Research Article

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Dehesilla Cave Rock Paintings (Cádiz, Spain): Analysis and Contextualisation within the Prehistoric Art of the Southern Iberian Peninsula

https://doi.org/10.1515/opar-2024-0010
received January 30, 2022; accepted May 16, 2024

Abstract: A systematic survey of Dehesilla Cave was carried out during 2017 in order to search for traces of rock art. Several panels with paintings were identified in the chamber next to the entrance (consisting of strokes, dots, stains, and remnants of shapes in red and black), which had remained unnoticed up until now and may provide relevant information towards the understanding of the prehistoric use of the cave and its seemingly symbolic topography. However, we cannot assume *a priori* a relationship between these paintings and the well-known Neolithic sequence of the site. To assess these paintings, we have analysed photomicrographs which have allowed us to determine their detailed characteristics, stroke morphology, and remnant features (for instance, hue, shape, density of paint, pigment grain size, micro-stroke traces left by the tools used). Taphonomic issues have also been considered and several physical and chemical techniques of analysis have been applied in order to identify the pigments and possible binders.

Keywords: rock art, Southern Iberian Peninsula, Neolithic, physical and chemical analysis, Dehesilla Cave

1 Introduction

Dehesilla Cave (Jerez de la Frontera, Cádiz) is a relatively large cavity located in the western foothills of the Subbetic System (Sierra de Cádiz) at an elevation of about 290 m, on the South side of Cerro de la Arrayanosa, which reaches 464 m above sea level (Figures 1–3). The inner widest breadth of the cave reaches almost 35 m,

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whilst its maximum length is just over 49 m. Its maximum internal height from the current ground level is approximately 22 m. The entrance of the cave is a 16.25 m wide rock shelter, looking out over an exceptional view towards the South. The cavity is divided into four chambers of different dimensions.

Geologically, it is located in the Middle Subbetic, stratigraphically formed by a sequence of dolomites from the Lower Lias; marls and limestones with flint from the Upper Lias, Dogger, and Malm; and limestones and marls from the Cretaceous. The base of this sequence appears in contact with gypsiferous Keuper marls (Trias) through an overthrust (Delannoy & Díaz del Olmo, 1986). Morpho-structurally, the Arrayanosa hill belongs to a recumbent tectonic system, with a chest fold that locally displays superimposed tectonic fractures, giving way to fault line folds. The gallery system is made up of currently inactive and suspended sub-horizontal conduits, one of which opens onto the southern slope of the hillside (Cerro Arrayanosa), with characteristics indicative of a forced conduit (García Rivero et al., in press) (Figure 4). Numerous rock shelters and caves are known in the Sierra de Cádiz geological complex, an area in which evidence of prehistoric settlements and rock art has previously been documented (Baena et al., 2012; Cortés & Simón, 2007; Fernández Sánchez, Gutiérrez López, Navarro Robles, Espinosa Borrego, & Arroyo Álvarez, 2018; Guerrero Misa, 1992; Jennings et al., 2009; Mora Figueroa, 1970, 1976; Pellicer & Acosta, 1982; Santiago et al., 1997).

The historiography of Dehesilla Cave began with speleological explorations in 1970 (Martí, Sanmartí, & Viñas, 1975; Viñas Vallverdú, 1970, 1971). In 1977 and 1981, an archaeological stratigraphic sequence including Neolithic and Copper Age levels was excavated (Acosta & Pellicer, 1990). A new research project was launched in 2015, under the title *Cueva de la Dehesilla*: *Estudio arqueológico y paleoambiental para el conocimiento de la ocupación humana prehistórica de la Sierra de Cádiz* (authorised by the Consejería de Cultura of the Junta de Andalucía). A three-dimensional topographic reconstruction of the cavity, geomorphological and geoarchaeological studies, and archaeological excavations outside and inside the cave have been carried out. Evidence of Islamic Medieval settlement was documented on the external terrace at the cave entrance. The stratigraphic sequence inside the cave spans the entire Neolithic. From the archaeological materials and radiocarbon dates, several specific Neolithic periods have been distinguished: Early Neolithic A (~5600 cal BC), Early Neolithic B (*ca.* 5550–5000 cal BC), Middle Neolithic A (*ca.* 4800–4500 cal BC), Middle Neolithic B (*ca.* 4500–4000 cal BC), and Late Neolithic (from 4000 cal BC) (García Rivero et al., 2018a,b, 2019, 2022b, 2023; García Rivero et al., in press; García Rivero, Barrera Cruz, Díaz Rodríguez, Vera Rodríguez, & Taylor, 2022a; Taylor, Pérez Aguilar, & García Rivero, 2018). The latest excavations located two exceptional ritual environments, deep within the cave. The first, belonging to the Middle Neolithic A period (*ca.* 4800–4500 cal BC), included two human skulls displaying some traumatic traces, and a beheaded goat, deposited within a context created out of stones and with clear evidence of a hearth. One of the associated pottery vessels displays a particular symbolic decoration similar to one found in the schematic rock art of the region and known as ramiform figures (García Rivero et al., 2020). The second, belonging to the Early Neolithic Period, is formed by a plain pottery vessel covered by part of a human skull and a stone structure (García Rivero et al., 2021).

The purpose of this article is to present and discuss the new findings and the results of the physical and chemical analyses of the pictorial depictions from this cave in order to put forward a relative chronology. Indeed, the motifs discovered cannot automatically be attributed to the schematic art belonging to the farming and herding populations of the Iberian Peninsula (Acosta, 1968; Breuil, 1933–1935; Martínez García & Hernández Pérez, 2006, 2013). Consequently, a most detailed examination is of prime importance. In an archaeological site such as Dehesilla Cave, with repeated occupation during Prehistory and History, all anthropic evidence must be taken into account, regardless of whether or not its chronology has been established. The results of these studies are essential for future conservation and management proposals (Mac Leod, 2000), developed on the basis of a deep understanding of the paintings themselves, other related evidence, and the particular environment in which they have been found (Gomes, 2020).

We have analysed the rock paintings at Dehesilla Cave from typological and spatial perspectives, taking as a starting point the corpus of the prehistoric art of Western Andalusia. The nearest reference sites are located in the hill ranges surrounding the Laguna de la Janda (located between the South of the province of Cádiz and the Straits of Gibraltar), displaying hundreds of ornamented rock shelters, as well as La Pileta Cave, which is closely linked to the caves of the province of Málaga and their palaeolithic artistic representations. Although

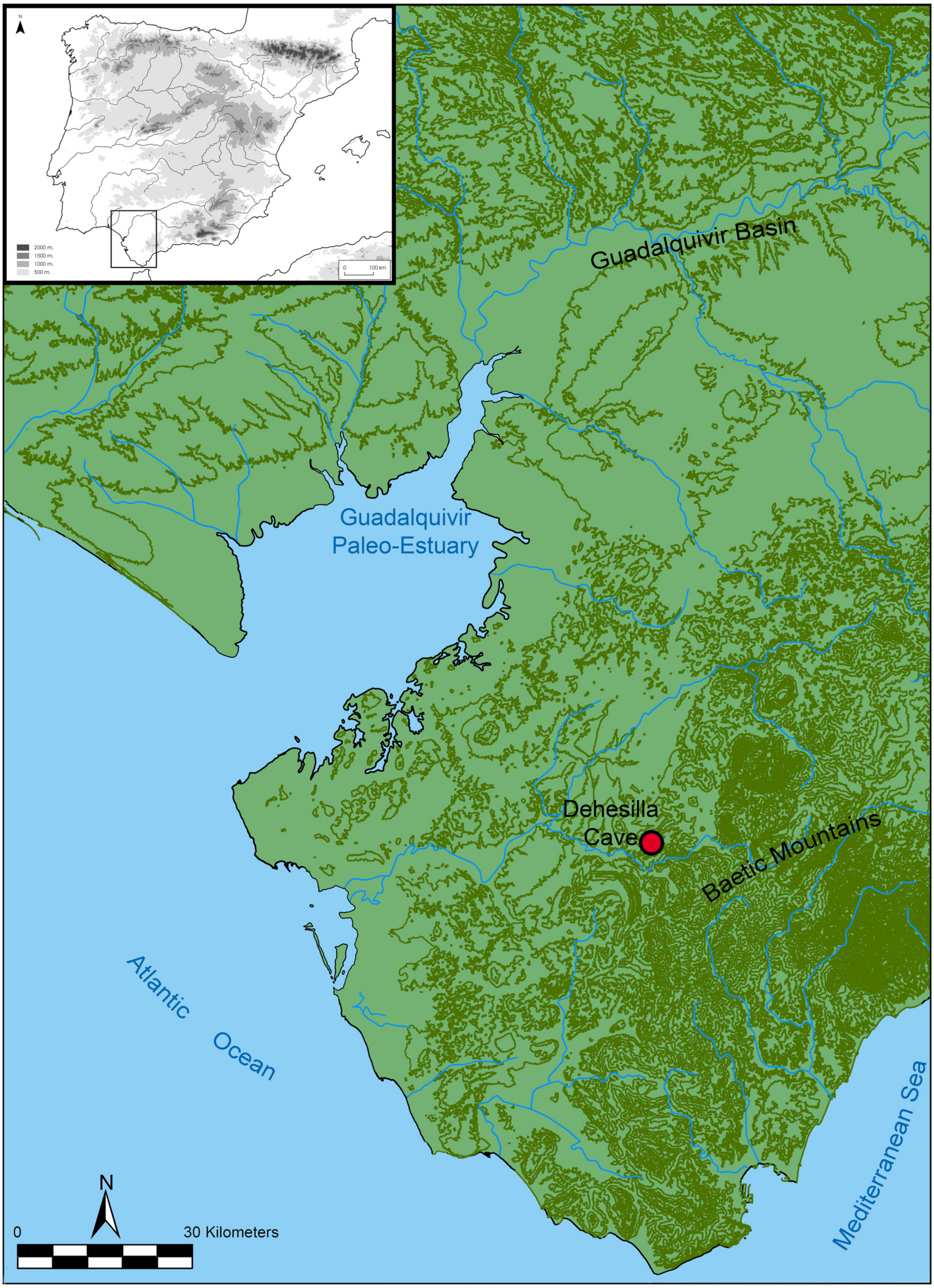

Figure 1: Location of Dehesilla Cave in the South of the Iberian Peninsula. Based on Instituto de Estadística y Cartografía of the Consejería de Transformación Económica, Industria, Conocimiento y Universidades of the Junta de Andalucía. Available from: http://www.juntadeandalucia.es/institutodeestadisticaycartografia.

