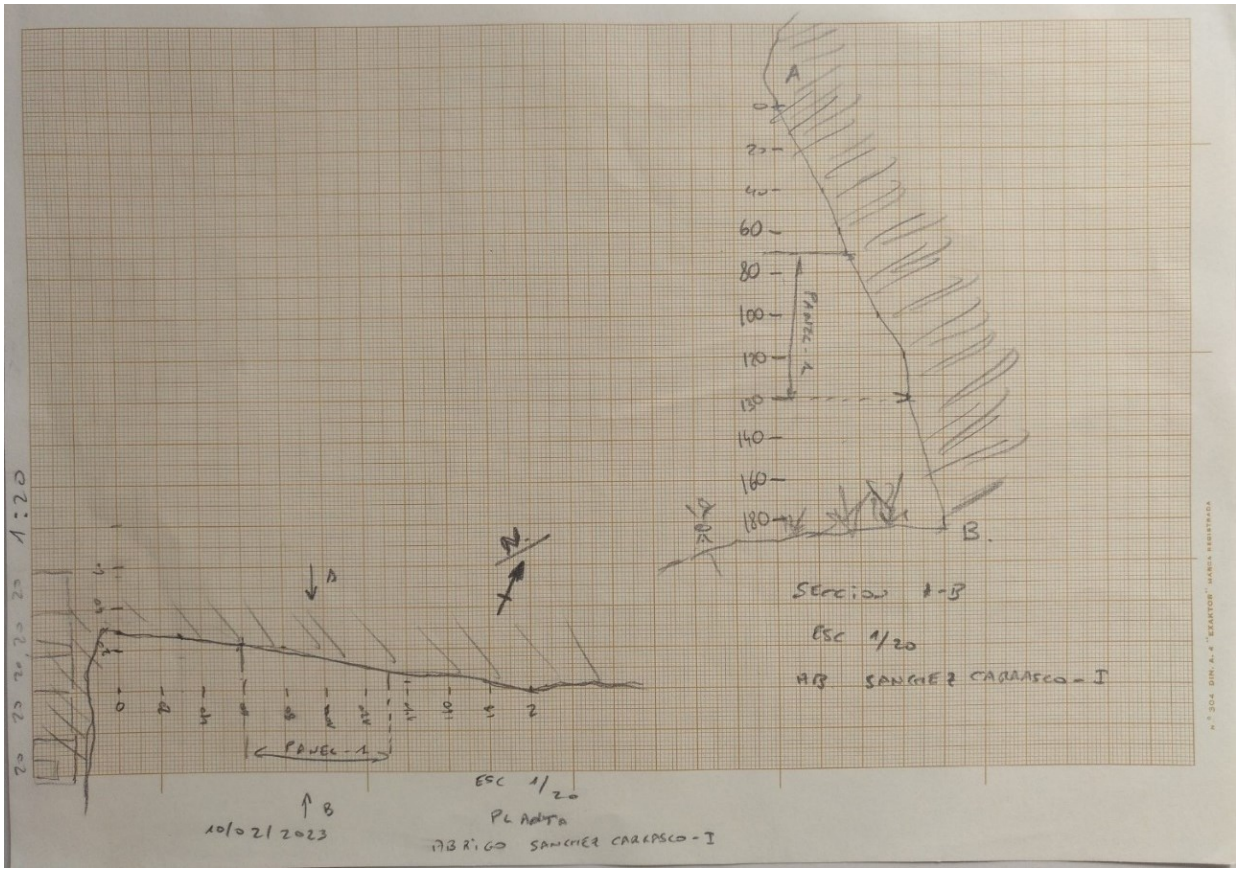


Figure 20: Graph sheet from the rock shelter Sanchez Carrasco I. (© Hipólito Collado Giraldo, 2023).

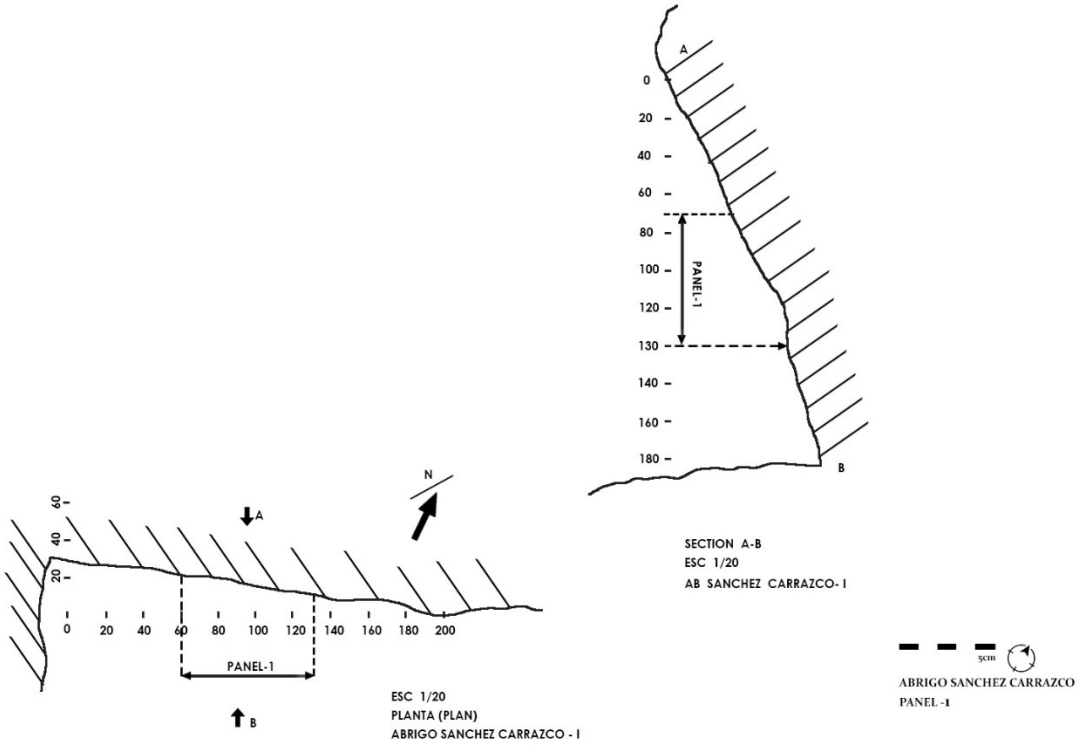


Figure 21: Drawing on the graph paper traced in Adobe Photoshop®.

3.4 Photography

Domingo (2014), elaborates on the requirement for more accurate formal and metric documents than are obtained from hand drawings. These hand drawings, watercolors, and pastels created by researchers, artists, and illustrators such as Breuil, Porcar, Cabre and Benitez-Mellado, to name a few, were used as evidence of early twentieth-century discoveries. She explains how these preliminary hand sketch of the panels, including the location and numbering of all remaining motifs, provides a good first grasp of how the panel operates. This first technique is required to plan the site's systematic recording.

Continuous breakthroughs in research and a desire to address new issues arising from the study of rock art The outcomes gradually improved when new improvements were introduced. These novel methods are divided into two groups: direct recording methods and indirect recording methods.

Direct method (direct tracing or contact tracing): This approach entails laying transparent paper on the decorative surface tracing motifs with a permanent ink pen, and rubbing engravings using carbon paper on top of thin paper placed on an engraved surface to obtain a production of the engraving. However, this method is one of the major drawbacks

of this technology is the direct influence on the fragile rock surfaces and motifs, which may hasten the disintegration processes.

The Indirect method (Tracing produced using a frame): Apart from analog and digital photography, indirect recording methods include several tracing approaches, Tracing on analog images entails tracing the motifs on transparent paper that is placed directly on the photograph. The use of orthogonal pictures, digitally calibrated cameras, and appropriate software, a wide range of equipment, programs, and techniques for capturing, retouching, processing, and graphic and metric rectification of 2-D images (photoshop, GIMP, ImageJ, rdf, etc) as well as high-resolution and precision 3-D restitution (digital photogrammetry, 3-D laser scanner) to correct metric distortion lowers camera distortion and the transformation of 3D into 2D surfaces (Domingo et al. 2013, 2014).

Most rock art researchers now use digital cameras for a variety of reasons, including fewer restrictions on the number of photographs taken, the production of high-resolution imagery, the ease of uploading images to databases, and the ease of stitching photographs together to create panoramas. Tablets with pre-populated recording forms are utilized in conjunction with high-resolution in-built cameras in several large-scale recording projects in northern Australia (e.g., Wellington Range, Kimberley), offering the possibility of avoiding the need to bring bulky, expensive equipment into the field. In some cases, drones and kites are employed to capture aerial images of sites and motifs, providing researchers with drastically different perspectives than normal photographic approaches. While there are numerous ways available for researchers to apply techniques when photographing rock art, there are some simple but crucial elements that can help to ensure that images of motifs are effectively performed (Brady et al.2017).

- To reduce distortion, align the camera lens at a 90-degree angle to the rockface.
- When necessary, we should use a tripod (or unipod) to eliminate camera shake and ensure sharp photos.
- If required polarizing filters should use.
- Scales should be correctly positioned, and color swabs should be used to facilitate future calibrations. It is important to note that scales should never be affixed to the wall since residues such as sticky tape or 'blue tack' can negatively impact subsequent rock surface studies.

- Consider lighting carefully, and attempt to ensure that the light on the panel is homogeneous (e.g., if necessary, bounce in natural light using a reflector disc or utilize artificial light obliquely, particularly when shooting engravings).
- Return to the site in different weather conditions, times of day, and seasons if possible; previously overlooked details may suddenly become obvious (e.g., by returning at night and recording faint engravings with artificial sidelights).

The camera CANON EOS 6D MARK IID and lens CANON EF 24/105 (installed DStretch®) was used to document the rock art shelters, for better understanding of the site context, we took photographs of i) Landscape, ii) Shelter, iii) Panel, iv) Macro photography. Used a tripod to avoid movement or camara shake and for crisp images. Uusually, it is recommended to save the shot in RAW format since it can be exported to TIFF, and both formats are a type of file with a larger amount of information that can later be modified with programs such as Adobe Camera RAW or Adobe Lightroom.

Figure 22: used color checker, tripod, and scaling for photography. (© Seema Rehaman, 2023).

Figure 23: used color checker, tripod, and scaling for photography. (© Seema Rehaman, 2023).

3.5 X-Rite Color Checker®

One of the most significant tasks in rock art documentation is color description. Color plays an obvious function in pictographs, as it is a primary palpable aspect that is balanced with morphology or the distribution of figures in a panel. The early years of the digital age witnessed the introduction of personal computers and visual editing software, which were quickly used for the capturing of archaic pictures. Robert Bednarik created the IFRAO Standard Scale (Bednarik, 1994; Bednarik and Seshadri, 1995) in the early 1990s to become the standard reference for calibrating rock art images. Despite its shortcomings, this chart has established a global de facto standard, not only for rock art but also for other archaeological subjects. In contrast to color rendition charts such as X-Rite ColorChecker or QPcard 203, the IFRAO scale lacks any published colorimetric references that may be utilized for correct color rendition.

Historically, the technique for describing colors in rock art has been restricted to arbitrary naming based on the researcher's criteria, who, after naked eye observations, created phrases such as "wine-colored red," "deep red," "blueish brown," and so on. Color recording in Iberian Peninsula post-Palaeolithic rock art is a good example of these issues. This erroneous system was utilized by researchers such as Breuil and Obermaier, and later

by Ripoll and Beltrán. They even classified graphic levels based mostly on their color descriptions (Breuil, 1920).

By the early 1980s, authors such as Piñón, Viñas, and Hernández had recognized the unreliability of these approaches and began to argue that light and humidity conditions should be considered to accurately register color (Pión, 1982). At the same time, they recommended using established color charts as references, these researchers attempted to limit subjectivity by using standard charts, but their color descriptors were influenced by the obvious difficulties in adopting controlled and reproducible observation circumstances. Gerharz et al. (1988) examined the difficulties associated with the usage of this form of chart in archaeology. In truth, even in the controlled atmosphere of a museum, recording, and replication of color is a very hard affair (Ruiz 2014).

3.6 Rough scale

To have better documentation, a rough scale measuring 5 cm was used along with details of the panel.

Figure 24: The Rough scale was used for photography. (© Hipólito Collado Giraldo, 2023).

3.7 **3D Modeling:**

Photogrammetry was used to build aerial cartographies that were useful for military aviation at the beginning of the nineteenth century. The Frenchman Aime Laussedat, who made his engineering experience in generating topographic surveys available to the French army, was a driving force behind its creation. Following that, Albrecht Meydenbauer employed it to photograph iconic structures and monuments (Cheli, 2011: 15-16) to preserve a reliable copy in case they were destroyed. Many scholars devoted themselves to the development of this approach from that point forward, which reached a tipping point in the 1990s when it became a part of the digital era. (Gonzalez et al. 2019).

Lerma (2013), gave proper insight into photogrammetry, and it is widely regarded as one of the most successful indirect approaches for measuring and reconstructing 3D objects from a single, two, or numerous photographs (Lerma, 2010). Bohler (2006), and Jones (2011) categorize recording approaches into two broad categories: direct and indirect, and describe the best scale and performance dependent on the complexity and size of the object. Photogrammetry, either alone or in conjunction with laser scanning (Lerma et al, 2010, 2011), is regarded as an ideal in-direct technique for cultural heritage documentation, regardless of survey scale or platform static/mobile, terrestrial/aerial/underwater/underground used to acquire the images.

We applied "Agisoft PhotoScan," a program with very fast calculation speeds that is widely used in the archaeological research sector due to the simplicity of the different options it offers, the automation of the process, and the quality of the results obtained, was used to create the 3-D model (Charquero, 2016: 141) (Gonzalez et al. 2019).

3.7.1 Photogrammetry workflow:

Photogrammetry is the technique of recording, measuring, and analyzing photographic images and patterns of electromagnetic radiant radiation and other phenomena to gather trustworthy information about physical objects and the environment (Lerma 2013). "Agisoft Photoscan Pro®," a program with very fast calculation speeds that is widely used in the archaeological research sector due to the simplicity of the different options it offers, the automation of the process, and the quality of the results obtained, was used to create the 3-D model (Charquero, 2016: 141) (Gonzalez et al. 2019).

3.7.2 Data collection:

We have taken the photographs using CANON EOS 6D MARK IID and lens CANON EF 24/105 in a RAW format, and it is ideal to take the shots in a circle around the object, one after the other. Begin with a low-angle circle, then go on to a higher-angle circle to capture the topmost surfaces. Aim for at least 50% overlap between each image; optimal overlap is 60-80%. (fig.1) Finally, take a few more images of regions that contain essential features. Before processing blurred and unclear photos must delete them for a clear 3D model.

3.7.3 Processing:

A 3D model can be built in a fully automated three-step process using PhotoScan (AgiSoftLLC,2011a; Verhoeven,2011), involving (i) the alignment of the images, (ii) the calculation of a dense 3D surface, and (iii) the texture mapping of the model. It is, however, possible to intervene in the process at any moment (Reu et al.2013).

PhotoScan was then used to process the images. The photos were loaded and masked to produce a model with as low noise as feasible. The pictures were then aligned (Fig. 2), and the important points (the natural points) were calculated. tie points (the key points that coincide in different images) and the key points (the key points that coincide in distinct images). Following alignment, one of the most critical steps to ensuring satisfactory results was to apply a series of different filters that allowed the point cloud to be automatically cleaned. It was possible to reduce the reprojection inaccuracy of the photos to 0.87 pixels by using these filters.

3.7.4 Creating dense point cloud:

The depth maps are calculated once the dense point cloud is created. In this case, average quality and a moderate filtering mode were chosen in the image processing technique because high values are too huge and slow down the process. After obtaining the dense cloud, the noise generated was cleaned out using the program's selection tools.

3.7.5 Meshing:

After creating a dense point cloud, it allows us to continue meshing the model. In this stage, a random 3-D surface was chosen, and the number of faces was adjusted to reconstruct the mesh in 0. The computer then generates a 3-D mesh from as many faces as possible, depending on the initial resolution of the photos.

3.7.6 Texture:

The generic mode for making high-quality textures was chosen because the goal was to achieve high-quality texturing. As a result, the texture is more homogeneous and uniform. A mosaic combination mode with a texture size of 8192 was used.