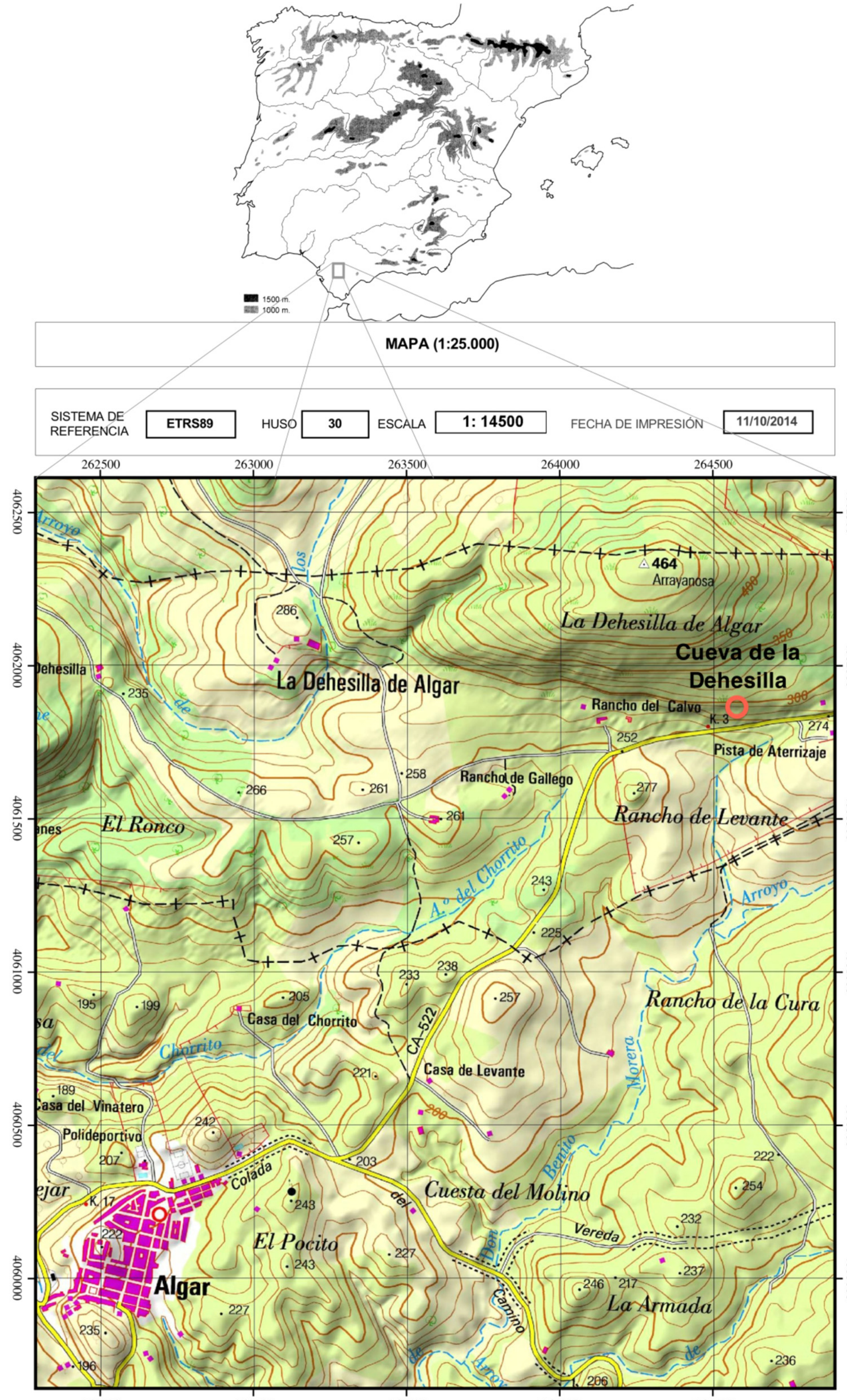

Figure 2: Location of Dehesilla Cave in relation to the village of Algar. Based on the *Iberpix viewer*, 1:25,000 topographic map. Instituto Geográfico Nacional of the Ministerio de Transportes, Movilidad y Agenda Urbana of Gobierno de España.

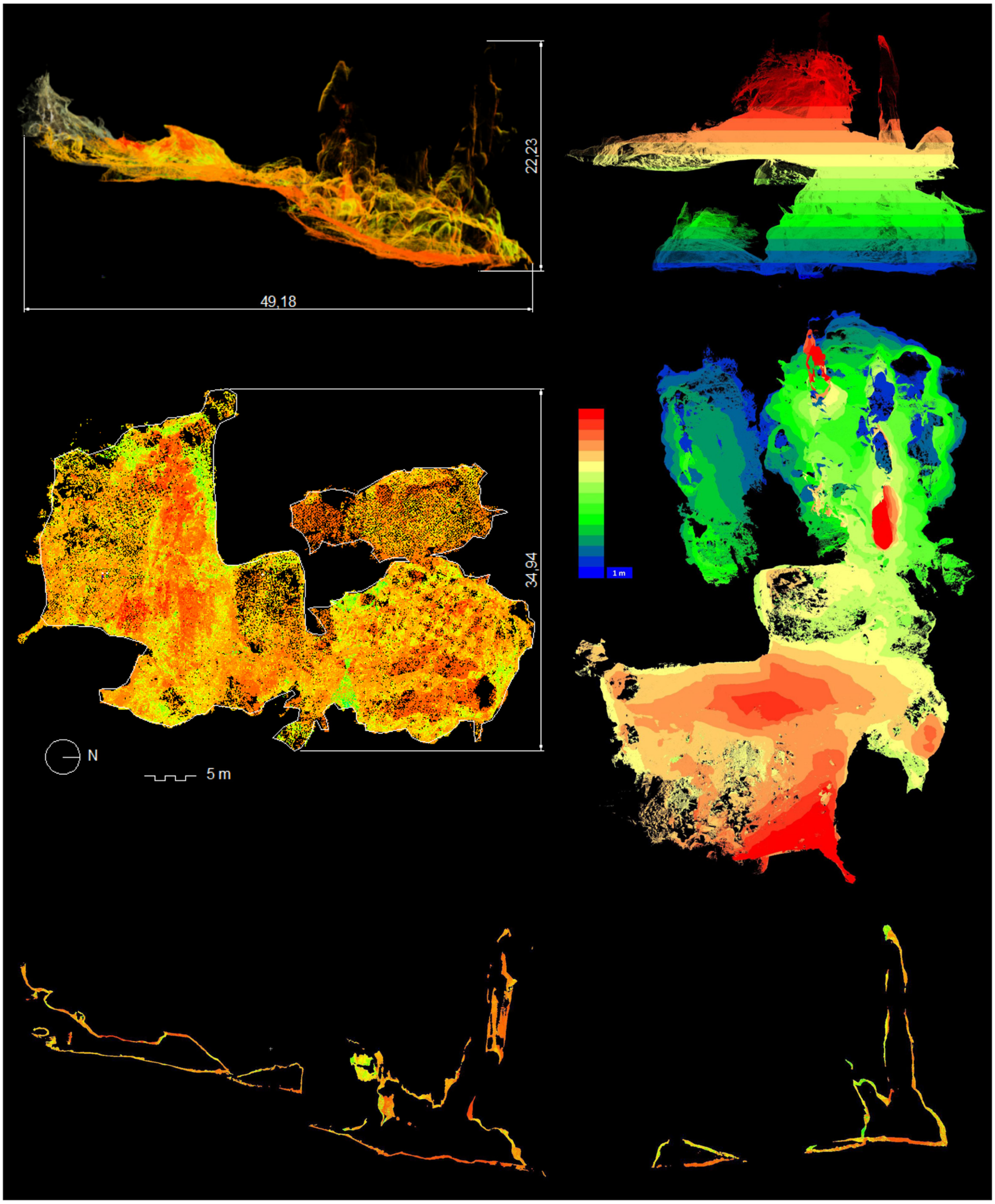

Figure 3: 3D topographic model of the cave.

not as close, geographically, but sharing similar Neolithic archaeological contexts and cave settlements, we have also considered the sites of the Subbetic hill ranges (province of Córdoba).

2 Materials and Methods

Since no information on parietal art was available prior to our exploration of Dehesilla Cave, the survey strategy consisted of a systematic and exhaustive examination of the walls. The cave was divided into sectors

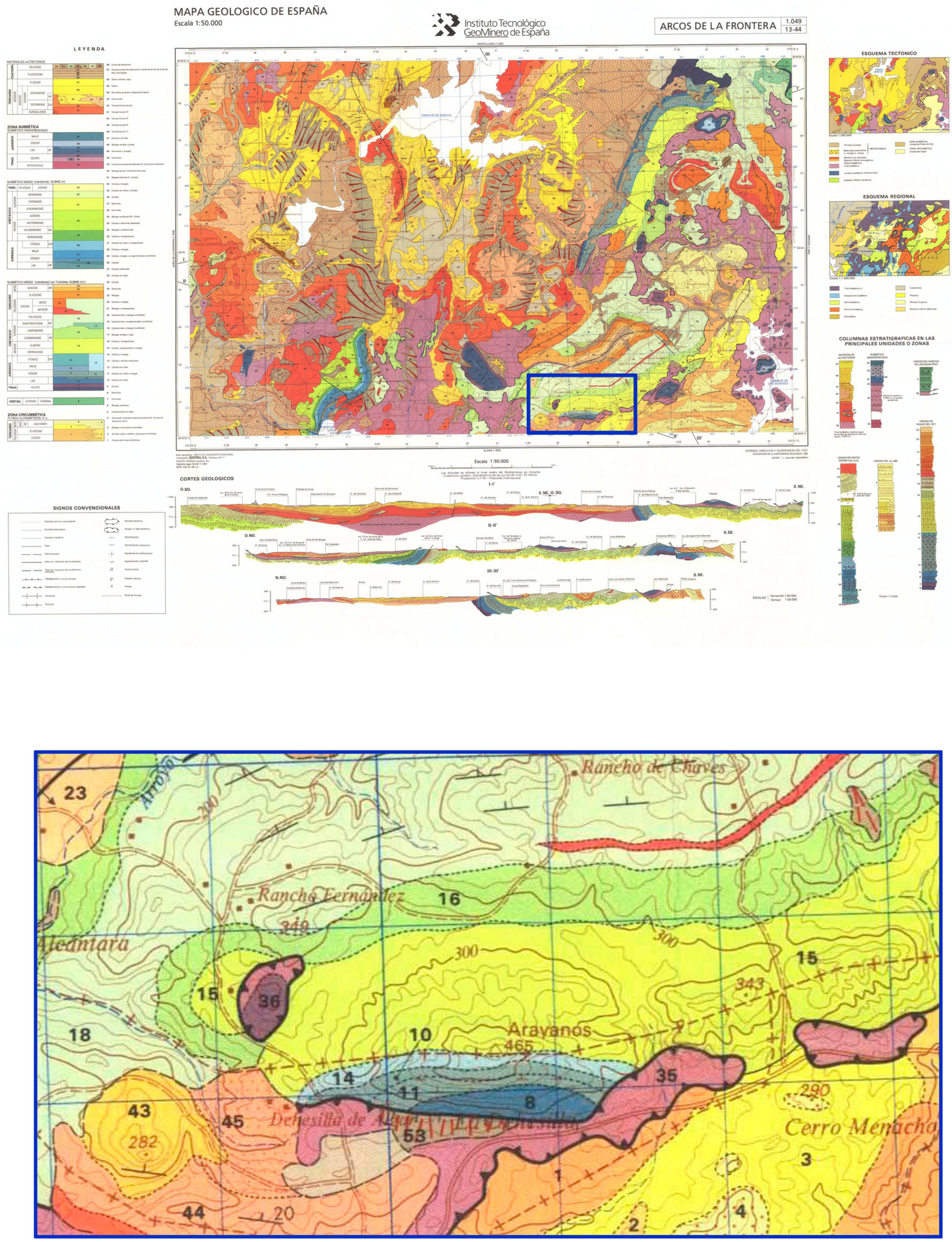

Figure 4: *Mapa Geológico de España. 1:50,000. 1049 (Arcos de la Frontera)* (1991).

based on the existing topographies, so as not to omit any area, including those of difficult access. Each sector was carefully examined with direct and grazing artificial lighting, making sure no painted or engraved evidence was missed. Several surfaces with traces of paintings were identified in the southern half of the cave, close to the entrance.

Once a motif, a possible representation or remnant was found, it was topographically located, photographed, and photomicrographed under different lighting techniques. The images were later processed using *Photoshop* in order to obtain high-quality digital reproductions, avoiding direct intervention on the actual paintings and contact with the samples, thus eliminating any possible negative impact of the recording process (Mas Cornellà, Maura Mijares, Solís Delgado, & Pérez González, 2013b).

Sampling followed strict protocols in order to avoid any possible contamination: microsamples were obtained using sterile scalpels, wearing latex gloves and masks. Samples have been stored in cryotubes or Eppendorf tubes (Mas Cornellà et al., 2013a). Several analytical techniques were applied.

As a first approach to both the external and internal visual appearance of the samples, photographs were taken through a Nikon SMZ 100 stereoscopic microscope.

An Olympus BX 51 reflected light optical microscope with an integrated ultraviolet lighting system (Wood's lamp) was used to observe the microsamples, which were previously embedded in a methacrylate resin and cut in cross-section.

Scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM-EDX) were used to complete the textural and compositional study of the microsamples. The equipment used was a Hitachi S-3400 located at the Centro de Microscopía Electrónica *Luis Bru* of the Universidad Complutense (Madrid).

Fourier transform IR (FTIR) spectroscopy has mainly been used for the identification of mixing with other components. These analyses were carried out between 4,000 and 550 cm^{-1} using the universal attenuated total reflectance (UATR) technique.

GC has been used for the determination of possible binders, including lipophilic substances, such as drying oils, resins, and waxes; and hydrophilic substances, such as proteins and polysaccharides gums (gum arabic and similar products). The analysis of lipophilic substances required the samples to be treated with the Meth-Prep II (Alltech assoc. 2 M methanolic solution of *p*-tolyltrimethylammonium hydroxide as a methylation reagent). For proteins, lipids, and terpenic resins, hydrolysis with 6 M HCl and derivatisation with TBDMSTFA (*bis*-tert-butyldimethylsilyl-trifluoroacetamide) in pyridine were carried out of the resulting fatty acids, amino acids, and terpenic acids.

The combination of these procedures and complementary techniques permits a complete and detailed characterisation of the pigments and possible binders.

3 Results

3.1 Techno-Morphological Analysis

Three painted sectors have been located in the entrance chamber of the cave. We identify them as S1, S2, and S3 (Figure 5).

3.1.1 Sector 1 (S1)

Six strokes, accumulations, or remnants of red and black paints have been documented, which could make up a motif or pictorial unit (Figure 6). However, its original formal composition is unclear due to its current state of preservation:

S1.1.1: Curved stroke with a pointed upper extremity (black paint superimposed over red [*M. 10R 3/6*][1]).

S1.1.2: Remnants (black).

S1.1.3: Curved stroke and stains or remnants of red [*M. 10R 3/6*] paint superimposed over black.

1 *Munsell Soil Color Charts* (Munsell, 1981).

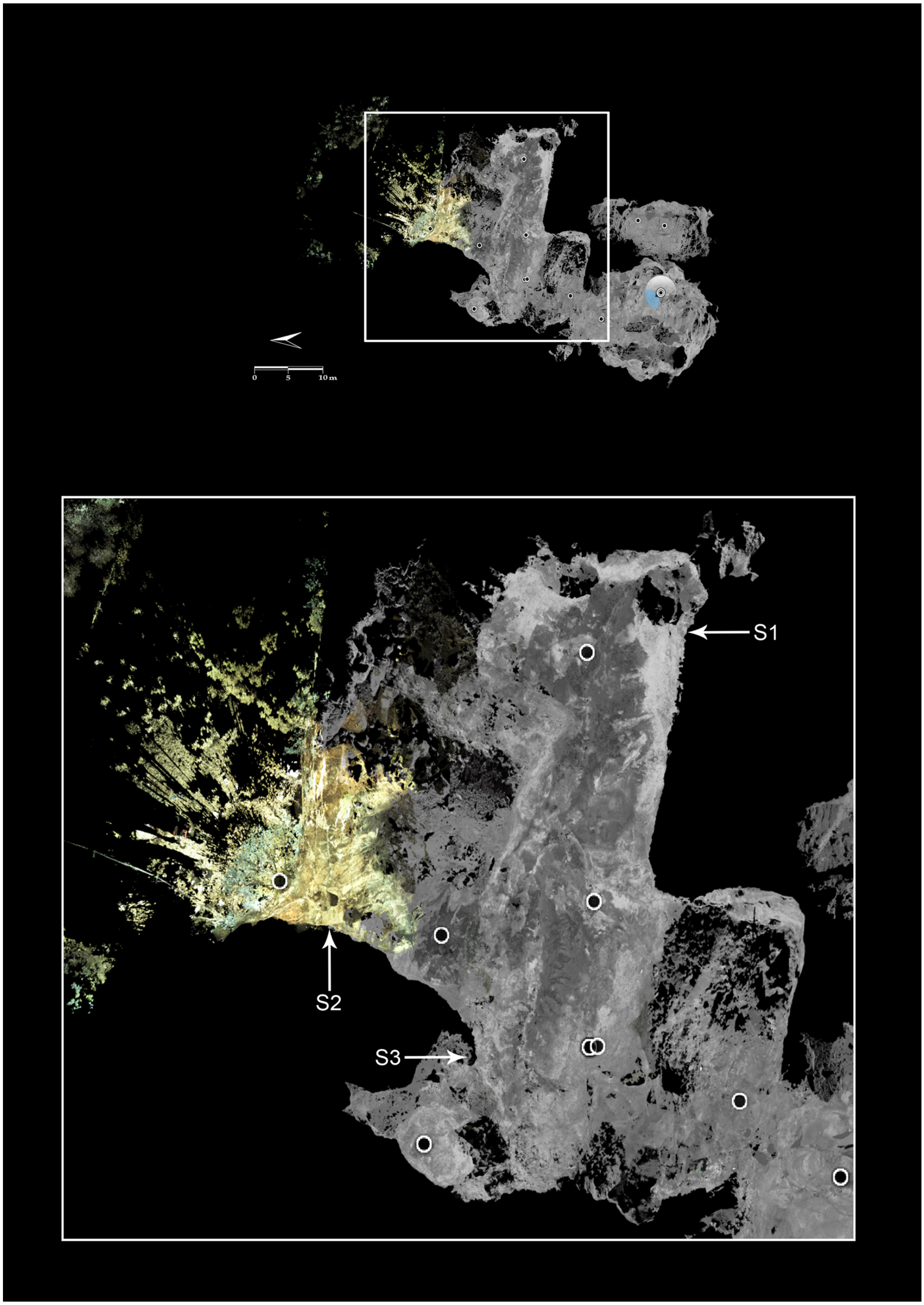

Figure 5: Location of Sectors 1, 2, and 3 in the 3D topographic model.

S1.1.4: Remnants (black).
S1.1.5: Remnants (black).
S1.1.6: Stains or remnants (red [*M. 10R 3/6*] paint superimposed over black).

Figure 6: Sector 1. Photograph and digital tracing.

Photomicrographs with magnifications ranging from 25× to 50× were taken of particular points of the motifs in order to analyse their pictorial techniques (Figure 7). In S1.1.1, the use of two pigments, red and black, is noteworthy. The direction of the brush stroke may be deduced from the probable marks of bristles, which allow us to infer plastic activity. In traces S1.1.3 and S1.1.6, the use of the two colors is repeated. Marks formed during the application of red pigment are also observed, especially in S1.1.6. The fact that black-over-red and red-over-black layers were described together suggests the possibility of synchronised performance.

3.1.2 Sector 2 (S2)

It is located at the entrance of the rock shelter on a surface exposed to natural light (Figure 8). Given the dimensions of this sector and the distance between the painted depictions, three panels have been defined: Panel S2.1, Panel S2.2, and Panel S2.3.

Panel S2.1 (Figure 9).

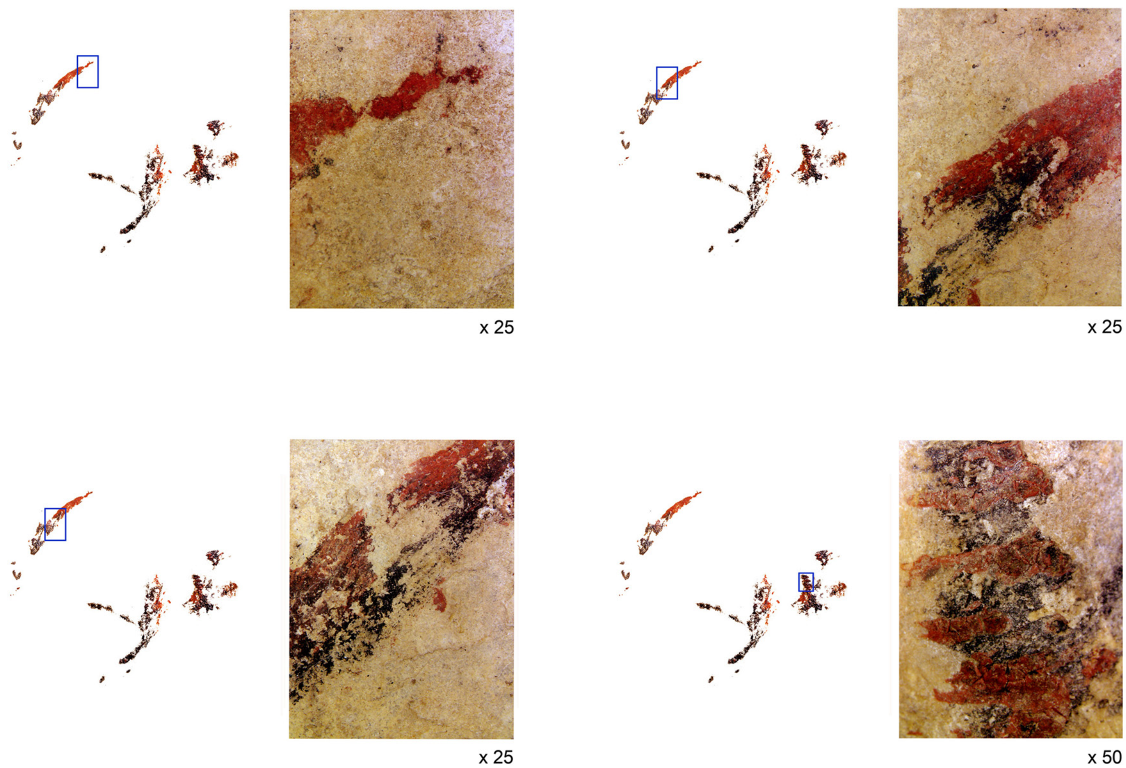

Figure 7: Sector 1. Photomicrographs (DigiMicroscope USB Reflecta).

S2.1.1: Possible finger painting (red [*M. 10R 4/8*]).
S2.1.2: Possible finger painting (red [*M. 10R 4/8*]).
S2.1.3: Stain (red [*M. 10R 4/8*]).
Panel S2.2 (Figure 10).
S2.2.1: Partially drawn Greek phi-shaped figure (orange red [*M. 2.5YR 5/8*]).

The 10× magnification photomicrographs were taken in order to carry out a more detailed technical observation of motif S2.2.1 (Figure 11). The image provides evidence of discontinuous strokes of variable thickness, probably made by a haematite mineral fragment applied directly to the cave wall.

Panel S2.3 (Figure 12).
S2.3.1: Dot (orange red [*M. 10R 5/8*]).
S2.3.2: Dot (orange red [*M. 10R 5/8*]).

3.1.3 Sector 3 (S3)

A single motif has been documented on a speleothem at the entrance of a diverticulum, or side room, in the eastern area of the chamber (Figure 13). The complete absence of natural daylight in this part of the cave, despite its proximity to the entrance, must be taken into account.

S3.1.1: Dot (carmine red [*M. 10R 3/4*]).

The dot is covered by a concretion layer, indicating that it might be an ancient motif.

3.2 Physical and Chemical Analyses

All samples were taken from panel S1 (Figure 14) as the most complex composition.