Even if a 3D model is a scientifically sound method of documentation and presentation, viewing it requires special software. When printed on a 2D piece of paper, it loses any geometrical value. To address this, an orthophoto of the 3D model can be made. This orthophoto provides a geometrically perfect image in which all possible deformations caused by camera tilt and variations in object height are addressed. The outcome was a high-quality, high-precision orthophotograph of the piece's inside and outside. (Reu et al.2013, Gonzalez et al. 2019).

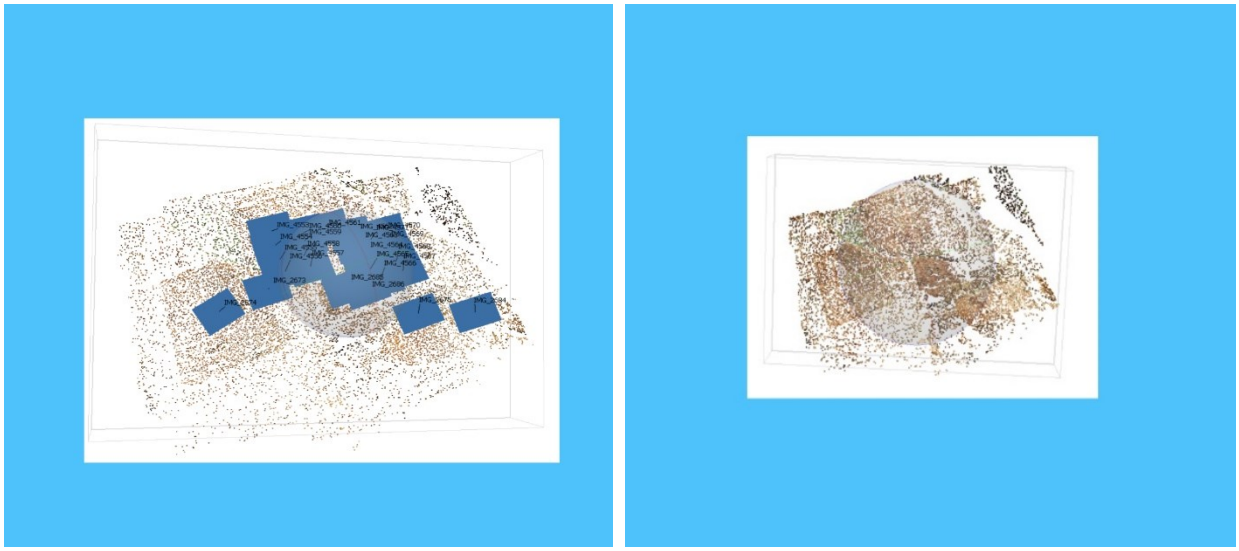


Figure 25: Lift side: Scattered point cloud obtained after aligning the images, right side dense point cloud.

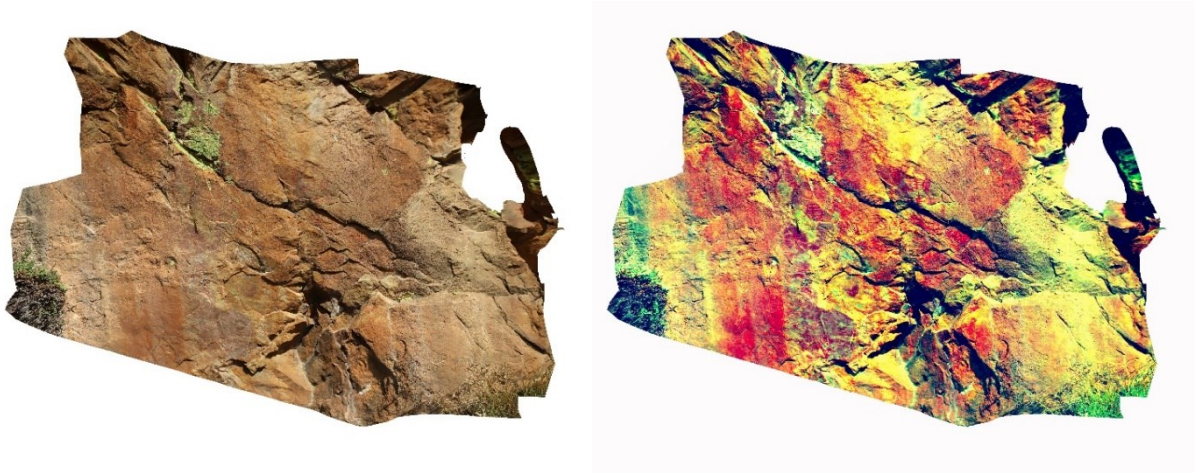


Figure 26: Lift side: 3D reconstruction of the panel, right side: digital tracing in D Stretch®

3.8 DStretch

The DStretch plugin is a component of the Imagen J computer program, which is a free open-source image processing tool that may be obtained from https://imagej.net/Welcome for Any operating system is welcome. Jon Harman designed the DStretch plugin, which can also be downloaded and utilized for free, anyone who is interested in applying it. (Harman,2005) (Gonzalez et al. 2019) DStretch® begins by transforming the Principal Component Analysis—The Karhunen-Loeve Transform (PCA-KLT). PCA is the most well-known and longest-standing multivariate analysis approach. Pearson found it, and it was later developed by Hotelling, Basilevsky, and Hum. PCA is also known as the Karhunen-Loève Transform in engineering, thus the name PCA-KLT. For any given vector range, this approach delivers the best linear estimate.

This transform is widely employed in image coding systems and, more specifically, in shape and object recognition tactics, such as face recognition, fingerprint recognition, written characters, and so on. DStretch® enables users to improve color (stretch) and balance out variations. It employs the inverse transform to transfer or correlate colors back to an approximate representation of the original.

Researcher using DStretch® software for rock art study that uses digital image processing to bring out faint pictographs and indistinct features. The software's success in documenting rock art engravings and paintings led to it being widely used throughout the scientific community in numerous nations. DStretch® is an ImageJ plugin. This is an open-source plugin for digitally manipulating scientific photographs. It is distributed using Donationware licensing, which is a licensing arrangement that provides fully functional unconstrained software to the user in exchange for a gift to the developer.

DStretch® contains a diverse set of filters that may be applied to digital photographs directly or in combination to enhance specific colors. The result is a false-color image that exposes themes that are practically imperceptible to the naked eye, color pigment differences, and superposition differences. And it generates a transformation matrix that is applied to all the image's colors. Users can select from numerous preset color space settings supported by the software.

- Standard color space (RGB or LAB)
- customized color space created by Harman, they are based on LAB color space (YDS, YBR, YBK, LDS, LRE)

- These are simply the three hues of RGB light measured in conjunction with colors under specified lighting conditions:
- L (light, black-white), A (red-green), B (yellow-blue)
- YDS color space enhances yellow pigments
- YBR and LR the red
- YBK the black, blue, and yellow
- color spaces that users can customize to their specific needs (YXX and LXX)

Soto (2020), suggests with considerable experience with DStretch® in the context for which it was created suggests utilizing TIFF files rather than JPEG files (loss-less information compression) and the highest resolution achievable [26,66]. They also advise utilizing a low ISO to reduce pixel noise, natural light, and a tripod or support to assure image stabilization for long exposure images [54,56]. This tool is incredibly user-friendly, and users may quickly learn how to master the fundamentals. It was created for end-users with no prior image processing skills, allowing them to change color spaces, tweak histograms (contrast levels), saturation, and so on, and identify elements that were not visible to the human eye, such as:

i)clear projection of motifs, and strokes, it makes us to identify or understand what they had used for painting;

ii) obtain superimposition order;

iii) Obtaining more extensive and metrically correct information about sites and themes;

iv) To assist in the reconstruction of motif geometry;

v) to keep track of deterioration processes;

vi) To aid in the reduction of deterioration effects on motifs and places during recording;

vii) It makes easy to distinguish the geological impact on motifs.

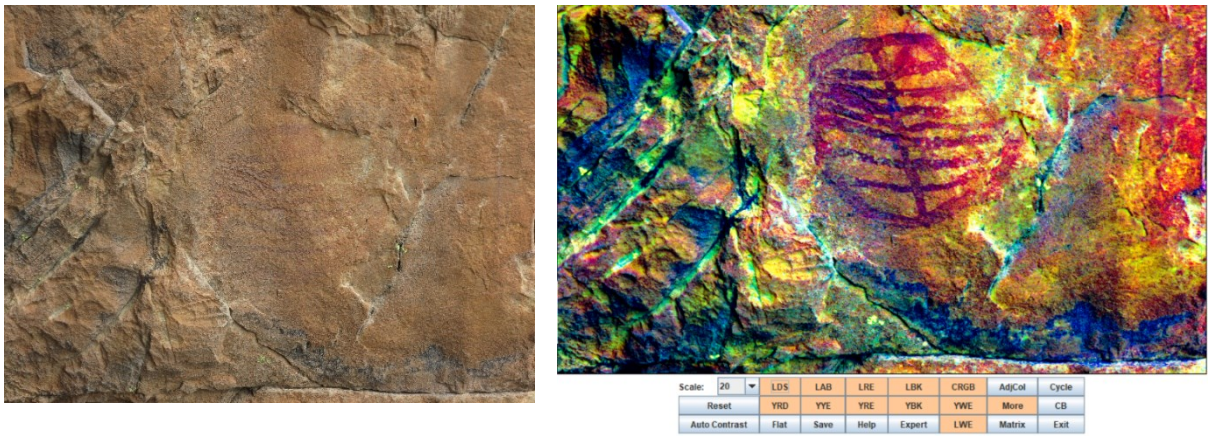


Figure 27: Left side image is originalThe user interface for the ImageJ plugin, DStretch®. The commands and main color spaces are displayed directly below the image being analyzed. Pop-up windows provide the user with helpful information on colorspace actions.

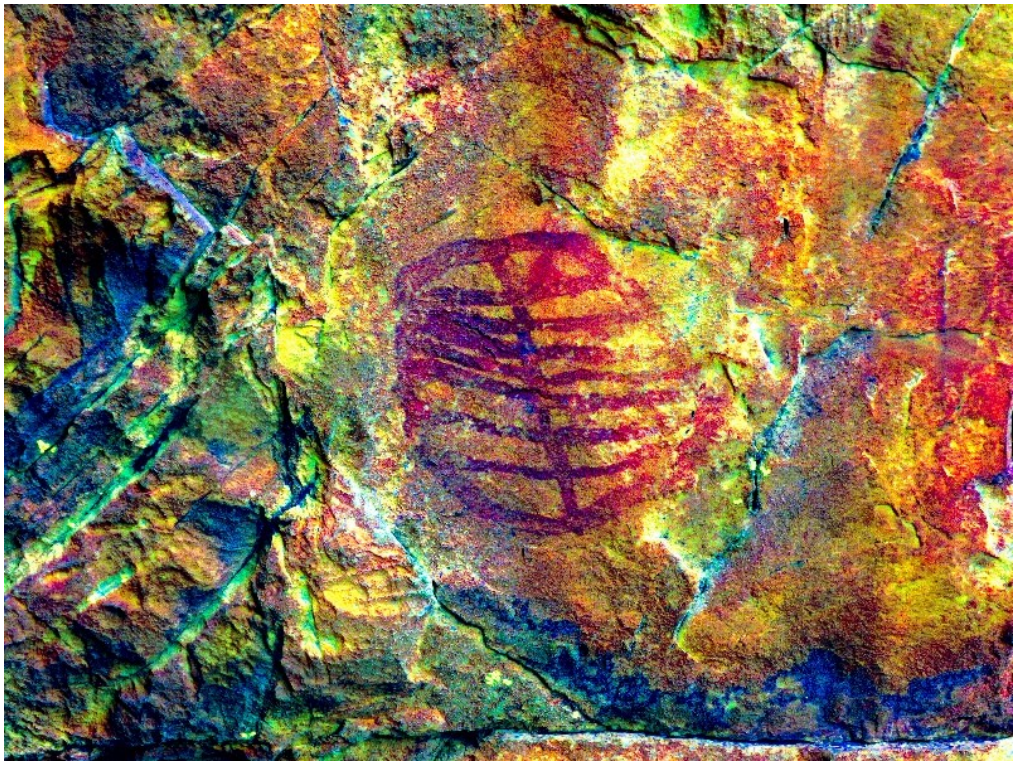


Figure 28: Final result processed using D Stretch®

3.9 Adobe Photoshop

Domingo (2015) explained that tracings for each motif are usually created using visible light pictures captured in situ and processed with digital image processing tools. Color selection tools are typically used to choose and distinguish colors from the rock surface when recording rock art. This technique is simple to use, although it can be time-

consuming when the patterns are faded or intricate. Furthermore, the results strongly rely on our visual perception, ability to spot faded paintings, expertise in studying rock art, and familiarity with digital image processing tools. This Conventional computer image enhancement approaches include digital image and color space augmentation.

Brady (2017), also advocates Digital photographs in either the visible, frontal light for paintings, oblique light for engravings, micro-, and macro-photography or nonvisible (infrared reflectography, multispectral photography, thermography, etc.) parts of the spectrum serve as a foundation for the multi-technical and multistep digital recording process. A generic outline can be used to obtain a thorough and detailed digital recording of themes, it involves three phases:

- *Digital image preprocessing*
- *Digital 'tracing' of the motifs*
- *Digital reconstruction of the compositions, panels, and/or geometry of the artwork (whether portable art or a rock art site)*

Digital image preprocessing focuses on improving features of the original or raw image acquired during photography. Preprocessing is commonly associated with picture editing (perspective correction) and/or enhancement, with both procedures potentially altering perceptions and interpretations of the art. There are two types of picture improvement techniques: conventional which use tools like channel mixers, filters, contrast, brightness, and saturation available in image processing programs like Adobe Photoshop, Gimp, Corel photo paint, etc, and non-conventional.

Digital tracing of the motifs: There are some major tools that we can use in Adobe Photoshop to produce digital 'tracing'.

- The magic wand and color range tools); are used to capture the colors or shape of a motif to better emphasize and display the image's qualities against a plain or neutral background (Domingo 2013, 2014 & Brady 2017)
- Drawing tools: such as Adobe Photoshop's Pen tool and Adobe Illustrator's Pen tool.
- Lasso tool: To achieve better results, work on smaller areas of the image and edit the figure with the Lasso tool rather than choosing the full figure at once (Domingo, 2007).

- We must create new layers for fractures, lichens, numbering, adding panel numbers and names, and scale.

Stages or methodology of tracing digital processing:

Uploading the raw image:

To trace the image in Adobe Photoshop® (CC 2015) first, we took the image of a panel, it is preferred if the image has a scale so that the image size can be calculated. The primary objective is to extract the exact geometry of the motif while retaining it in the panel. we must work on one motif at a time by creating one PSD file for a single motif, though, it might be a concentration of motifs or a single motif. Here we are taking images from Sanchez Carrasco I shelter. This image will be the background image.

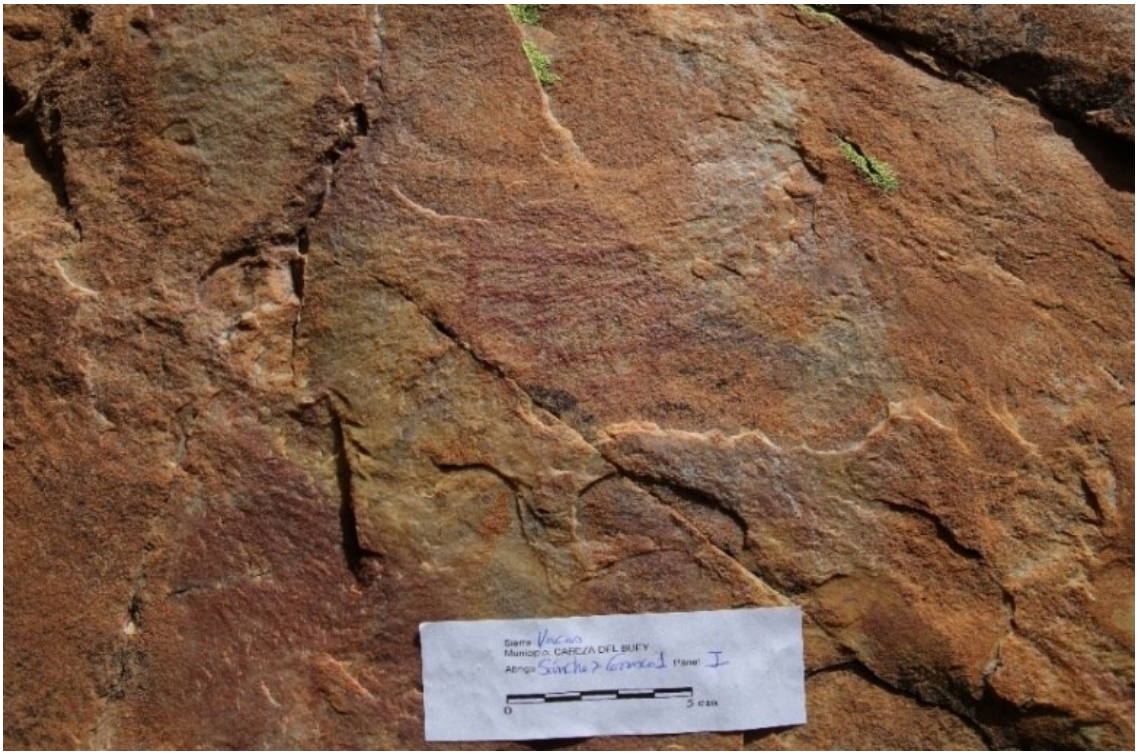


Figure 29: Raw image of panel I from Sanchez Carrasco I shelter. © Hipólito Collado, 2023.