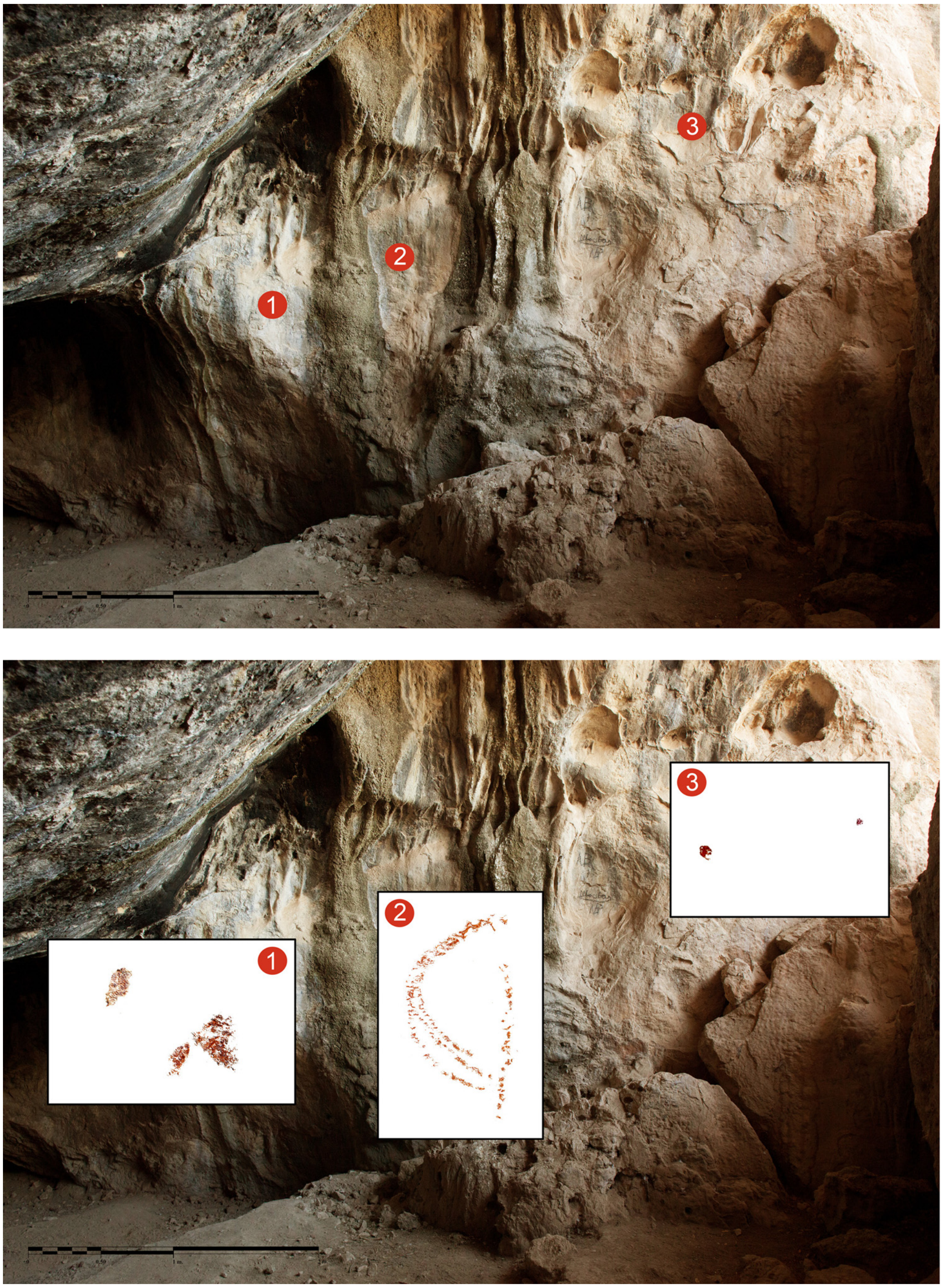

Figure 8: Location of the panels in Sector 2.

3.2.1 Sample 1 [S1.1.1] (Red and Black Paint)

The study of this sample using stereoscopic microscopy, reflected light optical microscopy, and SEM-EDX has enabled us to determine its stratigraphic layering based on elemental chemical composition and texture (Figures 15–17).

Layer 1. A homogeneous compact layer, slightly translucent with a minimum thickness of approximately 100 µm. Its elemental chemical composition shows a higher percentage of calcium with traces of silicon and magnesium. A discontinuous and irregular remnant of a silicate composite has been identified in the lower portion of the layer.

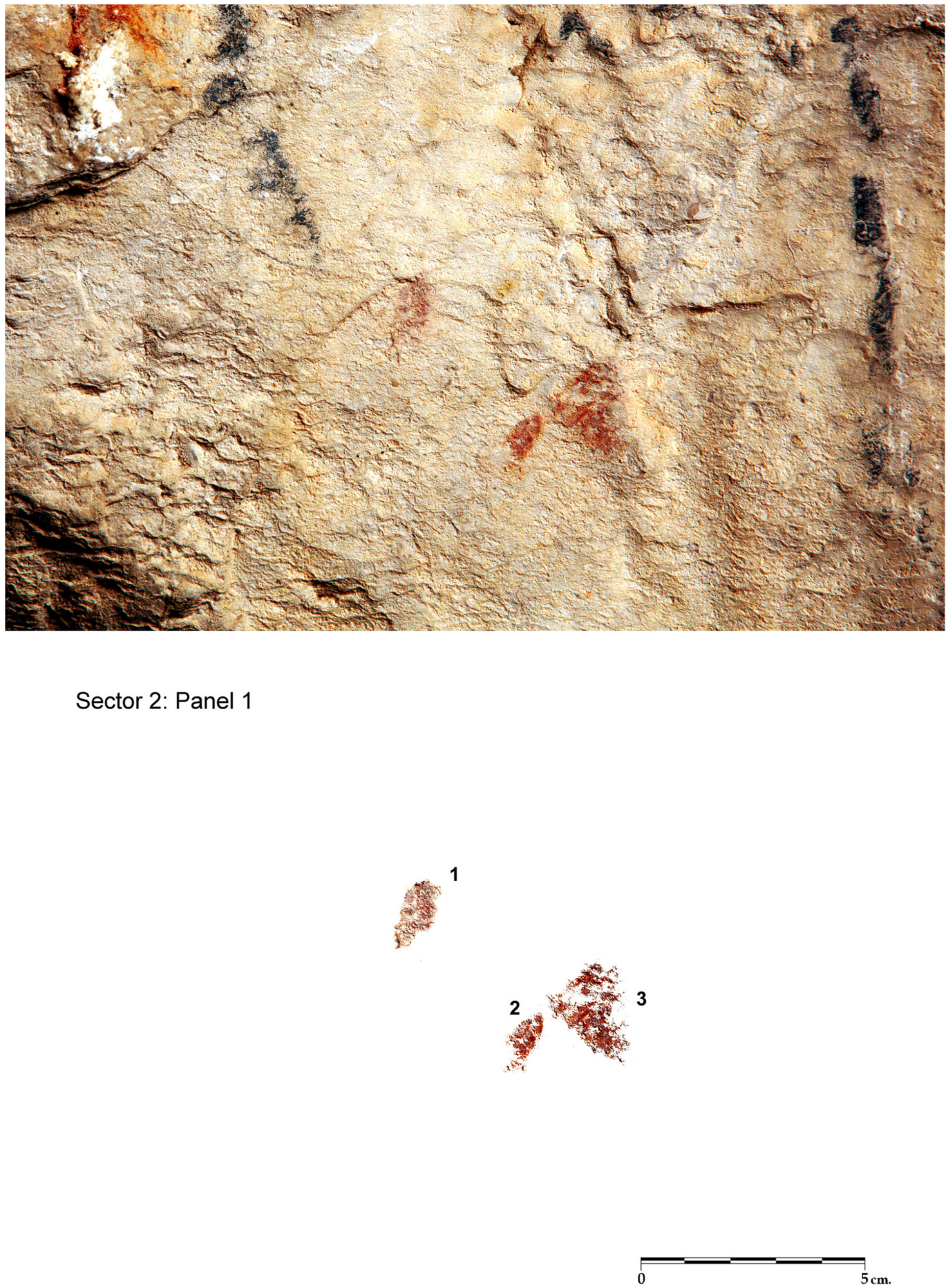

Figure 9: Sector 2, panel 1. Photograph and digital tracing.

Layer 2. A thin film displaying a caramel texture, with a thickness between 10 and 40 μm and a heterogeneous consistency, considering that areas with a higher average of silicate and others of calcium have been identified. The areas of silicate composition are characterised by a notable content of silicon, aluminium, and magnesium, while the areas of higher calcium contents show larger quantities of calcium and oxygen, thus suggesting the presence of oxalates. In general, the content in siliceous material is higher in the lower portion of the layer.

Layer 3. White layer with an average thickness of around 25–30 μm and a fundamental calcium composition that appears to correspond to an essentially oxalate layer.

Layer 4. Red layer, thin (5–15 μm) and discontinuous, consisting essentially of iron oxides (haematite).

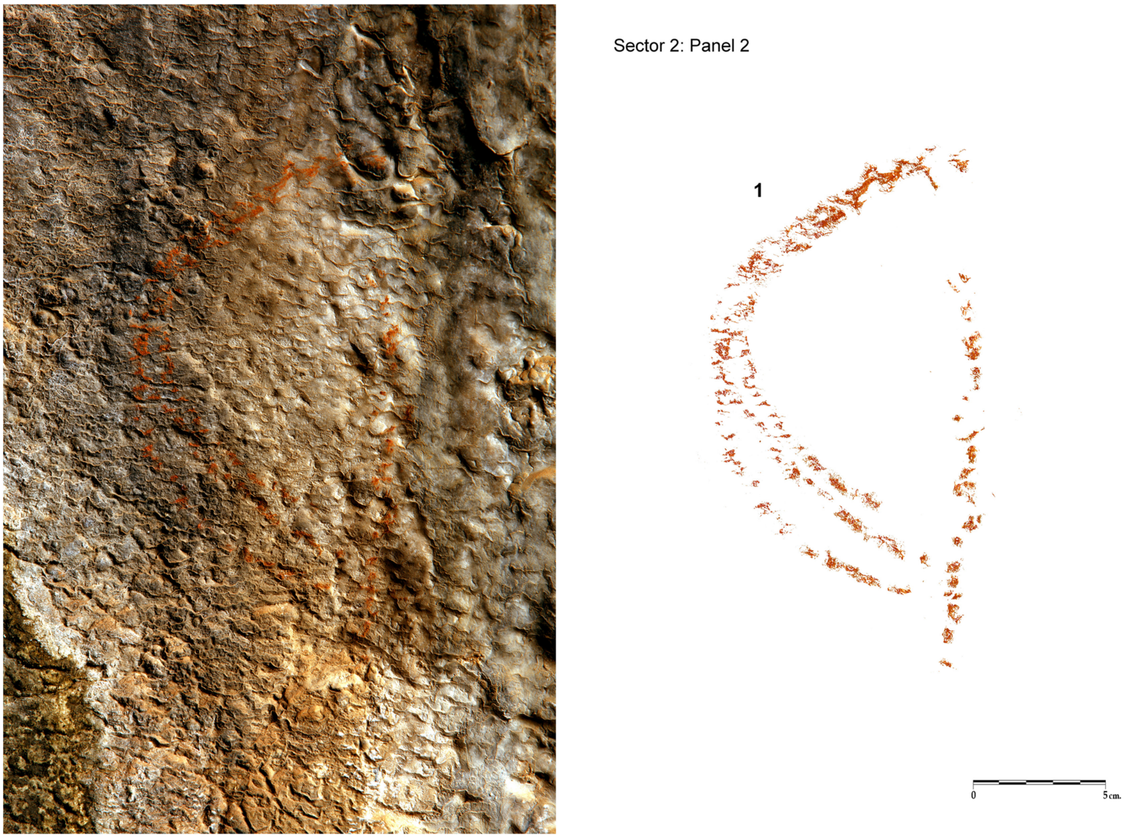

Figure 10: Sector 2, panel 2. Photograph and digital tracing.

Layer 5. A relatively heterogeneous black discontinuous layer (5–20 μm) with a complex elemental chemical composition containing sulphur, zinc, barium, magnesium, silicon, aluminium, phosphorus, calcium, and iron. This composition suggests the presence of particles of distinct mineralogy: calcium phosphate, barite (barium sulphate), zinc sulphide, and silicates and carbonates of various kinds.

The following observations can be highlighted on the element distribution map (Figure 18). Calcium is the most abundant element, primarily related to the calcium carbonate layer, whereas when it appears in a smaller proportion, it may be linked to the oxalate layers. Silicon and aluminium appear in the lower and upper-most portions of the sample, linked in the lower part to silicate particles and, in the upper part, mostly to oxalate and silicate layers. Magnesium has a similar distribution to the previous two elements. Iron is associated with the red layer on the top of the sample. Sulphur, phosphorus, and zinc have an approximately similar distribution and, in any case, are always linked to the superficial black layer.

Red (layer 4) and black (layer 5) paint, the composition of which (black) is similar to sample 2, are superimposed on the calcium oxalate layer that covers the rock surface.

3.2.2 Sample 2 [S1.1.3] (Black Paint)

The stratigraphic sequence based on the elemental chemical composition and texture of Sample 2 (Figure 19) has been reconstructed from the analysis by stereoscopic microscopy, reflected light optical microscopy, and SEM-EDX.

The black pictorial layer may be observed in clear contact with the carbonate substrate (Figure 14). It is a layer of essentially homogeneous, compact, and organic characteristics, with an average thickness of approximately 100 μm and abundant presence of inorganic particles of different types. These particles have sizes up to 30 μm, although most grains are comprised between 5 and 10 μm.

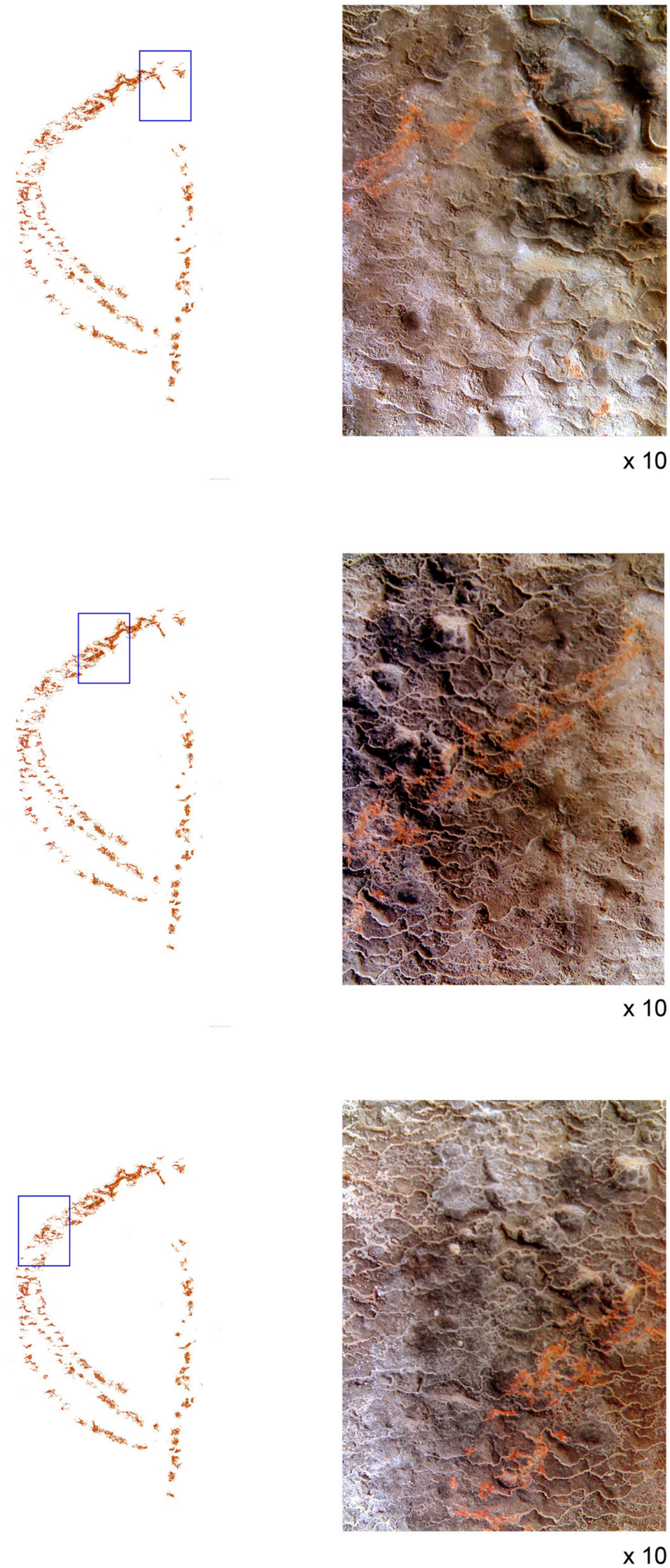

Figure 11: Sector 2, panel 2. Photomicrographs (DigiMicroscope USB Reflecta).

Figure 12: Sector 2, panel 3. Photograph and digital tracing.

Regarding the nature of the grains, most of them correspond to a sulphur and zinc enriched compound (possibly a sulphide or less likely a zinc sulphate), while there are also grains of calcium carbonate, iron oxides, and silicates.

The global elemental composition of this layer displays high percentages of carbon and oxygen, major elements of sulphur, zinc, calcium, and silicon, and traces of aluminium, magnesium, iron, and potassium.

The following features are highlighted on the map of the individual distribution of the elements (Figures 20 and 21). Calcium is associated with the limestone substrate, and some calcite grains are included in the black layer. Iron is related to grains of oxides contained in the black layer. Magnesium shows a higher concentration in the stone substrate, supporting its identification as a slightly magnesian limestone. Silicon appears in small percentages in the substrate and is also identified in silicate grains within the black layer. Aluminium has a similar distribution throughout the sample. Contents of sulphur and zinc are distinctive of the black layer (explained by the possible presence of zinc sulphide) (Figure 22).

Figure 13: Sector 3. Photograph and digital tracing.

3.2.3 Sample 3 (Rock Surface)

This sample belongs to a carbonate rock of crystalline appearance, quite compact, with little porosity and a light beige hue. Around the margins of the sample, a darker colour and a weak banding are observed.

The reflected light optical microscope and SEM-EDX analyses indicate that the sample corresponds to a very pure limestone – with high content of calcium (97.5%) and a small percentage of magnesium (2.5%) – characterised by its homogeneity and compact texture. In the lower part of the sample, a banding is formed by the alternation of levels of limestone with possible levels of calcium oxalates (higher oxygen contents), levels with notable calcium, silicon, and magnesium contents (possible calcium oxalates, oxalates, or magnesium oxides and silicates) and, especially in the innermost part, thin levels enriched in gypsum.

3.2.4 FTIR Spectroscopy and GC Analysis

Analysis by means of FTIR spectroscopy mainly supports the identification of mineral composition, with some incursion into the organic range (Figure 23). The superficial rock crust (Sample 3) is composed of calcite and

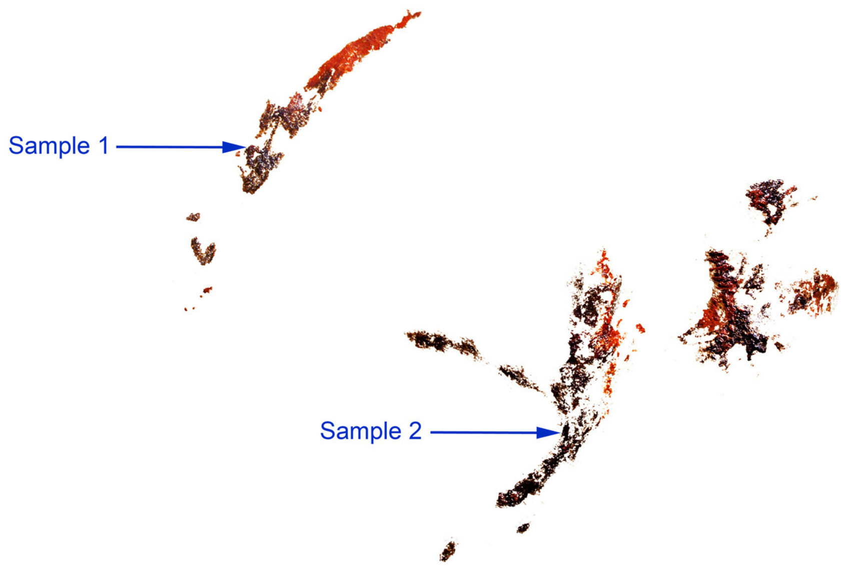

Figure 14: Sector 1. Sample points. Rock surface sample was obtained approximately 10 cm below the panel (microsample 3).

Figure 15: Sample 1. Detailed microscopic image highlighting the presence of the discontinuous reddish layer (1) and the superimposed black layer (2).

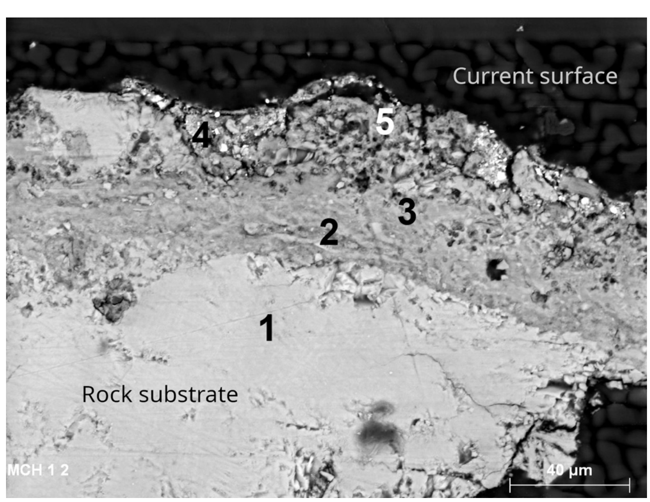

Figure 16: Sample 1. SEM image showing the calcium carbonate layer (1), the layer with a high content of oxalate and silicates (2), the oxalate layer (3), the layer with a high content of iron oxides (4), and the black layer with the presence of zinc sulphide (5).

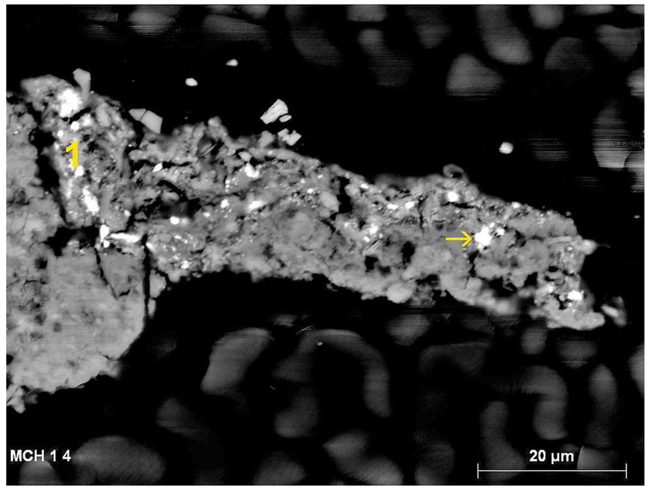

Figure 17: Sample 1. Detailed SEM image showing red areas with high content of iron oxides (1) and black areas with the presence of zinc sulphide (arrow).

oxalate with higher amounts of quartz/aluminosilicates. Sample 1 contains mainly calcite and red earth (clays and iron oxide) and is also rich in calcium oxalate, a very interesting substance in relation to rock paintings (Mas Cornellà et al., 2013a; Ruiz et al., 2006; Watchman, 1991) and its hypothetical origin (Maravelaki-Kalaitzaki, 2005; Russ, Kaluarachchi, Drummond, & Edwards, 1999). However, the component that produces the greatest signals in the FTIR spectrum is a lipid, particularly a saturated triglyceride. In lower intensities, there are also two bands that could be attributed to proteins (around 1,538–1,510), although they may be due to the formation of calcium soaps. Sample 2 mainly contains calcite, gypsum, aluminosilicates, calcium oxalate, and a small amount of liquid saturated triglyceride.