Photoshop>Open > File name > Image

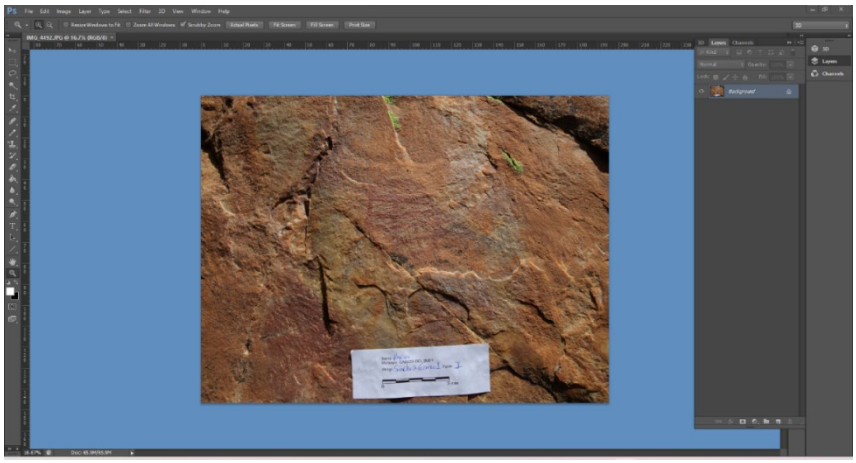


Figure 30: Panel 1in Adobe Photoshop®

Uploading DStretch® image:

To get a clearer visualization of the images obtained for tracing, it is necessary to undergo digital manipulation by producing fake colors. This is done through the DStretch® plug-in. Upload the image that is visible by clicking on 'place embedded' (or place) and it is good to upload multiple images obtained from the DStretch®.

Photoshop>Place embedded > File name> Image>Enter

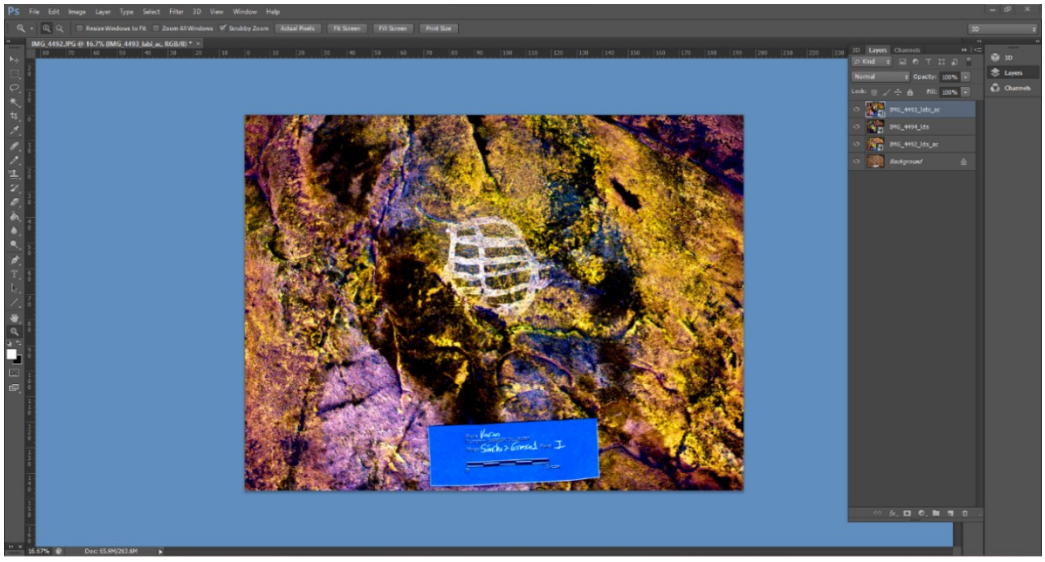


Figure 31: DStretch® image in Adobe Photoshop®

Rasterizing Layers:

Rasterizing a Photoshop layer is the process of converting a vector layer to pixels. Vector layers use lines and curves to generate graphics that retain clarity when enlarged, but this format makes them unsuitable for artistic effects that use pixels. To use any of these filters, the layer must first be rasterized. To rasterize we should right-click on DStretch® images one by one, in the pop-up window shows Rasterizing Layers.

Panel >Select image(s) >Rasterize layers

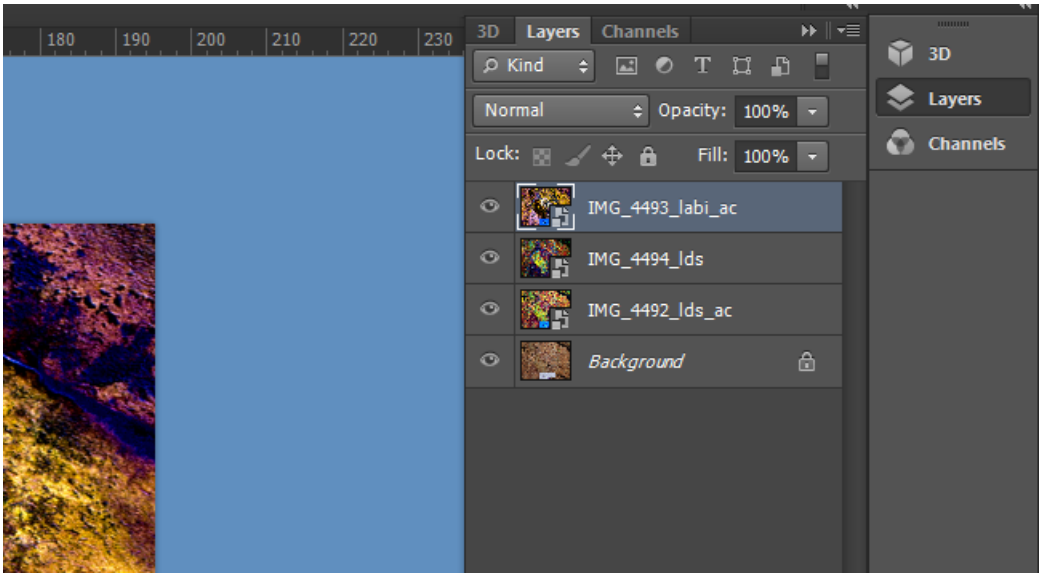


Figure 32: Folder for rasterizing layers

Scaling:

The process of resizing an image in Photoshop without changing its resolution is known as scaling. This allows you to enlarge or reduce the size of your photographs for web, print, or other purposes. In Photoshop, go to the "Image" menu and pick "Image Size" to scale an image. You can change the width and height measurements here by using pixels or percentage values, whilst scaling down can assist reduce file size. Here the scale size in this panel is 5 cm, the image size must be modified here by following the formula**:**

A X B=? ÷ C = D

A = Image size width (when we click image size > Document Size > Width) (Fig.34)
B = Our real scale (5 cm)
C = Scale size on the original image (Background image in layers) (Fig. A6)

D = Substitute the image size proportion.

A X B=? ÷ C = D

195.3 X 5 = 976.5 ÷ 32.12 =30.40 (See fig A7)

Once the width is added the length will adjust by itself, width and length should be in centimetres. The constrained proportion and resample image must be selected. (See Fig 33).

Image > Image size

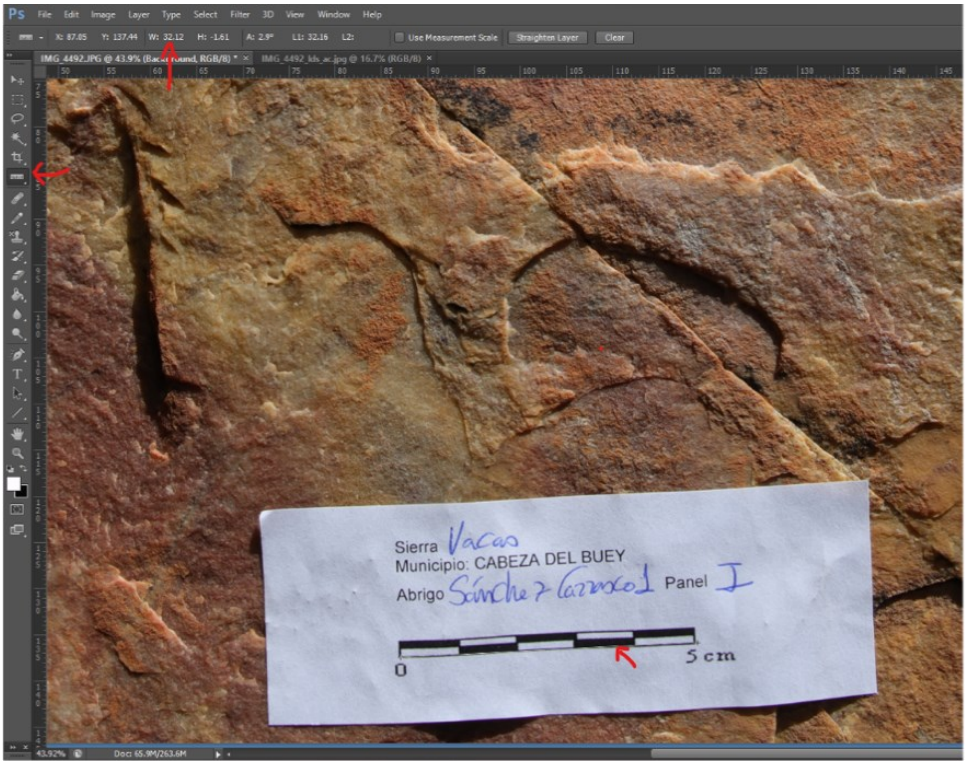


Figure 33: Measuring the scale on the background image. (The top arrow shows the width of the image "C = Scale size on the original image", another arrow points to the scale measuring with the 'ruler' tool on the left).

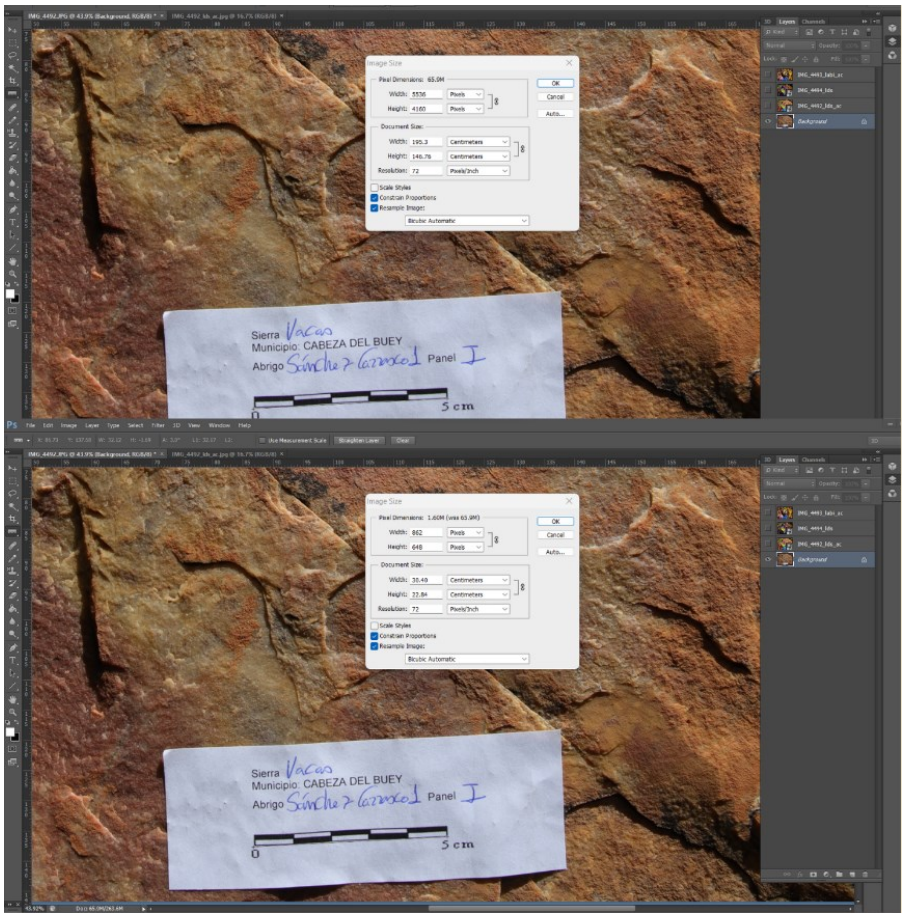


Figure 34: The top image depicts the original image size and the bottom one is the result of applying the formula

Copy-paste:

Using the rectangular marquee tool selected the motif in the layer holding the DStretch® image is copied and pasted, it creates a new layer and we created a new layer that must be put beneath the white background.

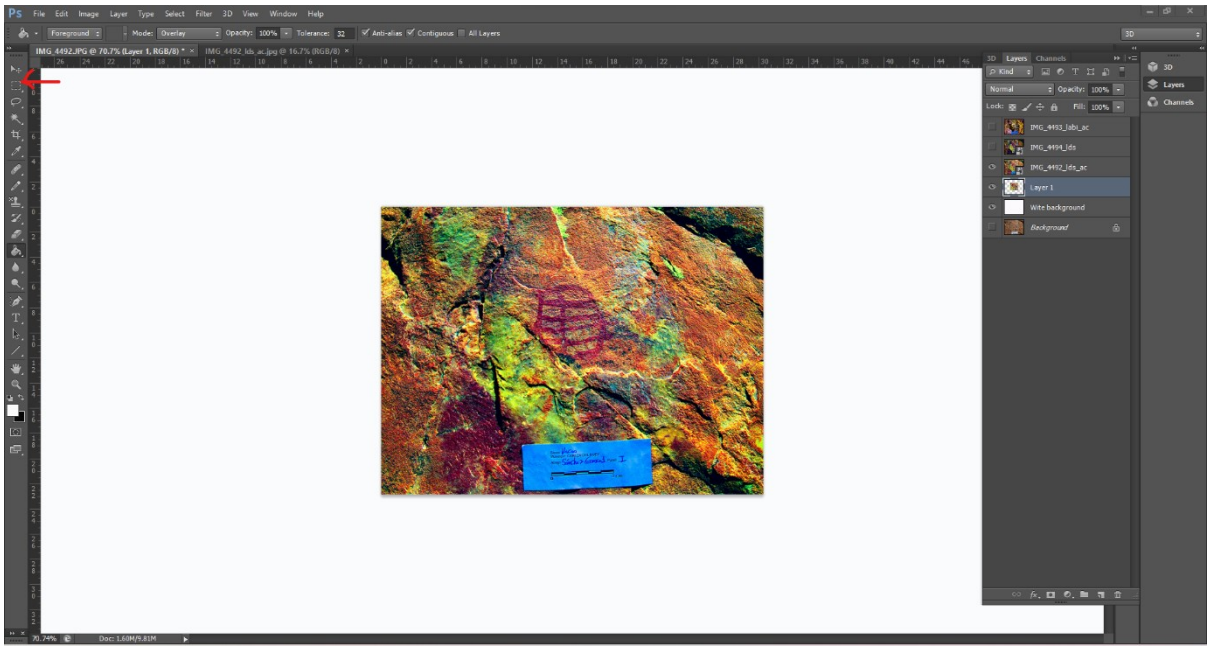


Figure 35: image in a new layer and we created the white background

Reduction:

The color we selected by selecting all pixels that are the same as, or within a particular range of, that color (thus the term "Color Range"). In most circumstances, we may want to leave the Select option set to Sampled Colors, but the Color Range command, unlike the Magic Wand, allows us more ways to select pixels.