Regarding the GC analysis (TBDMS protocol) (Figure 24) comparing the rock sample to the paints, we observed that amino acid content from the hydrolysis of proteins increases in the paints. The readings from Sample 2 are compatible with egg or blood protein albumin, while Sample 1 cannot be linked to a specific protein. Small amounts of biotin (vitamin H) are also detected in Sample 1, consistent with the presence of albumin. The metabolite is also notable in both samples. A compound derived from glycerine (2-methyl-2-amino-1, 3-propanediol) is predominant in Sample 2, as well as lactic acid Sample 1. Both components may be a product of fungal activity. A high content of oxalic acid was also detected in both samples. This is also a result of micro-organism activity. Equally, the fatty acid content is much higher in the paint than in the rock samples. The relative proportion of fatty acids is very favourable to saturated palmitic (C16) and stearic (C18) acids, showing proportions of approximately 1:1, which is the pattern accepted for the presence of fats of animal origin, although subject to different interpretations in the scientific literature (Fiore, Maier, Parera, Orquera, & Piana, 2008; Mas Cornellà et al., 2013a).

In the methylation GC analysis, only fatty acids, terpenes, hydrocarbons, and relatively few polar substances appeared. In Sample 2, fatty acids and small amounts of saturated hydrocarbons, ranging from 10 to 25 carbons, were identified, which are consistent with the presence of animal fat. In Sample 1, the same fatty acids, a small amount of dehydroabietic acid, and a marker component of the resin of pine or rosin (Figure 25) were detected.

Neither calcium oxalate nor organic matter were present in sufficient quantities to be dated. Two unsuccessful attempts were made by Beta Analytic and were negative.

4 Discussion

The possible chronology of the newly discovered rock paintings may be considered in relation to the stratigraphic sequence of the cave. Despite their state of preservation, the study of the pigments and possible

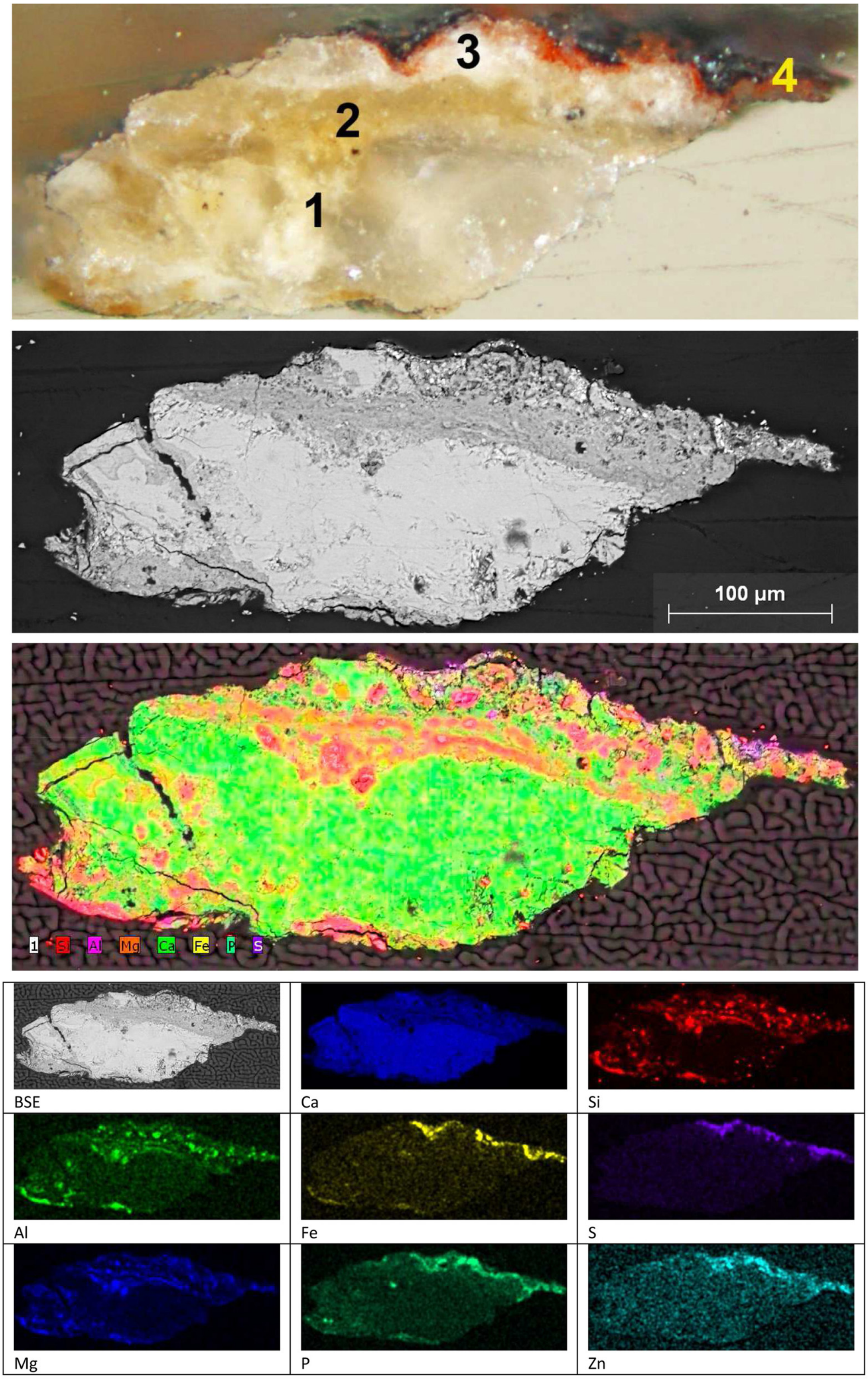

Figure 18: Sample 1. Optical microscopy image, SEM image, and distribution map of elements.

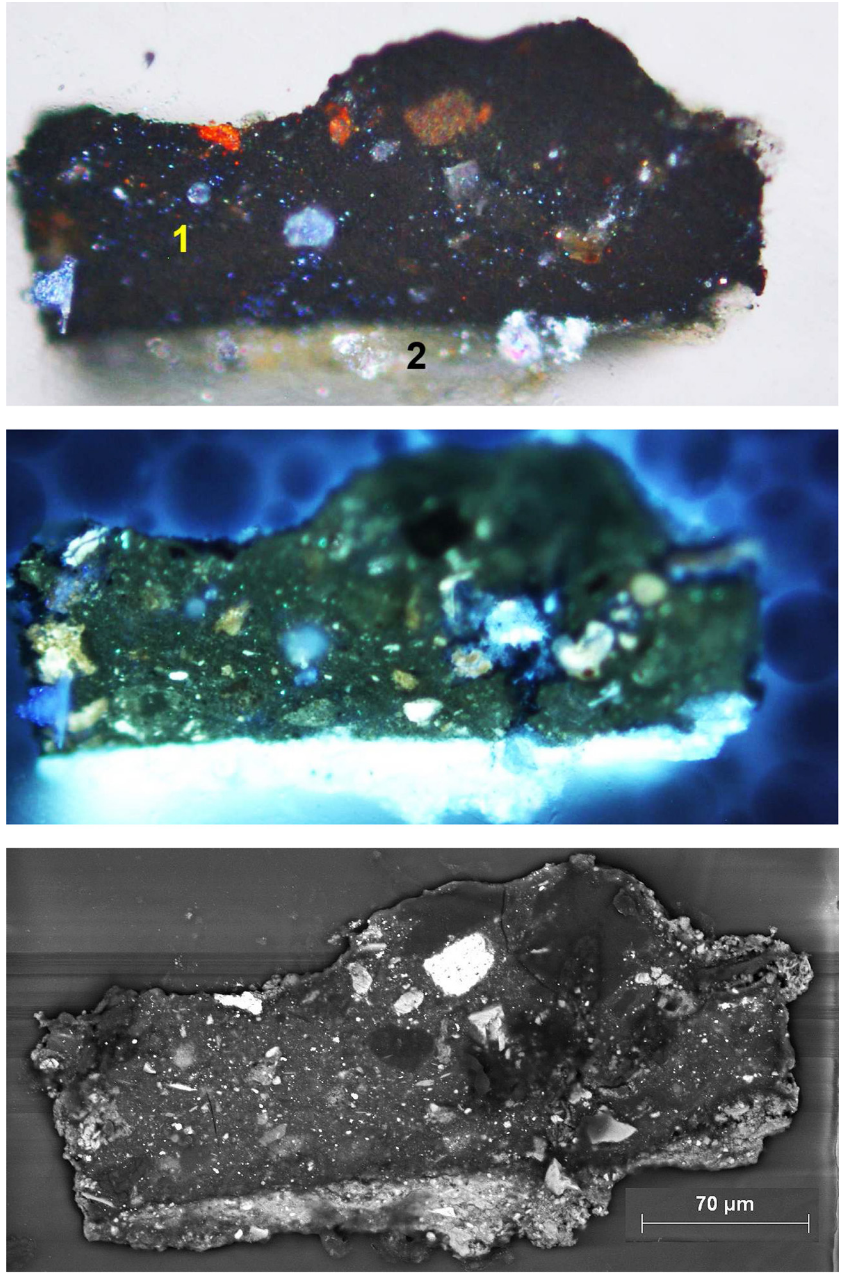

Figure 19: Sample 2. Optical microscopy images (with polarised and ultraviolet light) and SEM image. The black layer (1) superimposed on the rock substrate (2) is observed.

binders has enabled us to establish beyond doubt their pictorial intention, as well as to document the use of brushes and other tools for their application, as seen in the photomicrographs. A range of hues have been detected: black, orange red [*10R 5/8* and *2.5YR 5/8*], red [*10R* 3/6 and *4/8*], and carmine red [*10R 3/4*]. Overlays of black on red paint and vice versa in Sector 1 have also been observed, suggesting a synchronous use of both types of pigment. However, the use of different colours, as well as different techniques (paintbrush, finger painting, direct use of solid haematite) and locations, could indicate diachronic phases separated by unknown periods time.

Red and black paintings are known in other caves in the Subbetic hill-ranges with Neolithic archaeological sequences. The presence of schematic post-palaeolithic paintings in deep underground cavities is well-documented in the provinces of Málaga and Córdoba. A technical analogy (discontinuous red line, haematite) may

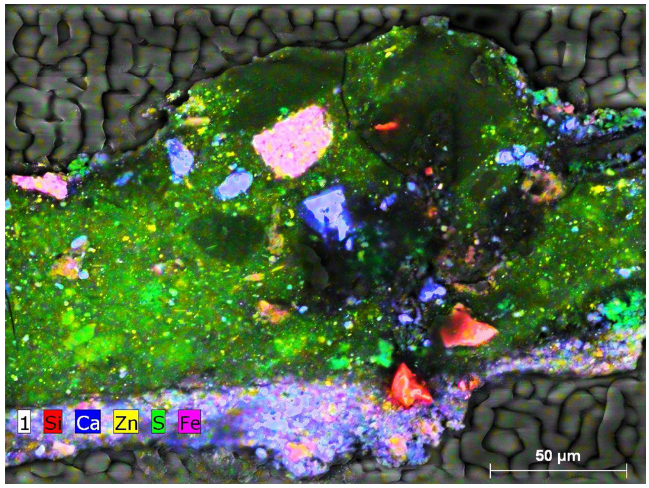

Figure 20: Sample 2. SEM image. The distribution of silicon, calcium, zinc, sulphur, and iron is superimposed.