When there is a significant contrast between the selected target and the remaining layers, the color range is an excellent technique for deciding. The fuzziness (most of the time we kept fuzziness 30) can be adjusted as needed by dragging the image's color within the range box.

The Eraser Tool can be found on the toolbar. It either makes the pixels translucent or alters the background color. In the case of the standard eraser, the capacity ranges from 1pt to 5000pt. It is also vital to lock the layer before working to avoid losing the pixels that can be wiped transparently. After using the color range, in the end, the lasso tool and magic wand tool were used to obtain the final image.

Colour range: Select > Colour range > Adjust fuzziness > OK

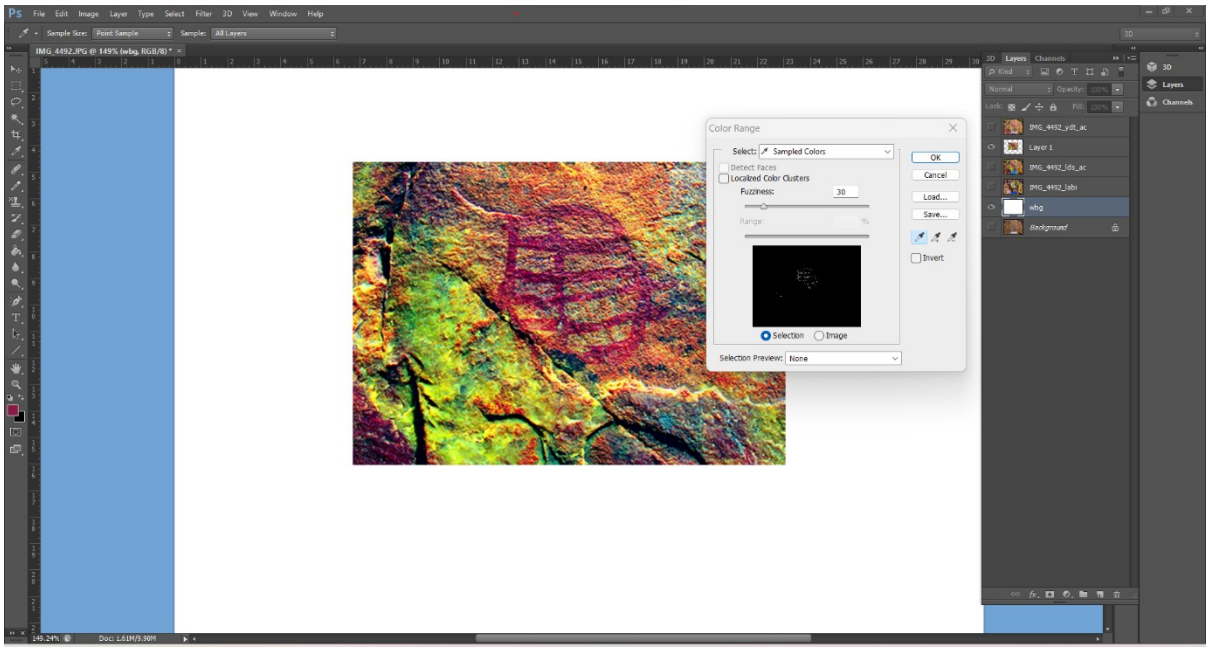


Figure 36: Reduction Sequence

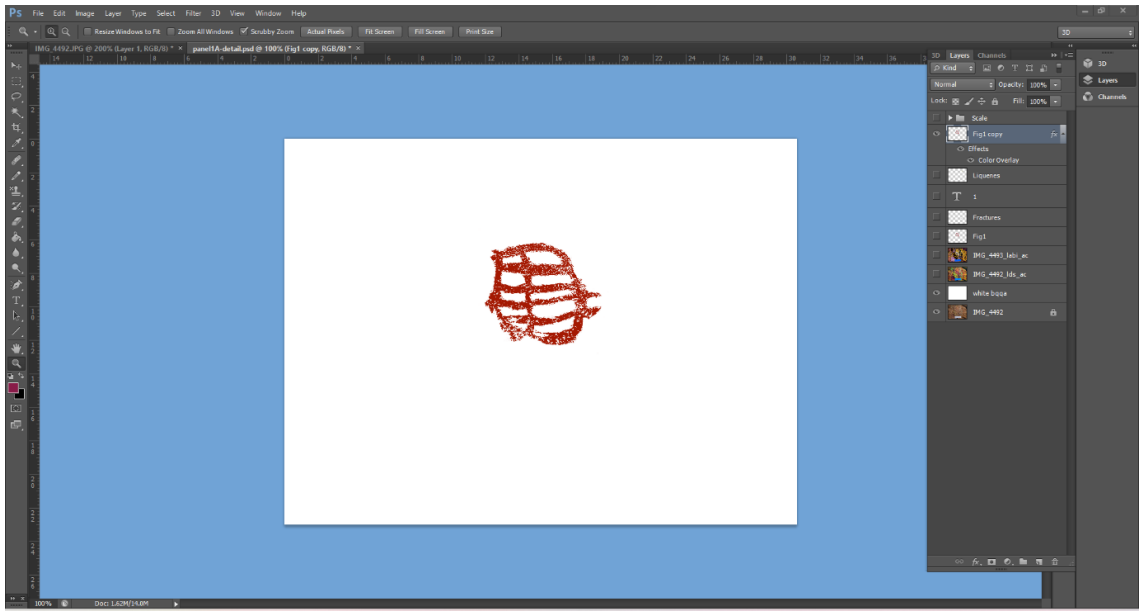


Figure 37: Used lasso tool and magic wand tool to obtain the final image.

Color Retention:

There are two methods for retaining the colors:

Creating a fictitious protocol: If there are multiple colors, the protocol can be customized for each one by generating a color code. The red color code (a41902) was developed.

R -(Red): 164

G- (Green): 25

B - (Blue):2

Keeping the original color: It attempts to keep the authenticity of the color present in the painting.

Panel>Background > Blending > Colour overlay > Enter 'RGB' > Yes to all

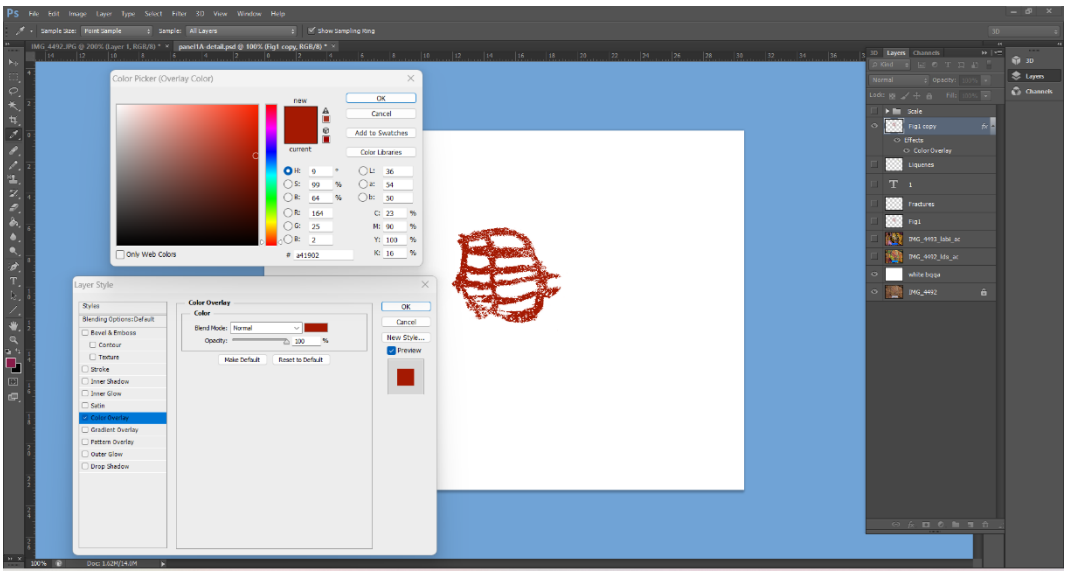


Figure 38: The original retained color from the background

Fractures:

Cracks are considered one of the most important fractures, that contribute to the rock's fragility. They frequently have an impact on rock art sites because water seeps in through these gaps, causing further erosion (Green, 2018). These fractures require human intervention and can only be drawn by humans. As a translucent layer, create a new layer

individual layer for cracks and place it beneath the background. Furthermore, the point used to draw fractures must be between 1 and 3.

Layer> New> Layer >Rename ‘fractures’ >Ok

Figure 39: Motif with Fracture

Lichens:

Lichens are fungi (Ascomycetes or, less frequently, Basidiomycetes) that coexist with photosynthesizing organisms (cyanobacteria or green algae). The symbiotic partners, the fungus (mycobiont) and the alga (phycobiont) produce a simple structure known as a thallus. The lichen thallus thrives in places where the alga and fungus cannot. This is why lichens can be found on a wide range of surfaces, including trees (epiphytes), the ground (terricolous lichens), stone (epilithic lichens), and even glass. The pH of the substrate conducts the first selection of lichen flora on stone items. Calcicolous species grow in neutral and alkaline environments, while siliceous species grow in acidic environments. Thalli that colonize stone may grow in the following ways on a range of surfaces,

including trees (epiphytes), the ground (terricolous lichens), stone (epilithic lichens), and even glass.

- *crust-like:* the thallus sticks to and penetrates the surface, forming a kind of crust;
- *foliose:* the thallus merely penetrates the substrate with its rhizines (thread-like anchorage devices) and may be easily removed from the stone's surface;
- *fruticose:* the thallus develops in three dimensions, assuming a hanging, ramified structure that is often fastened to the substrate by a sort of button;
- *endolithic:* only found on calcareous stone; the thallus is immersed in the substrate and difficult to discern due to its white hue. When it reproduces, it is often seen because the fruiting bodies emerge through the stone, leaving behind little pits. (Marcello Lisci at el 2002)

Layer> New> Layer >Rename 'Lichens' >Ok

Figure 40: Motif with lichens, the lichens are 'crust-like' the thallus sticks to and penetrates the surface, forming a kind of crust

Giving name or Number:

Plenty of images can be found in a shelter. It is vital to number the photographs in each panel to get a count as well as for statistical purposes. For this purpose, a new layer must create and name it.

Toolbar> Type tool > Horizontal

Figure 41: Motif with Number

Scale and Text box:

It is vital to understand the dimensions of the image for which we are documenting the panels. It also assists in obtaining the sharpness of the shot. The text box's principal content should include the name of the shelter as well as the panel number on which one is presently working. Figure 42 shows the final result.

Toolbar> Type tool > Horizontal

Figure 42: Final figure with scale and text box.

Final stage: when the digital tracing is done the whole file must be saved in Photoshop*.PSD, *.PDD format, we can save the final image in jpg format.

File > Save as > Photoshop*.PSD, *.PDD)

4 Results

4.1 Sanchez Carrasco, Shelter I

Shelter 1 was divided into 4 sectors (A, B, C, D) for better definition in the panel tracing.

Section A consists of only 1 figure a tectiform (a circle with a tree-shape figure inside).

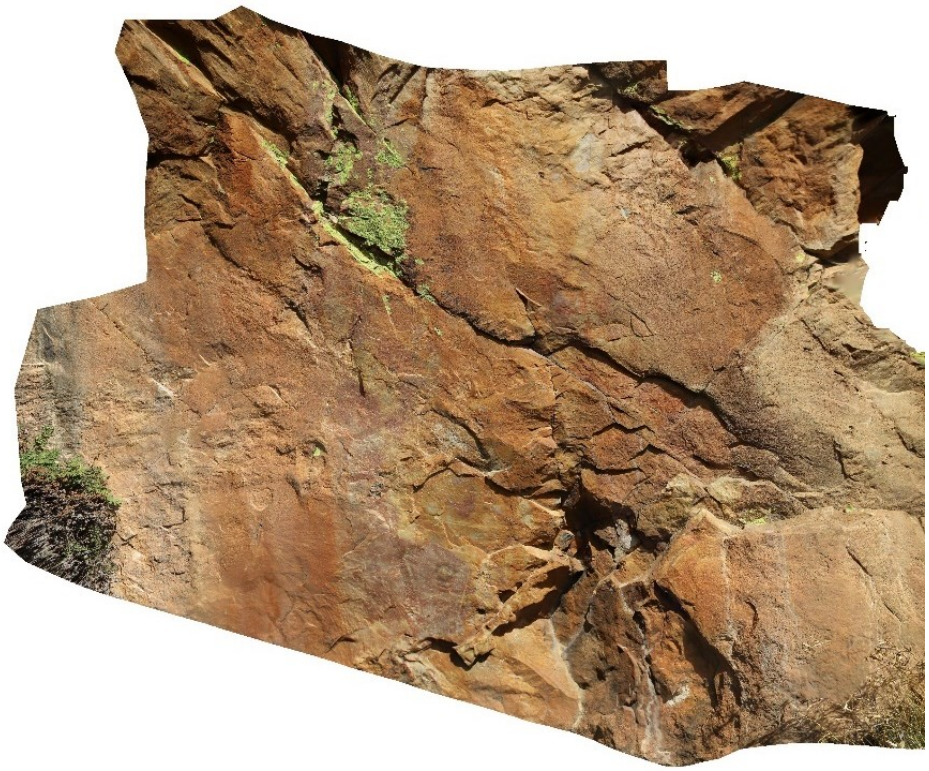


Figure 43: 3D representation of the panel 1 Sanchez Carrasco I shelter using Agisoft Metashape.

Figure 44: Photograph of shelter 1 with the tracing of the paintings incorporated.

Panel 1, Sector A:

Table 2: Description of the panel 1, sector A.

Color of the panel		Orange
Incline		63.3°
Dimension	Height x Width (in cm)	75 X 80 cm
	Distance from current soil (in cm)	120cm
Condition of the panel		Regular
Filter processed through DStretch®		LDS
No. of figures identified		1

Figure 45: Original image of the sector A of Shelter 1.

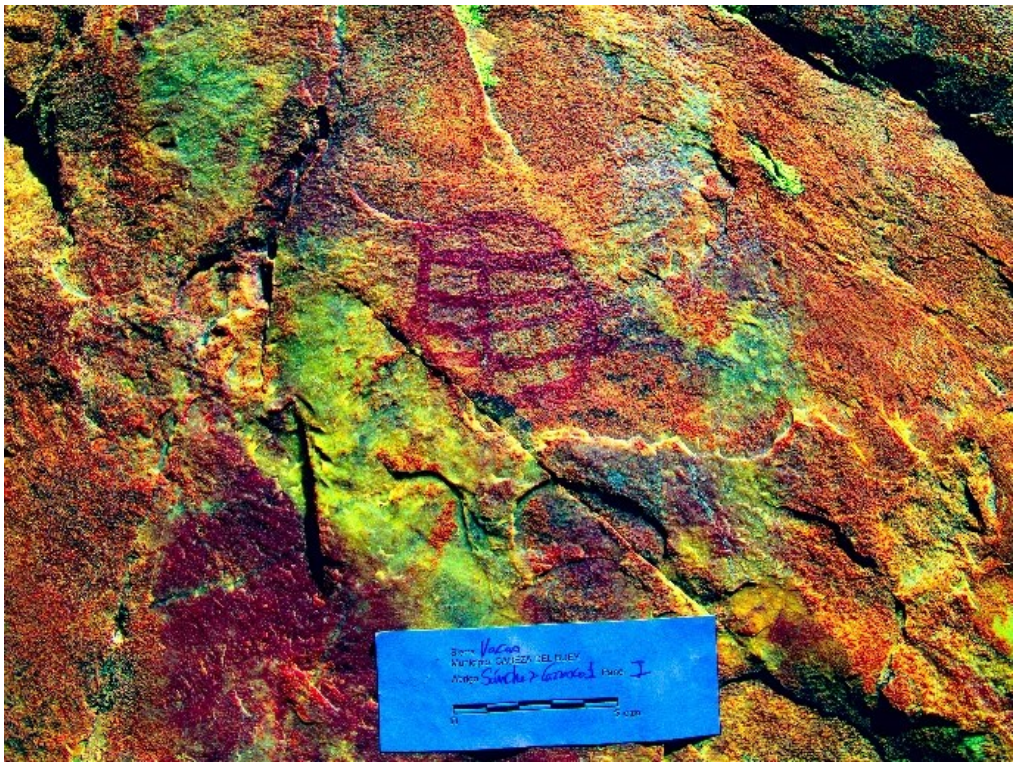


Figure 46: DStretch® version of the panel using LDS filter.

Figure 47: Figure of tectiform.

Figure 48: 2D representation of the entire section A.

Description of the figure(s):

Panel 1, Sector A: The figure consists of a tectiform of one long vertical axis from which emerges, on both sides with four horizontal lines within a circle. The figure is light red tone with a maximum width of 6.99 cm and a maximum height of 5.93cm. The figure is in a good state of conservation without any superimposition.

Panel 1 Sector B

Table 3: Description of the panel 1, sector B

Color of the panel		Light orange
Orientation		Open to 200°
Incline		63.3°
Dimension	Height x Width (in cm)	75 X 80 cm
	Distance from current soil (in cm)	120cm
Condition of the panel		Regular
Filter processed through DStretch®		LABI
No. of figures identified		5

Figure 49: Original image of the section B.

Figure 50: DStretch® version of the section B using LABI filter.

Figure 51: Photograph of section B with the tracing of the paintings incorporated.

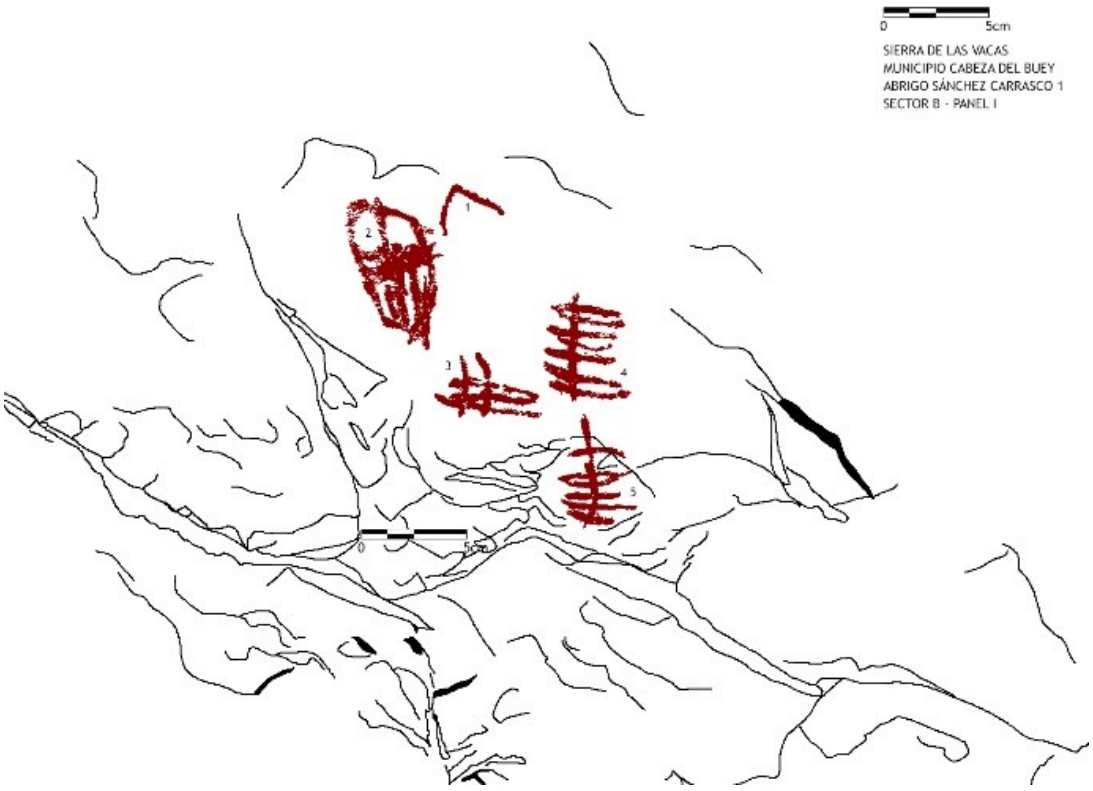


Figure 52: 2D representation of the entire sector B using.

Figure 53: Figures from section B.

Description of the figures:

Figure 1 of section B: the figure consists of an Angular idiomorphic, inverted "V" (Collado 2017) the vertex pointing upper left of the panel. The figure is light red in the original panel with a maximum width of 2.75 cm and a maximum height of 1.37cm. The figure is in a good state of conservation.

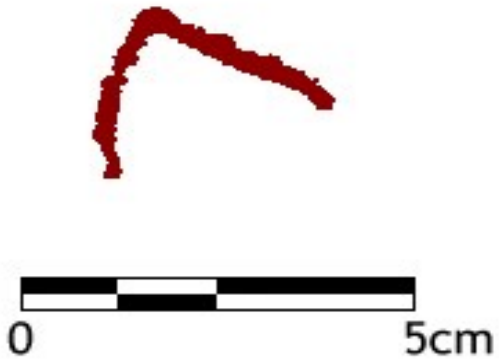


Figure 54: Figure 1 from section B.

Figure 2 of section B: the figure consists of a Tectiform with one vertical axes that arises on both sides and one horizontal line within a circle. The figure is light red in colour with a maximum width of 3.73 cm and a maximum height of 7.09 cm, and placed 0.95cm next to Fig.1. The motif is in good state of conservation without any superimposition.

Figure 55: Figure 2 from section B.

Figure 3 of section B: The figure consists of a ramiform with two vertical axis, on which three horizontal lines are drawn. The figure is light maroon in color, with a maximum width of 5.05 cm and a maximum height of 2.94 cm, and placed 0.67 cm below Fig. 2. The figure is in a good state of conservation.

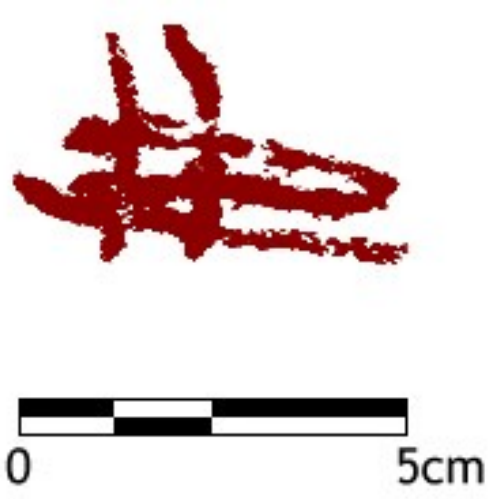


Figure 56: Figure 3 from section B.

Figure 4 of section B: The figure consists of an anthropomorph in the form of vertical ramiform with one vertical axis, on which seven horizontal lines are drawn. The figure is light red color, with a maximum width of 4.16 cm and a maximum height of 5.15 cm.

Figure 57: Figure 4 from section B.

Figure 5 of section B: The figure consists of an ramiform (tree-shape figure) with one vertical axis, on which six horizontal lines are drawn. The figure is light red colour, with a maximum width of 3.51 cm and a maximum height of 5.50 cm. and placed 0.80 cm.

Figure 58: Figure 5 from section B.

Panel I sector C:

Table 4:Description of the panel 1, sector C

Color of the panel		Light orange
Orientation		Open to 200°
Incline		63.3°
Dimension	Height x Width (in cm)	75 X 80 cm
	Distance from current soil (in cm)	120cm
Condition of the panel		Regular
Filter processed through DStretch®		LABI
No. of figures identified		3

Figure 59: Original image of the section C of shelter 1.

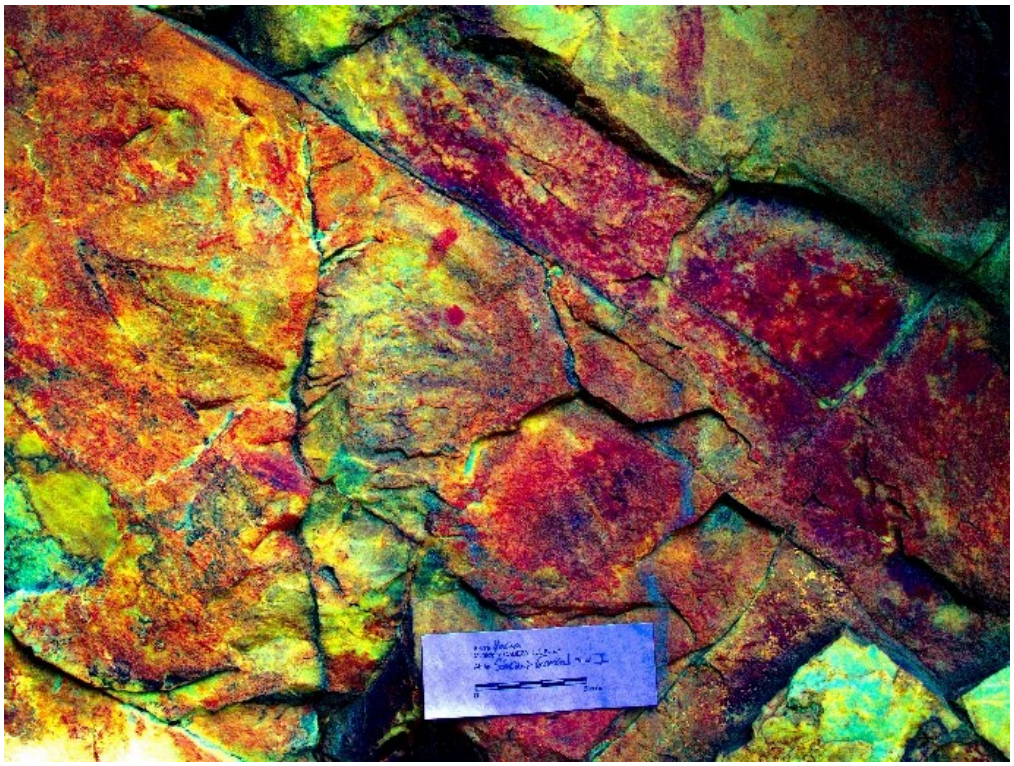


Figure 60:DStretch® version of the panel using LDS filter.

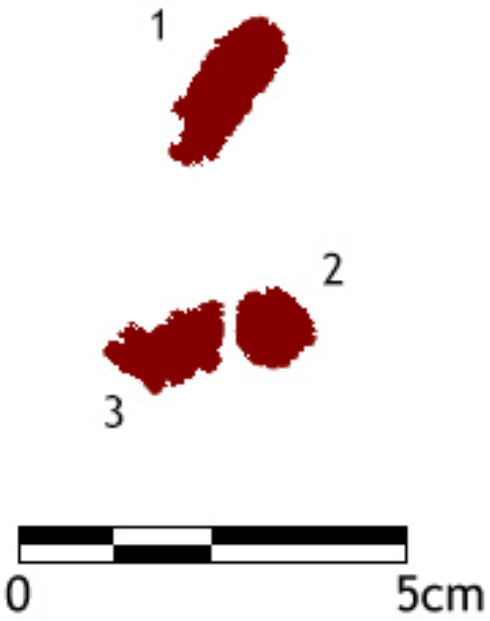


Figure 61: Dots from section C of shelter 1.

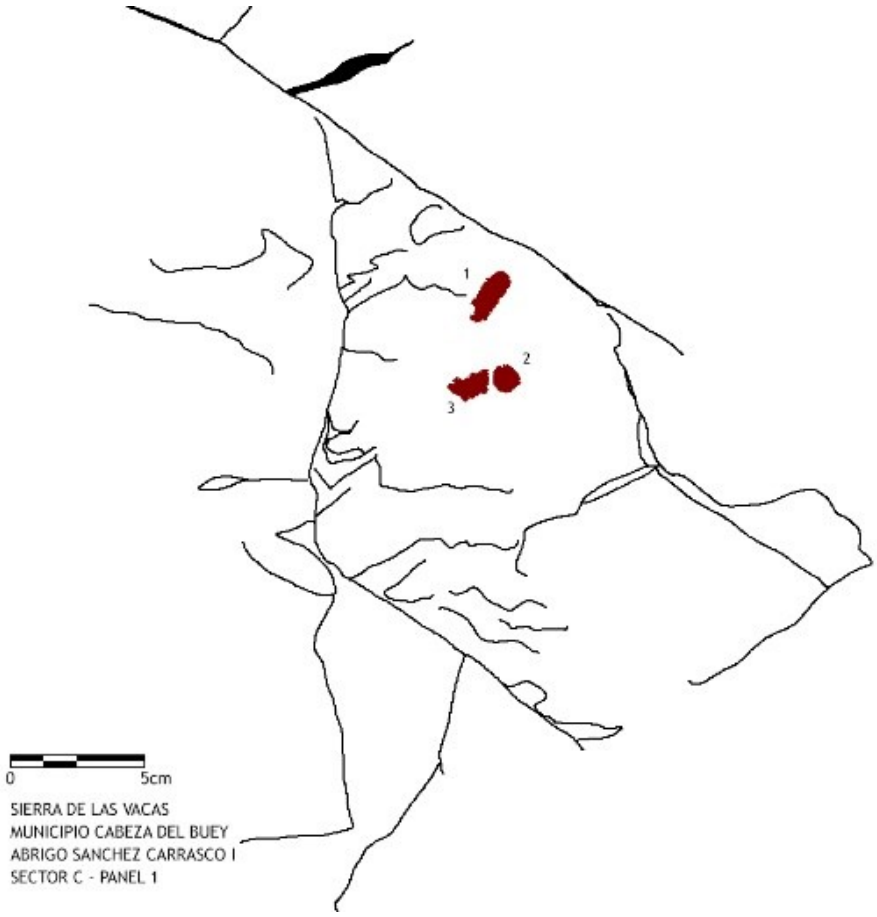


Figure 62:2D Representation of the entire sector C.

Description of the figure(s):

1: The figure consists of a small and thick line. with a maximum width of 0.62 cm and a maximum height of 1.74 cm. The figure is light maroon, the figure is in a good state of conservation without any superimpose.

2: The figure consists of a mark made by the digits. with a maximum width of 0.92 cm and a maximum height of 0.95 cm. The figure is light maroon and placed 1.71 cm below Fig. 1. The figure is in a good state of conservation without any superimpose.

3: The figure consists of a very small and thick line. with a maximum width of 1.25 cm and a maximum height of 0.79 cm. The figure is light maroon and placed very next to Fig. 2 of 0.13 cm distance. The figure is in a good state of conservation without any superimpose.