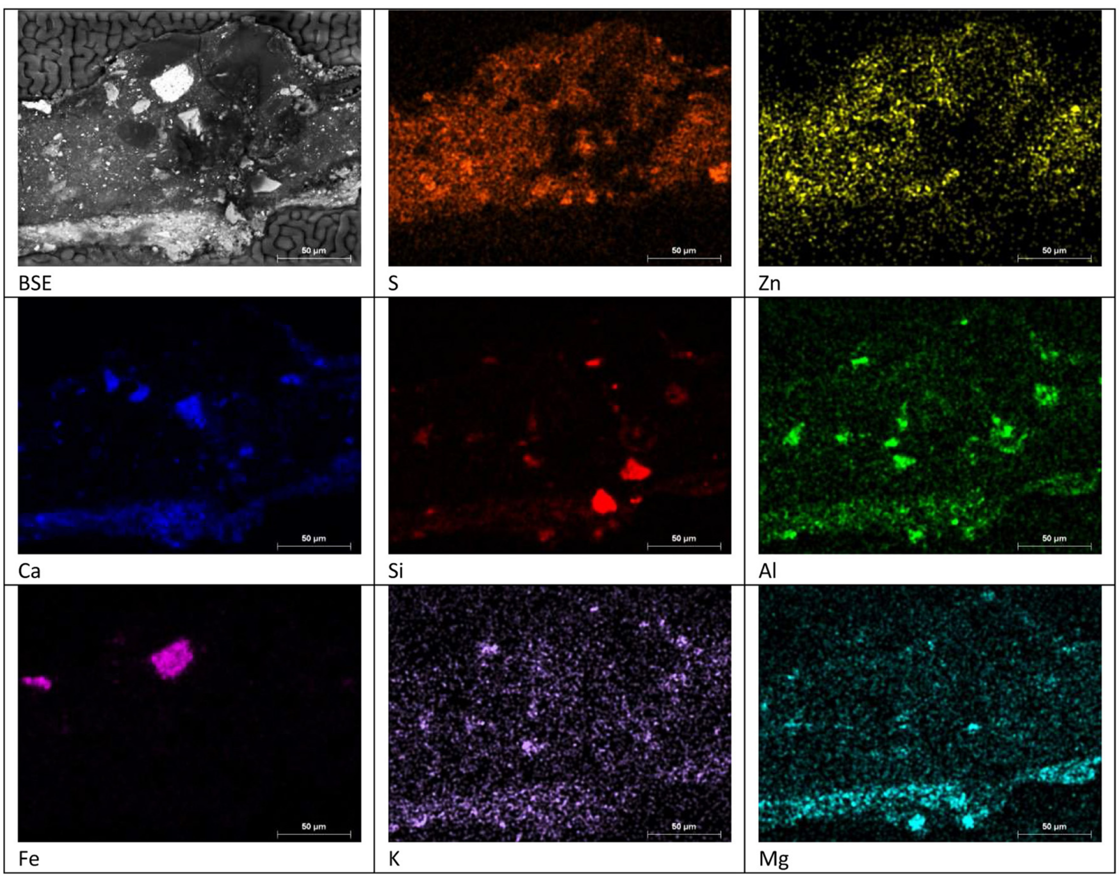

Figure 21: Sample 2. Individual distribution maps of various elements (sulphur, zinc, calcium, silicon, aluminium, iron, potassium, and magnesium) on an SEM image.

be suggested between the anchor-shaped figure of Cueva de los Murciélagos (Zuheros, Córdoba) and the partially drawn Greek phi-shaped figure of Dehesilla Cave. The anchor-shaped motif (Figure 26) is placed at the upper left part of the main panel, which displays the largest amount of representations of black outlined goats (discontinuous lines, wood charcoal) at Cueva de los Murcielagos (Figures 27 and 28). Red is statistically

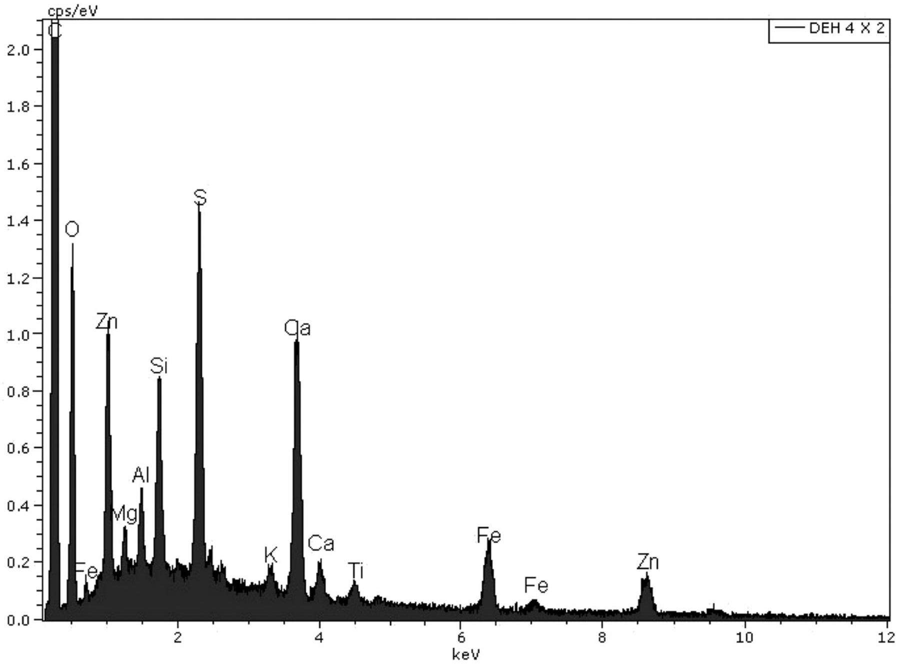

Figure 22: Sample 2. EDX microanalysis corresponding to the black layer.

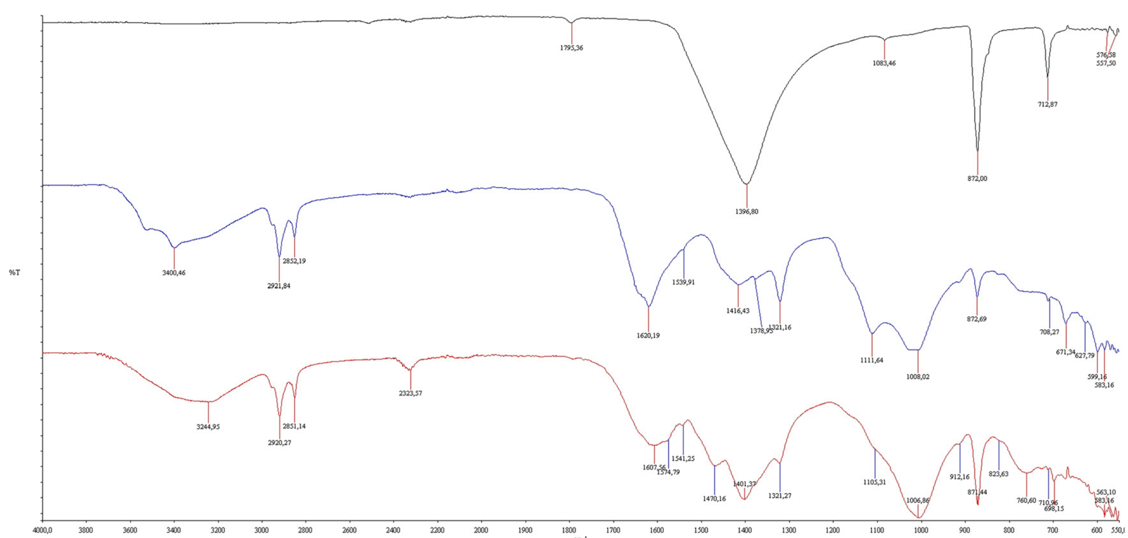

Figure 23: (Top) IR spectrum of the rock surface with calcium carbonate (calcite) and traces of silica and silicates. (Mid) IR spectrum of black painting calcium oxalate monohydrate (1,620, 321 cm^{-1}), calcium carbonate (calcite, 1,416, 872, 712 cm^{-1}), earths (1,008 cm^{-1}), gypsum (1,111 cm^{-1}), and a possible protein or metal soap (1,539 cm^{-1}). (Bottom) IR spectrum of red paint with calcite, earths, calcium oxalate (1,321 cm^{-1}), and protein or metal soap (1,541 and 1,574 cm^{-1}).

the least used colour at this site, in such a way that attention may be drawn to the Greek phi-shaped composition, in the chamber known as Sala de los Estratos, although this painting was drawn in a continuous stroke (Figure 29). The caves of Murciélagos, Murcielaguina, Cholones, and Mina de Jarcas (Córdoba) constitute a group mainly distinguished by schematic black wall paintings, showing diverse techniques including paintings and, more commonly, the direct application of vegetal charcoal (Bernier & Fortea, 1968–1969; Gavilán Ceballos & Mas Cornellà, 2006; Gavilán Ceballos, Vera Rodríguez, Peña Chocarro, & Mas Cornellà, 1996;

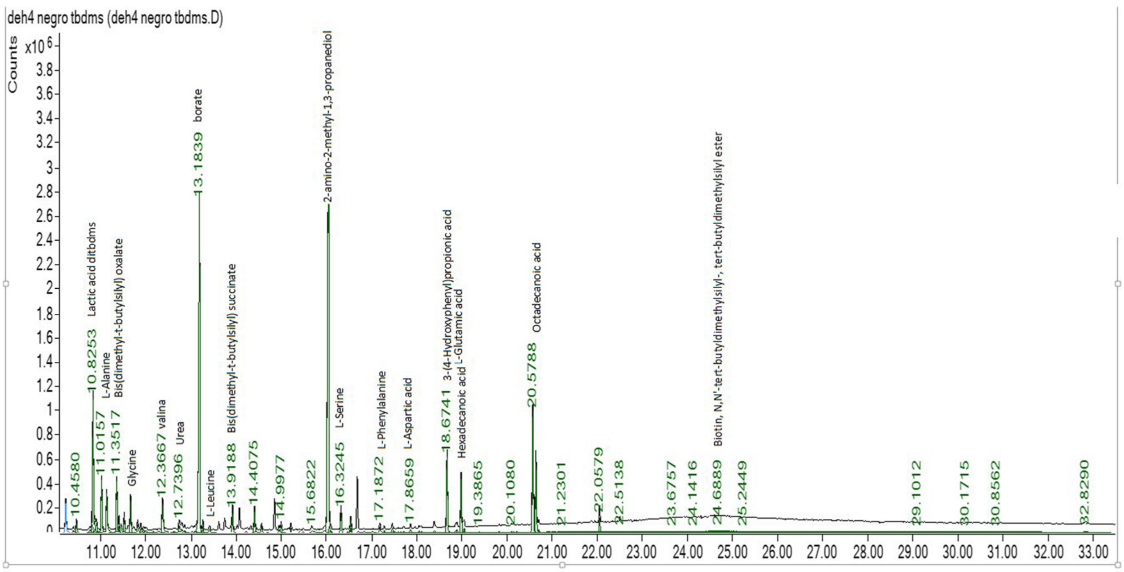

Figure 24: TBDMS analysis of paint sample 2. The main components after hydrolysis are marked.