Panel I, sector D:

Table 5: ***Description of the panel 1, sector D***

Color of the panel		Light Maroon
Orientation		Open to 200°
Incline		63.3°
Dimension	Height x Width (in cm)	75 X 80 cm
	Distance from current soil (in cm)	120cm
Condition of the panel		Regular
Filter processed through DStretch®		LDS
No. of figures identified		1

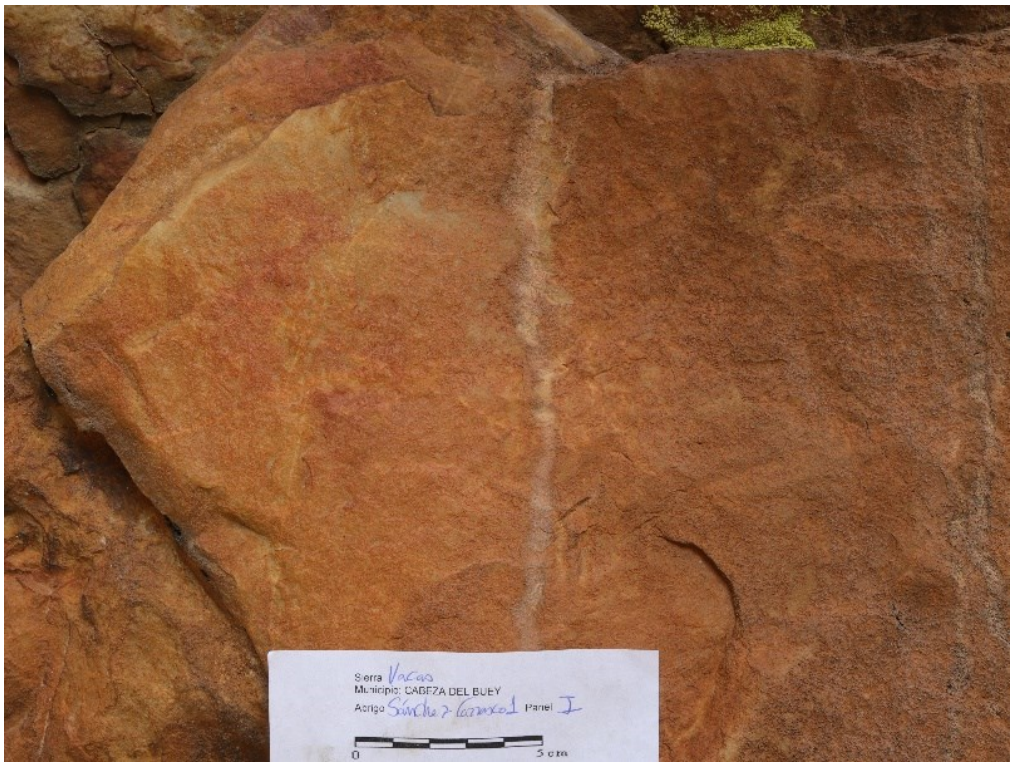


Figure 63:Original image of the section D of shelter 1.

Figure 64:DStretch® version of the panel using LDS filter

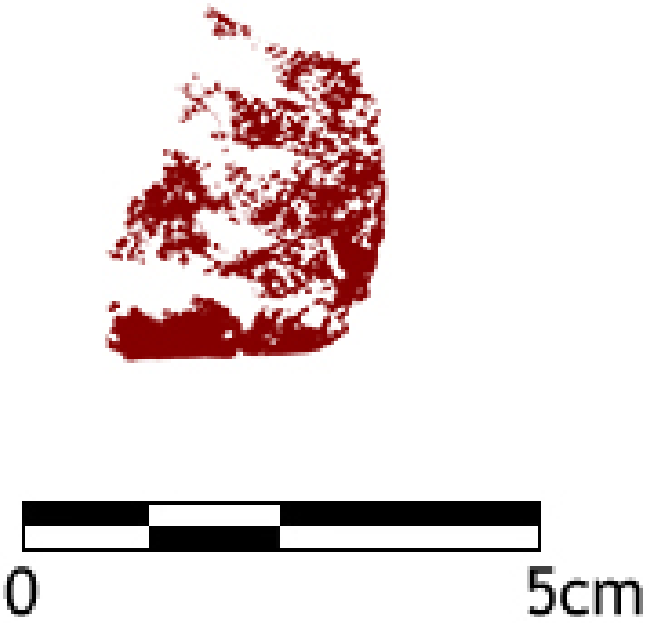


Figure 65:) Figure from section D of shelter 1.

Figure 66:Aligning the figure with an original image.

Figure 67:2D representation of the entire sector D of shelter 1.

Description of the figure(s):

Fig.1: The figure consists of a Tectiform, with a half circle and three horizontal lines drawn within a circle. The figure is light maroon. with a maximum width of 6.99 cm and a maximum height of 5.93cm. The figure is in a good state of conservation without any superimpose.

4.2 Sanchez Carrasco Shelter II

Shelter I and Shelter II come under the same coordinates. Due to the mountain range, Shelter II lies on the little left top of Shelter I, and the panel is oriented to the S-SW. Shelter I and II look naturally arranged to sit in front of the panel and paint the figures. Two panels are holding two ramiform figures. Panel 2 is 60 cm south of the first figure, or panel 1.

Shelter II, panel 1:

Table 6:Description of the panel 1, Shelter II.

Color of the panel		Orange
Visibility from shelter		Wide
Orientation		S/sw 192°
Incline		71.3°
Dimensio	Height x Width (in cm)	38 X 48 cm
	Distance from current soil (in cm)	88 cm
Condition of the panel		Regular
Filter processed through DStretch®		LDS
No. of figures identified		1

Figure 68:Original image of the panel 1 shelter II.

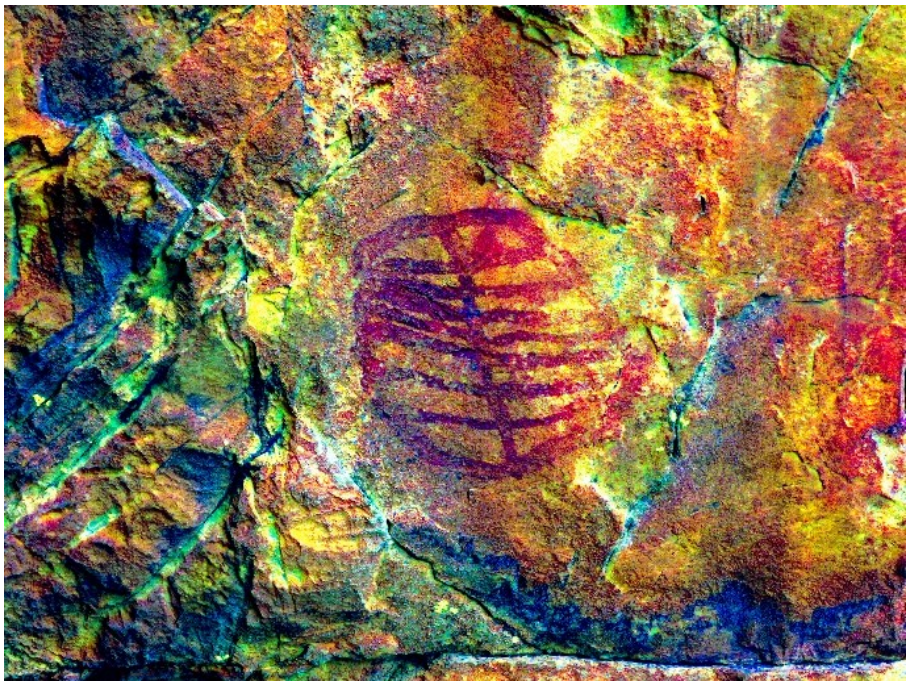


Figure 69:DStretch® version of the panel 1 using LDS filter.

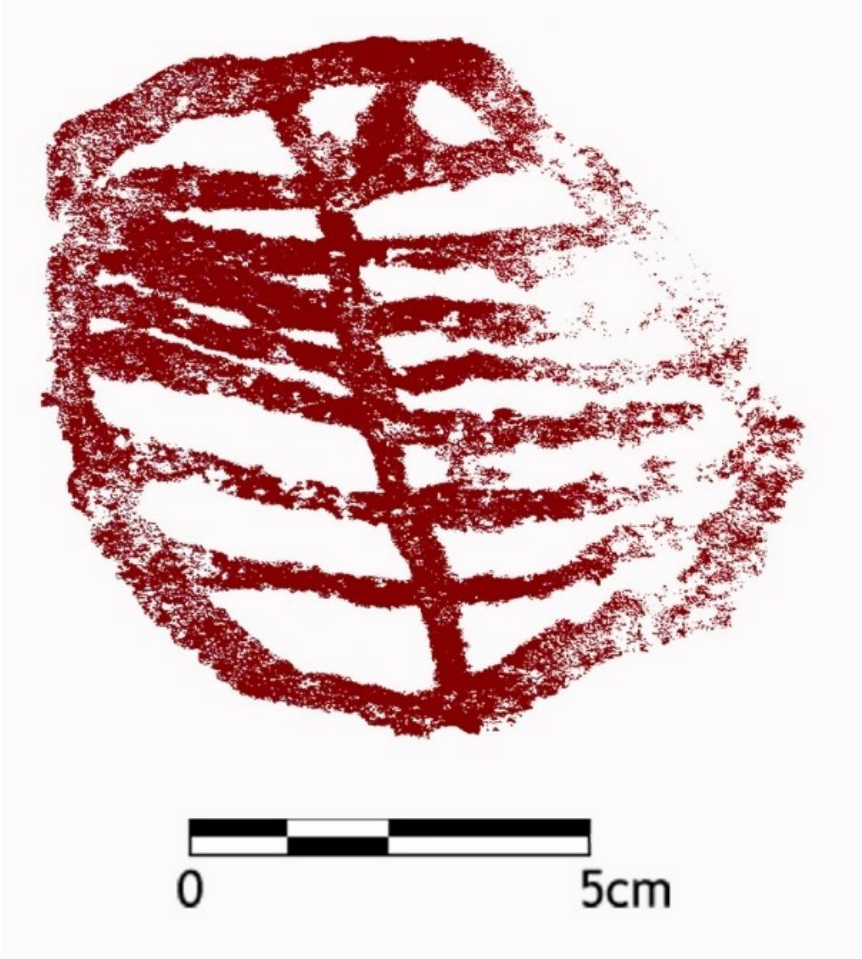


Figure 70:Figure 1 from shelter II.

Figure 71:2D representation of the entire panel 1.

Description of the figure(s):

1: The figure consists of a Tectiform of one long vertical axis from which emerges, on both sides with seven horizontal lines within a circle. The figure is light maroon with a maximum width of 8.80 cm and a maximum height of 8.11cm. The figure is in a good state of conservation without any superimpose.

Shelter II, panel 2:

Table 7:Description of the panel 2, Shelter II

Color of the panel		Orange
Visibility from shelter		Wide
Orientation		S/sw 192°
Incline		71.3°
Dimension	Height x Width (in cm)	38 X 58 cm
	Distance from current soil (in cm)	37 cm
Condition of the panel		Regular
Filter processed through DStretch®		LDS
No. of figures identified		1

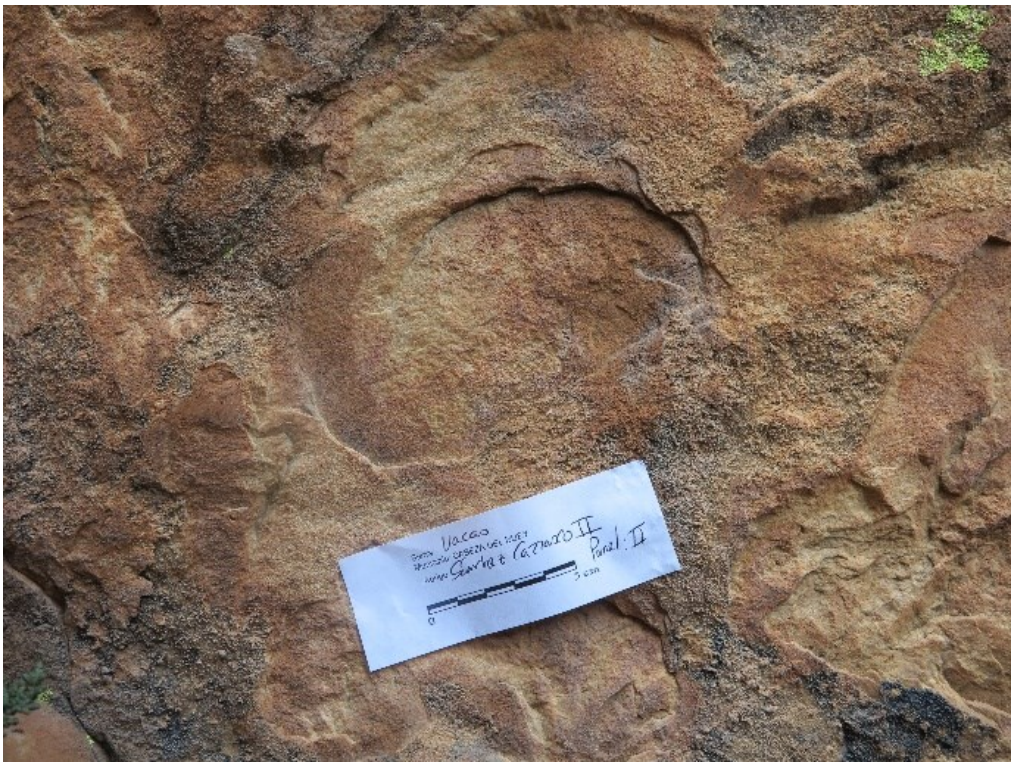


Figure 72:Original image of the panel 2, shelter II.

Figure 73:DStretch® version of the panel using LDS filter

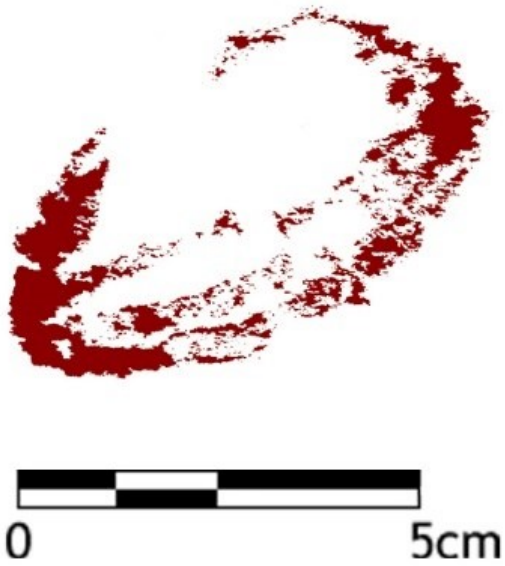


Figure 74:Figure from panel B sheltter II.

Figure 75:Aligning the figure with an original image.

Figure 76:2D Representation of the entire sector B using Adobe Photoshop ®.

Description of the figure(s):

Fig.1: The figure consists of a Tectiform of oval shape one or two horizontal lines within an oval circle. The figure is light maroon with a maximum width of 5.24 cm and a maximum height of 2.48cm. The figure is in a good state of conservation without any superimpose. Motif drawn on the side of a cavity circle.

4.3 4.3. Sanchez Carrasco Shelter III:

Shelter III is approximately 50 meters from Shelter II, an open-air shelter, oriented to the south. It has two panels; with 3 motifs the motifs are a little faded. From the shelter visibility is wide.

Shelter III sector A

Table 8: Description of the panel 3A, Shelter III

Color of the panel		Pray and brown
Orientation		S 180°
Incline		49°
Dimension	Height x Width (in cm)	54 X 33 cm
	Distance from current soil (in cm)	37 cm
Condition of the panel		Bad
Filter processed through DStretch®		LRS
No. of figures identified		1

Figure 77:Original image of the panel.

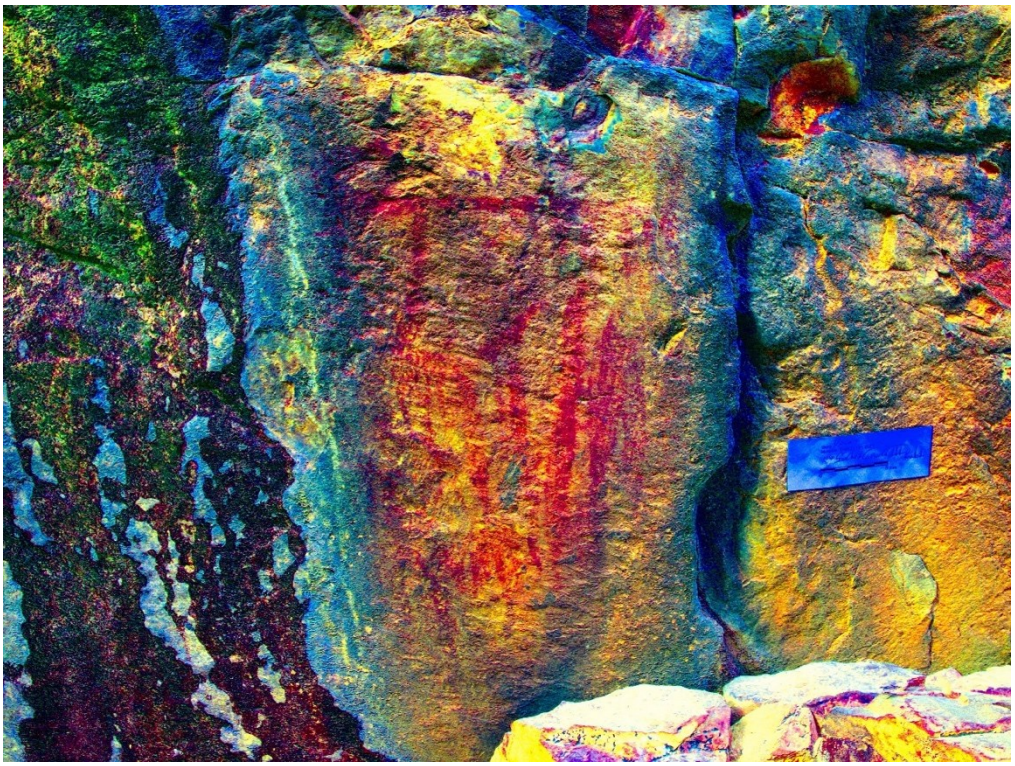


Figure 78:DStretch® version of the panel using LRS filter.

Figure 79:: images with scale

Figure 80:2D representation of the entire section A of shelter III.

Description of the figure(s):

Fig.1: The figure consists of a set of geometric figures including lines and a circle. The figure is in a bad state of conservation which makes it hard to make a interpretation.

Shelter III, panel B:

Table 9:Description of the panel 3B, Shelter III

Color of the panel		Orange
Orientation		150° SE
Incline		66.1°
Dimension	Height x Width (in cm)	49 X 25 cm
	Distance from current soil (in cm)	44 cm
Condition of the panel		bad
Filter processed through DStretch®		LDS
No. of figures identified		2

Figure 81:Original image of the shelter III, panel B.

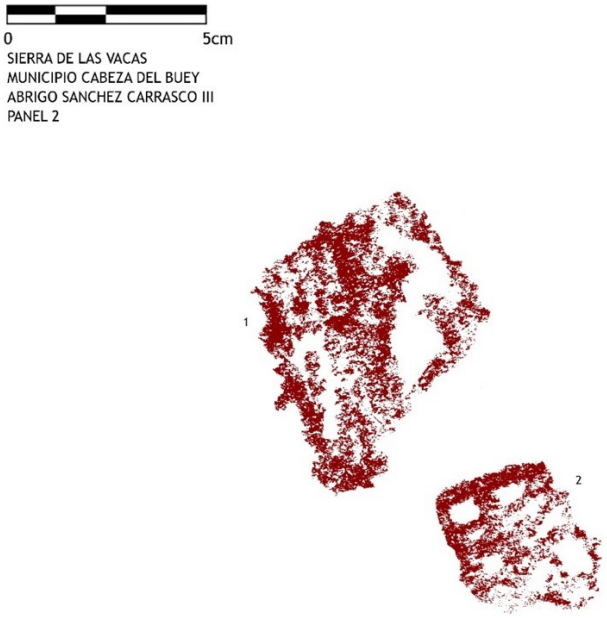


Figure 82:2D representation of the entire panel B from shelter III.

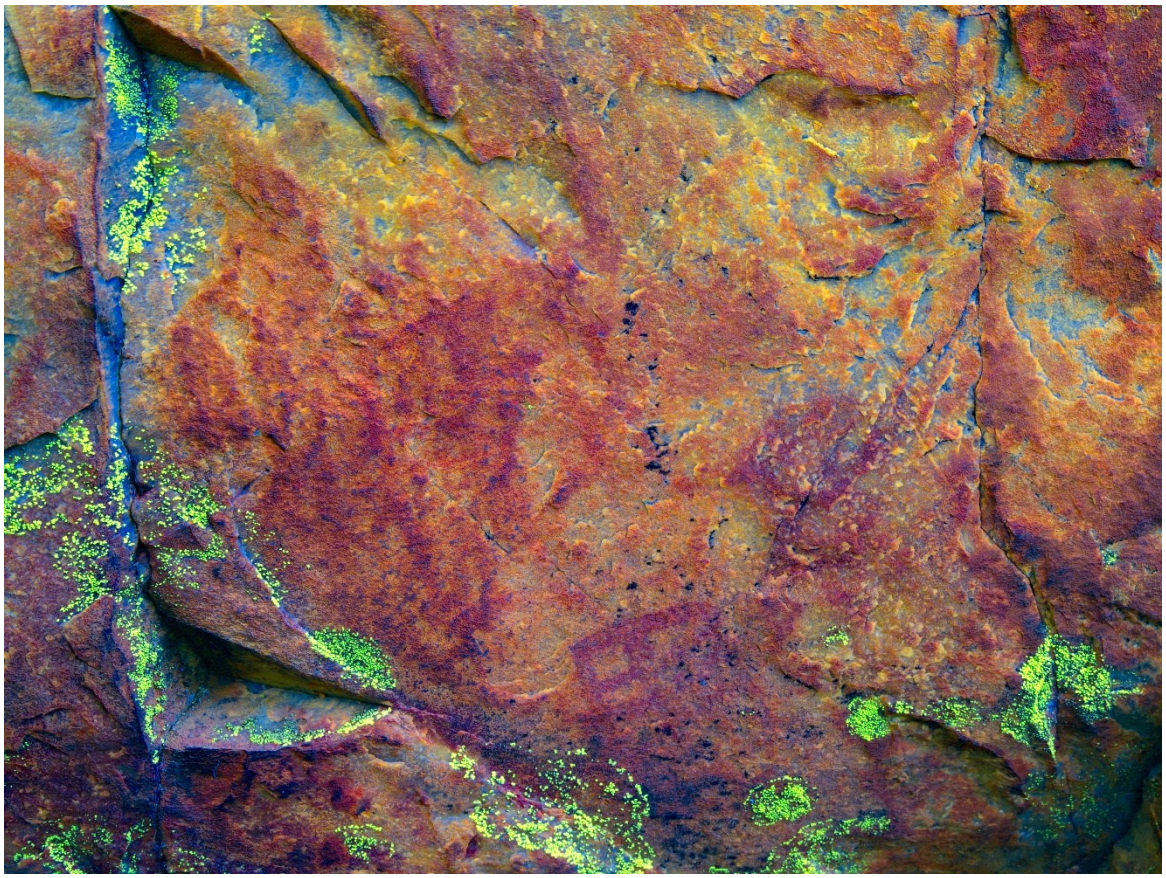


Figure 83::DStretch® version of the panel using LDS filter.

Description of the figure(s):

Fig.1: The figure consists of two tectiforms in red colour. The 1st motif with a maximum width of 4.87 cm and a maximum height of 7.48 and then a 2nd motif with maximum width of 2.61cm and a maximum height of 3.35cms. The figure is in a bad state of conservation. 2nd motif is without any superimpose, 1st motif could be superimposed.

4.4 Sanchez Carrasco IV Shelter:

This shelter is approximately 100 meters from Shelter III. There is wide visibility from the shelter, oriented to the south it is made up of eight motifs in a cluster within a panel and all are ramiform. Here little slopy in front of the panel, it seems naturally chipped the top layer of the quartzite.

Table 10:Description of the panel A, Shelter IV

Orientation		S/sw 160°
Incline		48.8°
Dimension	Height x Width (in cm)	70 X 100 cm
	Distance from current soil (in cm)	30 cm
Condition of the panel		Regular
Filter processed through DStretch®		YYS
No. of figures identified		8

Figure 84:Original image of the shelter IV.

Figure 85:DStretch® version of the panel using YYE filter.

Figure 86:2D representation of the entire shelter IV.

Figure 87:Aligning the figures with an original image.

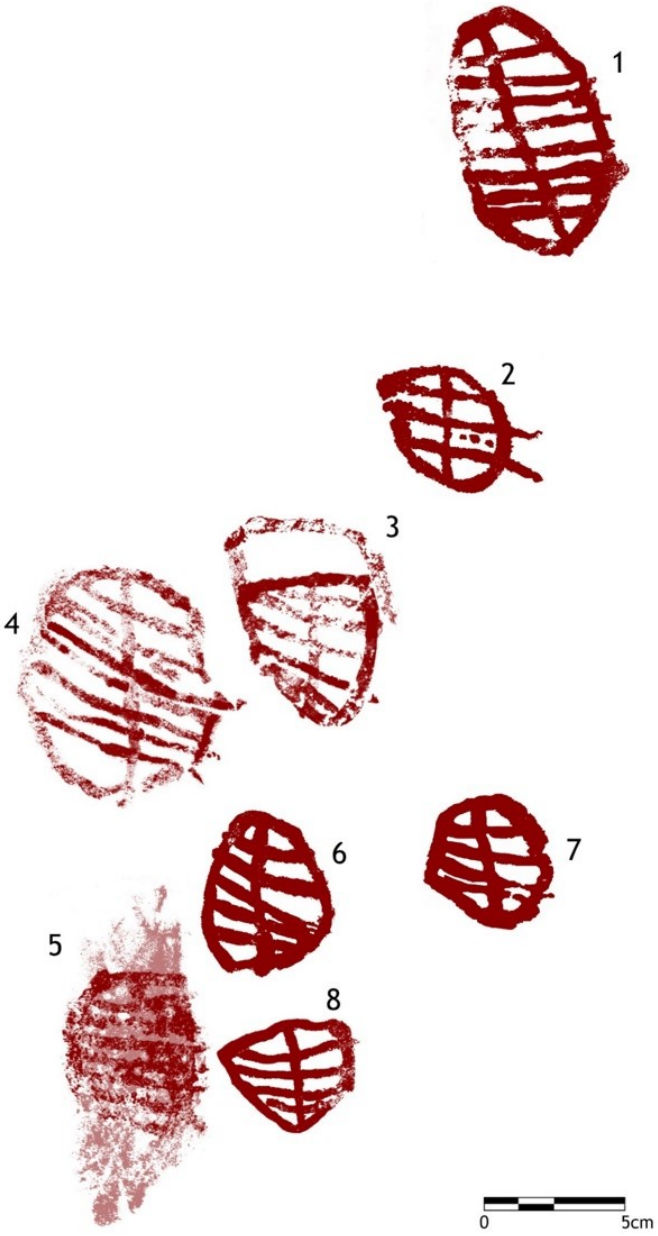


Figure 88: Figures from shelter IV.

Description of the figure(s):

Figure 1: The figure consists of a tectiform of one long vertical axis from which emerges, on both sides with eight horizontal lines within a oval and it is placed on right top of the panel. The figure is light maroon with a maximum width of 5.30 cm and a maximum height of 8.18 cm. The figure is in a regular state of conservation without any superimposition.

Figure 89:Figure 1 from shelter IV.

Figure 2: The figure consists of a Tectiform of one long vertical axis, with three horizontal lines within an oval, and two lines drawn out of the ovel. There are three dots (finger or digit mark) The figure is light maroon with a maximum width of 3.18 cm and a maximum height of 3.44 cm and 1.91 cm away from 1st motif. The figure is in good condition.

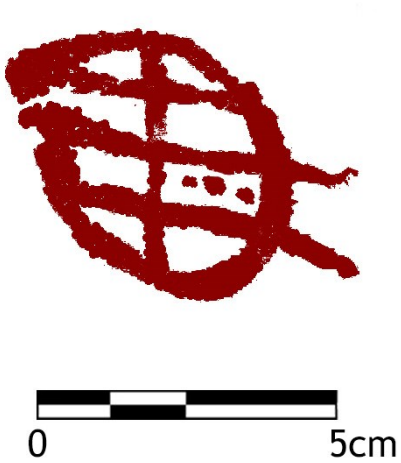


Figure 90:Figure 2 from shelter IV.

Figure 3: The figure consists of a Tectiform of one long vertical axis, with Five horizontal lines within an oval, and one line extended from left to right on the top of figure. The figure is light maroon with a maximum width of 4.85 cm and a maximum height of

7.26cm and 1.91 cm distance from figure two. It is in a regular state of conservation without superimposition.

Figure 91: Figure 3 from shelter IV.

Figure 4: The figure consists of a Tectiform of one long vertical axis from which emerges, on both sides with seven horizontal lines within a circle and it is placed very next to the fig. 3. In distance of 0.95 The figure is light maroon with a maximum width of 8.11 cm and a maximum and maximum height of 7.95 cm. within a regular state of conservation without any superimposition.

Figure 92: Figure 4 from shelter IV.

Figure 5: the figure consists of a Tectiform of one long vertical axis from which emerges, on both sides with six horizontal lines within an oval and it is placed in the bottom of the of the panel, next to figures 6 and 8. The figure is light red with a maximum width of 4.77 cm and a maximum height of 5.67 cm , it is in regular state of conservation with natural red pigment unde this figure.

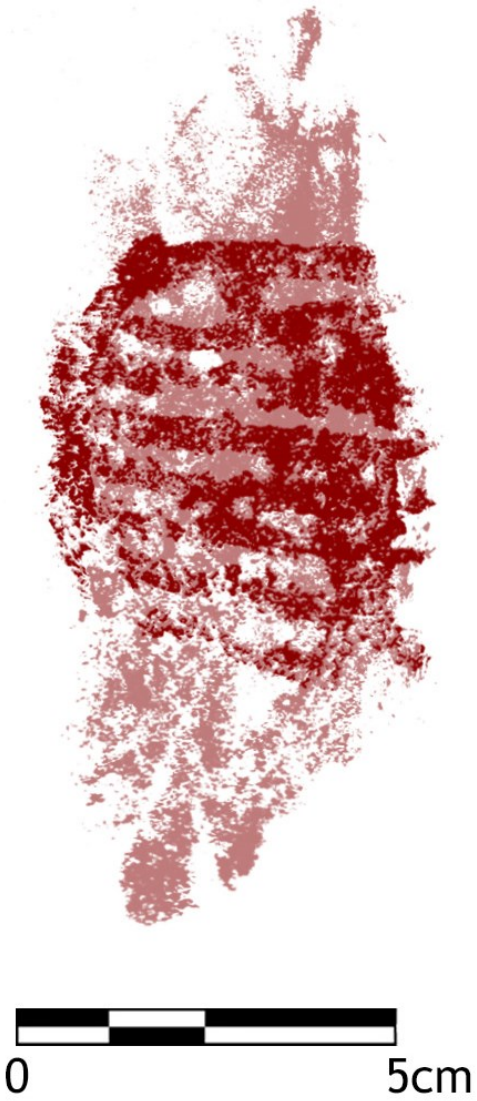


Figure 93:Figure 5 from shelter IV.

Figure 6: the figure consists of a tectiform of one long vertical axis from which emerges, on both sides with five horizontal lines within circle and it is placed next to the Fig.5 with the distance of 0. 95.. The figure is light maroon with a maximum width of 4.66 cm and a maximum height of 5.77 cm. It is in a regular state of conservation without any superimposition.

Figure 94:Figure 6 from shelter IV.

Figure 7: The figure consists of a tectiform of one long vertical axis from which emerges, on both sides with four horizontal lines within a small circle and it is placed next to the fig. 6. The figure is light maroon with a maximum width of 4.56 cm and a maximum height of 4.50 cm, it is in a regular state of condition without any superimposition.

Figure 95:Figure 7 from shelter IV.

Figure 8: the figure consists of a Tectiform of one long vertical axis from which emerges, on both sides with four horizontal lines within a oval and it is placed next the fig. 7 within a distance of 5.35 cm.. The figure is light maroon with a maximum width of 4.51 cm and

a maximum height of 3.85 cm. it is in a good condition of conservation. Without any superimposition.

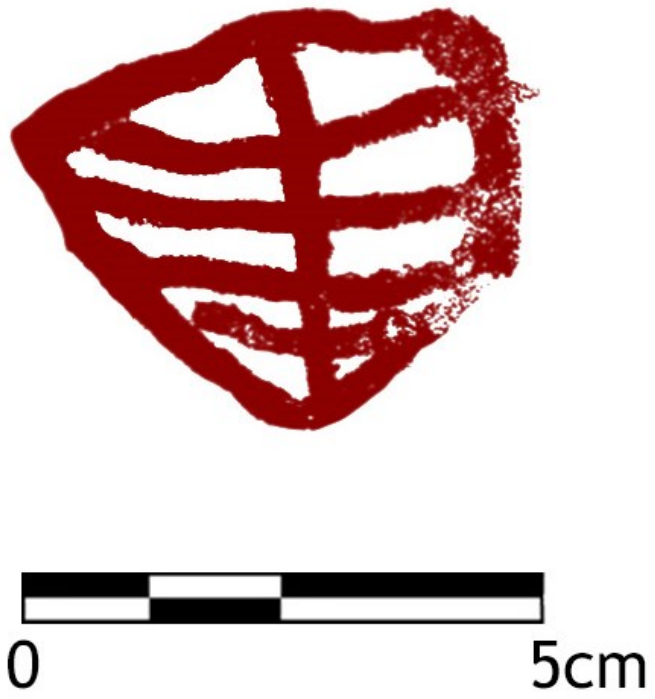


Figure 96:Figure 8 from shelter IV.

5 Discussion

The Sanchez Carrasco shelters, located in the heart of the Sierra de las Vacas mountain range, showcase striking reliefs that are primarily composed of Silurian quartzite with distinctive red patches resulting from iron oxide deposits. These mountains have a rich history, once inhabited by Neolithic people. (perello 1993)

Chronologically, the rock art found at Sanchez Carrasco spans a significant timeframe, as evidenced by comparisons with similar paintings and sites across the region and the Iberian Peninsula. This art covers a broad period of use of the shelter, extending from the early Neolithic era to the Copper Age or Chalcolithic period (approximately 6000-2000 BC).

The limited typological diversity observed in the rock art of the Serra das Vacas region, especially the prevalence of tectiforms and ramiforms, raises intriguing questions about their meaning and prevalence in this particular area. To delve deeper into this enigma, we need to consider what these tectiforms and ramiforms represent and why they seem to be such dominant symbols in this unique cultural context.

This intriguing pattern raises several compelling questions. Are these geometric symbols a reflection of the environment, perhaps the natural landscape or the flora and fauna specific to the region? Or could they have a deeper cultural or religious significance, representing the beliefs and rituals of the people who created them?

Furthermore, understanding why these symbols are so prevalent here may shed light on the cultural and social dynamics of the Serra das Vacas at the time when these artworks were created. Were these symbols part of a shared cultural identity passed down from generation to generation, or did they serve a specific purpose within the society of the time?

Exploring these questions not only deepens our appreciation of the rock art of the Serra das Vacas, but also provides valuable insights into the lives, beliefs and cultural expressions of the people who once inhabited this remarkable region.

Its style belongs to the so-called schematic rock art, with unnatural and very synthetic pictograms, with a predominance of simple motifs, except for some anthropomorphic motifs that are more complex (Collado Giraldo and García Arranz, 2017).

Technically, these pictographs are made with simple linear or circular strokes. Depending on the instrument with which the paintings were traced (hair or vegetable fibre brushes, sharpened sticks, feathers, etc.), a variety of thicknesses and sizes can be seen. Other procedures used include finger-tip printing. The size of the paintings does not vary much; in most cases they are considered to be small figures. All the pictograms are made with red pigments of different shades depending on their degree of preservation, the main elements of which we imagine to be iron oxide and hydroxide, materials that are very abundant in the surroundings of the Sierra de las Vacas (Collado Giraldo, 2014; Gomes et al., 2015; Rosina et al., 2019; Garcês et al., 2022; Gomes et al., 2022; Nicoli et al., 2022).

Typological analyses of ramiform motifs in pictorial works begin from the beginning of the research and are practically dealt by famous researchers in this field. The key issue was its interpretation, because while some were regarded anthropomorphic representations, others were clearly identified as vegetative representations (Breuil (1933-35: vol. II: 89). Later, Pilar Acosta (1968: 124-132), examined this problem in greater depth. Acosta did a comprehensive examination of the problem, dividing it into "ramiforms of simple typology" and "ramiforms of special typology" Within the former,

the most often recognized interpretation is that of human representation, yet depending on the graphical motifs, it tends to view them as representations on other occasions (García, 1963: 47 & Perelló 1993).

According to Collado Giraldo & García Arranz (2017), the "ramiform" motifs are formed by a vertical line or axis from which several straight, broken, wavy, curved, etc. lines depart to both sides, perpendicular or inclined with respect to it. This typology is usually given a double interpretation, either human or vegetal (the latter with arborescent forms in its ramifications), depending on the similarity with other figures of the same meaning, the general context in which they are found, the relationship with other motifs, etc. There are ramiforms in which the lateral "arms" are autonomous, not connected to the central axis, and others in which the main axis extends horizontally, and not vertically. Certain cases of particularly synthetic or elementary arboriforms can also be classified as ideomorphs or abstract symbolic figures.

There are four anthropomorphic ramiform motifs in the panel I of the shelter I, (fig. 57, fig.58, fig. 59)

One of the best shelters to make a stylistic comparison with the ramiforms in Shelter 1 at Sanchez Carrasco 1 are the shelters at Cornisa de la Calderita, where there are up to 15 figures belonging to this category. Quantitatively, this is the second most representative typology within the anthropomorphic group, representing 14.15% of the total in the Calderita shelter. Almost all specimens are concentrated in Calderita 1, which contains 14 of these figures, distributed between panels 2, 3, 4 and 6, which together represent 16.47 per cent of the human representations documented in this shelter. The remaining figure was found in panel 13 of La Calderita 2, representing 5% of all the anthropomorphic figures studied in this site.

Ramiforms are relatively common figures in schematic art, both in the form of paintings and engravings. Examples can be found in rock art shelters all over the Iberian Peninsula, such as in the Tagus valley in the form of engravings, for example (Garcês, 2017).

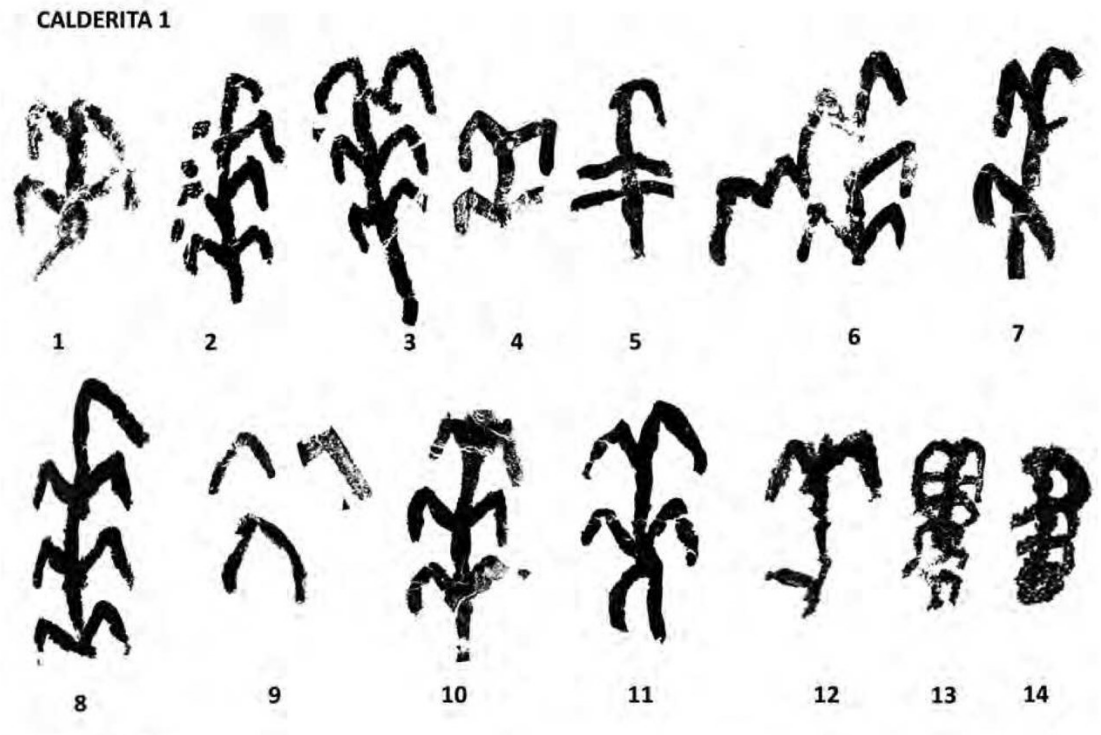


Figure 97:Ramiform figures from La Calderita 1 shelter (Collado Giraldo & García Arranz (2017).

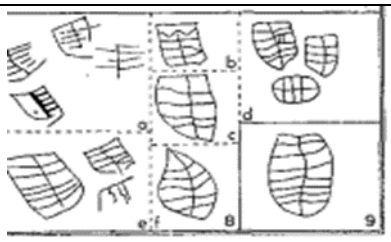
Tectiforms or Structures constitute yet another intriguing aspect of the rock art found in this collection of rock stations. According to Collado Giraldo and García Arranz (2017) this name refers to geometrical figures which, because of their formal features, seem to resemble certain constructions: architectural structures, fences or livestock enclosures, stairways, traps, etc. They generally take the form of quadrangular or rectangular figures, with an internal grid of various lines which give them the appearance of 'grids' or 'trellises'.

These distinctive forms are not unique to this region but are present across the entire spectrum of Iberian schematic art. Furthermore, these tectiforms exhibit intriguing correlations with other elements within the art, such as tectiform-soliform-bars, tectiform-bars, and tectiform-anthropomorphic representations (Perello 1993). This interplay of tectiforms with other symbols adds depth and complexity to the overall composition, offering a richer tapestry of meaning within this ancient artistic tradition.

Tectiform motifs are dominant in Sanchez Carrasco shelters: there are two motifs in shelter I: panel I sector A (Fig.48) in sector B (fig.55) in sector D (fig.67); shelter II:

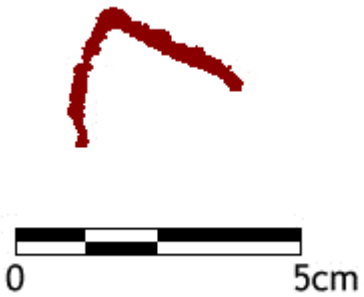
panel I & II: (fig.71) and (fig. 76); shelter III: Panel II: (fig.82); shelter IV: Panel I: (fig. 89 to 96).

Table 11:Comparison of Tectiform figure from panel 1 Sanchez Carrasco IV.

		
Sanchez Carrasco IV Panel 1	Tectiform type in nuclei of Penalsordo, II, III. Helechal Cabeza del Buey, Spain (Perello 1999)	Tectiform motif from La Calderita , Spain (Collado 2017)

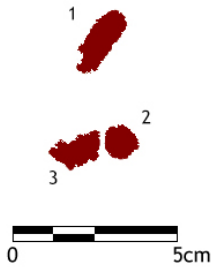
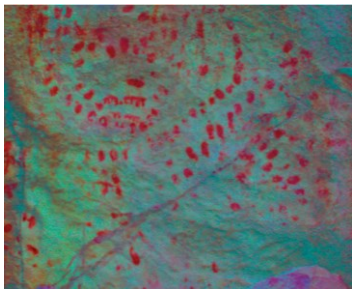
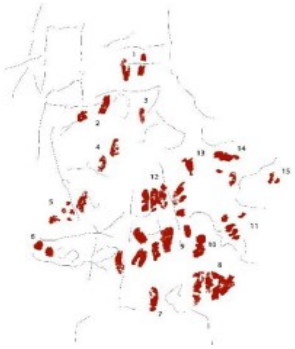
Angles: the figure of angle is considered to be one of the oldest figures of schematic rock art in Iberian Peninsula. These are usually autonomous motifs, which may appear in isolation. It is a very common motif in peninsular schematic art. For example, it is one of the motifs most commonly represented in the Calderita shelter Collado Giraldo and García Arranz (2017). According to Collado Giraldo (2013), angled motifs are relatively frequent in other stations of the schematic cycle, where they usually integrate the imagery corresponding to the initial stages of the iconographic discourse. Without leaving the region, we can highlight the presence of angled motifs in the lower part of panel 4 of the shelter of Castillo de Monfragüe, in the Cáceres town of Torrejón el Rubio (Collado and García, 2007), possibly one of the best-known shelters in Extremadura. Other parallels have been documented by Rubio Andrada (1995) in the remarkable painted ensemble of Paso de Pablo (Cabañas del Castillo, Cáceres), or by Caballero Klink (1983) in the shelter of Morrón del Pino, in Sierra Quintana (Fuencaliente, Ciudad Real).

Table 12:Comparison of Angular figure from panel 1Sector B, Sanchez Carrasco I.

	
Sanchez Carrasco I Panel 1 Sector B	La Calderita I, panel 5A Spain

Dots or digits: This is another type of decorated panelling by Sanchez Carrasco. This is one of the most frequent typologies in the schematic art of the Iberian Peninsula. As an example, we can see a large number of these figures in the Calderita shelter (62 figures) (Collado Giraldo & García Arranz (2017) and fewer in shelters such as Pego da Rainha in Mação (Martins, 2014; Pillai, 2019) and in different colours in the Benquerencia de La Serena shelters (Rosina et al., 2019).

Table 13:Comparison of Dots figure from panel 1Sector B, Sanchez Carrasco I.

		
Sanchez Carrasco I Panel 1 Sector B	Shelter of La Calderita (digital tracing in DStrech®, (Collado 2017)	Panel 1 Shelter 2:Pego de Rainha Mação (Pillai, 2019)

Conclusion:

Thanks to technological advancements, constructing a chronological timeline based on artistic style, particularly with pigment-based themes, has become significantly more convenient. This process necessitates the extraction of a maximum number of photographs from the site, and digital technology greatly aids in achieving this goal. The advantage of digital technology lies in its capacity to provide more objective and less subjective findings compared to human visual analysis.

Today's software applications are exceptionally advanced, and researchers worldwide are continually updating their methodological skills by harnessing cutting-edge technologies. For instance, laser scanners for 3D reconstructions, drones, and digital cameras enable the simultaneous capture of numerous images. However, it's worth noting that transporting such equipment to some remote sites may present logistical challenges. Some software applications, such as the DStretch® plugin for color manipulation and freely available 3D reconstruction software, have become accessible and affordable. Statistical analysis further assists in quantifying the number of figures present and their typological distribution. Advanced technologies are also invaluable for assessing the degree of deterioration that these ancient pigments have endured over millennia.

These delicate artistic figures are susceptible to various forms of degradation, underscoring the importance of regular site assessments, heightened awareness, and the development of effective management strategies for their conservation. Through these artistic representations, our ancestors have left behind messages and meanings for us to decipher and appreciate. Consequently, it becomes our responsibility to comprehend, conserve, and pass on this rich cultural heritage to future generations.

From a chronological perspective, the rock art of Sanchez Carrasco, when considered alongside other paintings and sites in the region and the broader Iberian Peninsula, spans a vast period of use of the shelter. This artistic tradition extends from the Early Neolithic era to the Copper Age or Chalcolithic period, covering the span of 6000-2000 BC. This extensive timeline reveals profound processes of economic, social, and cultural change, thus explaining the richness in terms of the variety of figures and the evolving techniques employed in their creation.

According to the colleagues who accompanied us on the fieldwork, the Serra das Vacas now has more than 500 undocumented rock art shelters.

The digital documentation of the schematic paintings of the Serra de las Vacas plays a key role in the conservation and heritage value of rock art studies in Extremadura region. This method of documentation has many implications for the conservation and understanding of this prehistoric artistic heritage. Digital technology allows for the creation of high-resolution, detailed records of rock art, ensuring that even the most intricate details are digitally preserved. This is essential to protect the art from potential deterioration due to environmental factors, vandalism or other threats. Digital documentation allows these records to be shared with researchers, scholars and the public worldwide. This accessibility fosters collaboration, knowledge sharing, and a broader understanding of the art's historical and cultural significance.

Digital records are an invaluable resource for researchers and archaeologists. They can conduct in-depth analyses, including stylistic comparisons, chronological studies and typological investigations, which help to uncover the history, symbolism and cultural context of the art and allows researchers to construct chronologies based on stylistic elements, helping to date rock art and understand the evolution of artistic styles over time. This temporal context is essential for placing the art within a broader historical narrative.

Documentation also provides a basis for assessing the condition of the rock art. This information is essential for the development of conservation strategies that can mitigate the effects of natural deterioration, climate change or human intervention, and ensure the longevity of these precious heritage sites, enabling the creation of educational resources, including virtual tours, digital exhibitions and educational materials. These resources engage the public and raise awareness of the importance of preserving and respecting rock art heritage.

In conclusion, the digital documentation of the Serra de las Vacas schematic paintings is essential for the conservation and heritage significance of rock art studies. It not only helps to preserve these fragile artworks, but also facilitates research, public engagement and the transmission of cultural knowledge across time.

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