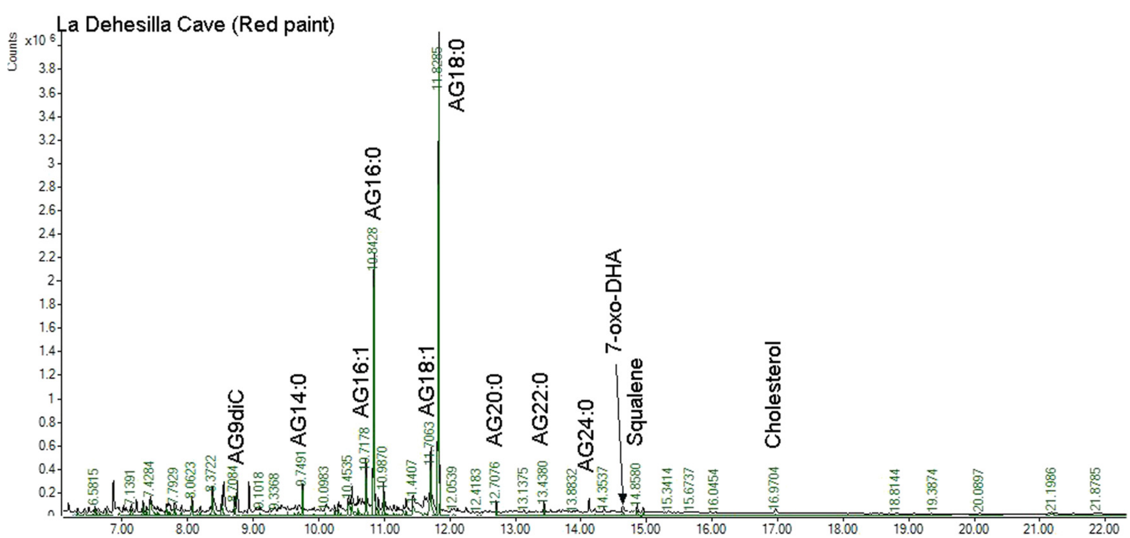

Figure 25: Methylation analysis of paint sample 1. AG9diC methyl azelate, AG14:0 methyl tetradecanoate, AG16:1 methyl 9-hexadecenoate, AG16:0 methyl hexadecanoate, AG18:1 methyl 9-octadecenoate, AG18:0 methyl octadecanoate, AG20:0 methyl icosenoate, AG22:0 methyl docosenoate, AG24:0 methyl tetracosenoate, and 7-oxo-DHA methyl 7-oxo-dehydroabietate.

Hernanz, Mas, Gavilán, & Hernández, 2006; Molina Expósito, Mas Cornellà, Gavilán Ceballos, & Vera Rodríguez, 1999).

Dehesilla Cave stands approximately 50 km to the West of the Serranía de Ronda, in which La Pileta Cave (Benaoján, Málaga) is located. This is an important site with palaeolithic art and post-palaeolithic black paintings (Breuil, Obermaier, & Verner, 1915; Sanchidrián Torti & Muñoz Vivas, 1990; Sanchidrián Torti, Márquez Alcántara, Valladas, & Tisnerat, 2001). Also, approximately 40 km to the South, in Sierra Momia, stands the Cueva del Tajo de las Figuras (Benalup-Casas Viejas, Cádiz) (Breuil & Burkitt, 1929; Cabré & Hernández Pacheco, 1914; Mas Cornellà, 2005), an emblematic rock shelter close to the ancient Laguna de la Janda. Cueva del Tajo de las Figuras belongs to the group of artistic sites of Campo de Gibraltar, which comprises hundreds of rock shelters mostly painted in different shades of red. Some of these sites are

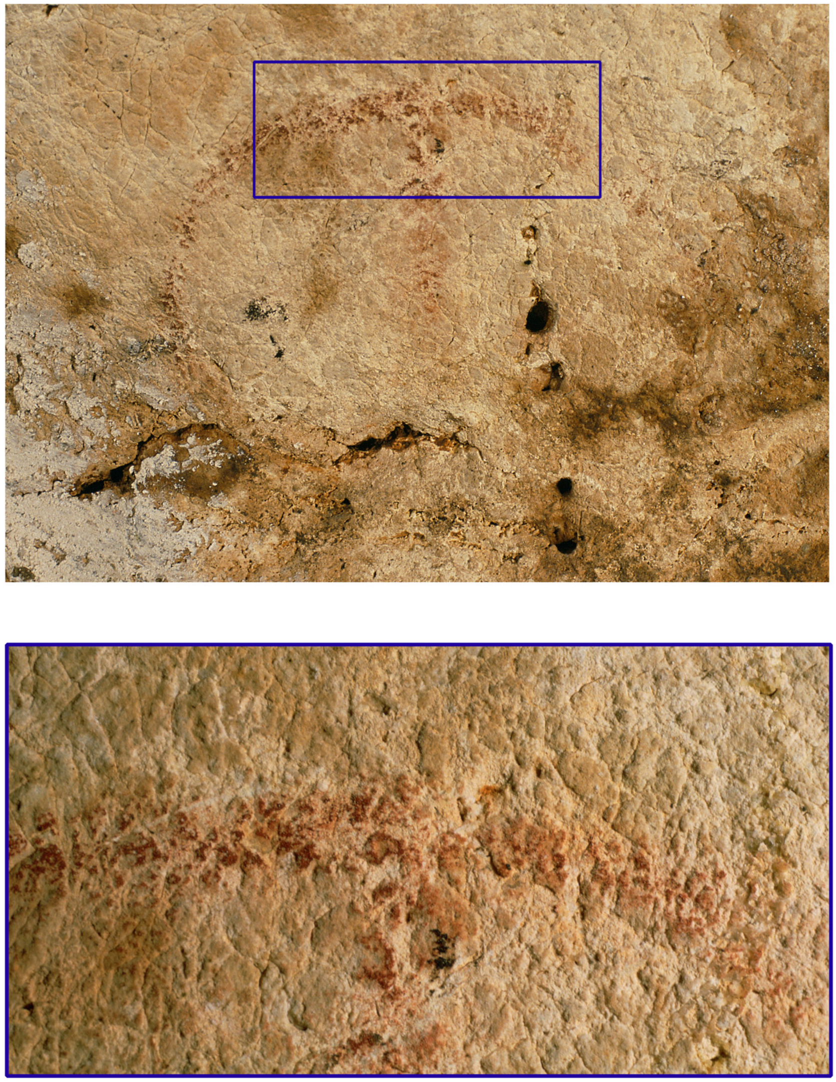

Figure 26: Anchor-shaped figure at Cueva de los Murciélagos (Zuheros, Córdoba).

Figure 27: “Panel de las Cabras” (Cueva de los Murciélagos).

Figure 28: “Panel de las Cabras”, right zone (Cueva de los Murciélagos).

significant in the literature, such as the rock shelters of Pretinas, Palomas, or Bacinete (Mas Cornellà, 2000; Solís Delgado, 2015, 2020). They display a naturalistic tendency, beginning in the Early Holocene (Figure 30), and continue under a schematic tendency during the Neolithic and Copper Age (Figure 31), ending in the Late Bronze Age at Abrigo de la Laja Alta (Barroso Ruiz, 1978; Corzo Sánchez & Giles Pacheco, 1978; Mas Cornellà, 2001). Acosta (1984) had already pointed out a relationship between the Early Neolithic chronologies at Dehesilla Cave and the human settlement of the Campo de Gibraltar and its artistic activity. We now suggest ramiform motifs, a relatively persistent typology in Early Neolithic ceramic decoration (Carrasco Rus & Pachón Romero, 2010; Gavilán Ceballos & Escacena Carrasco, 2009; Navarrete Enciso & Capel Martínez, 1977) as a new chronological proxy to date some rock paintings at least between second half of VI and first half of V millennia cal BC. In fact, this motive has also been identified at Dehesilla Cave pottery – dating ca. 4800-4500 cal BC – (Figure 32) (García Rivero et al., 2020) and indeed are equally frequent in schematic paintings within the region. Such motifs are depicted, for instance, at a nearby rock shelter (Abrigo del Zapatero) (Fernández Sánchez et al., 2018).

Due to its spatial location within the cave, its specific relationship with a speleothem, the concretion that covers it, and the appearance of the pigmentation, which could be applied dry, the red dot (S3.1.1) recalls the characteristics of some strokes, dots, or stains that have been linked to the early symbolic topography of some Palaeolithic caves in Málaga and Cordoba (Cantalejo Duarte et al., 2006; Maura Mijares, 2011) (Figure 33).

The formal composition of Sector 1 remains difficult to decipher, although its technical features do not appear to differ from other depictions in the aforementioned sites belonging to the same relative chronology within the region. The patina that covers it indicates a considerable antiquity. It is important to notice the formal likeliness between stroke S1.1.1 and the goat antler at Cueva del Tajo de las Figuras (Figure 34) (Mas Cornellà, 2000, 2001, 2005), although this similarity may be observed in several examples of different styles and chronological periods (Carrasco Rus, Riquelme Cantal, Pachón Romero, Navarrete Enciso, & Sanchidrián Torti, 2004).

The analysis of Sample 1 revealed a layer composed of red earth rich in iron oxides, bound together with an albumin-like protein, possibly obtained from egg. Sample 2, in contrast, displayed a pigment layer made up of a black organic mass, with mineral grains including quartz, earth, calcite, and zinc sulphide (or sulphate). All of them are natural materials that may have been obtained from the ground and intentionally collected to obtain the desired consistency, texture, or colour. Both zinc sulphide and sulphate are substances that do not particularly provide or enhance colour, since the first is white-colourless and the second is pale-yellowish. However, when mixed with small amounts of metal cations, they may achieve remarkable colours, especially fluorescents. However, none of the mentioned components is black. The significant presence of fat and, to a

Figure 29: Greek phi-shaped figures in the “Sala de los Estratos” (Cueva de los Murciélagos). Conventional, infra-red, and ultraviolet photographs.

Figure 30: Naturalistic motifs at Cueva del Tajo de las Figuras (Early Holocene).

Figure 31: Schematic motifs at Gran Abrigo de Bacinete (Neolithic – Copper Age).

lesser extend, of a marker of pine resin, could indicate the use of a pitch of tar, obtained by burning or heating the resin, fat, or mixtures of both for a long time.

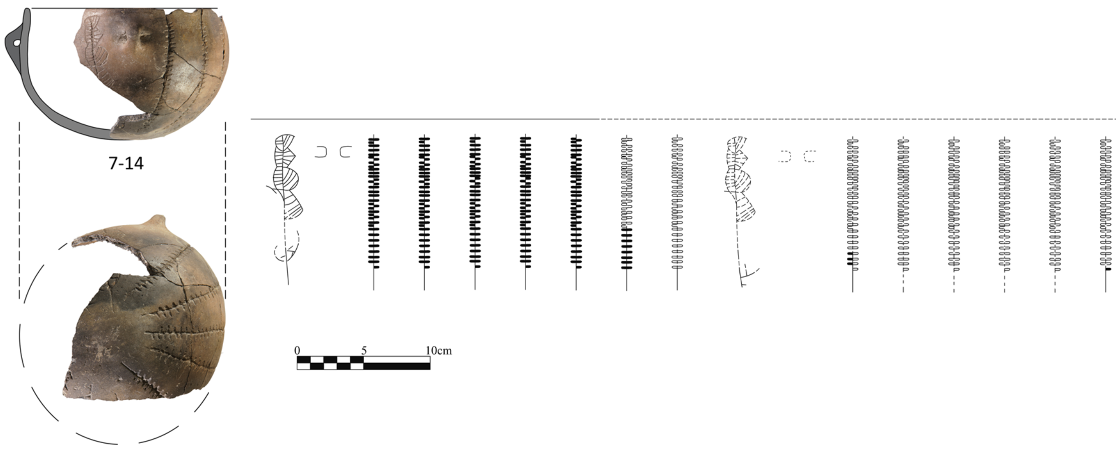

Figure 32: Pottery vessel with schematic decoration (Dehesilla Cave) and ideal reconstruction.

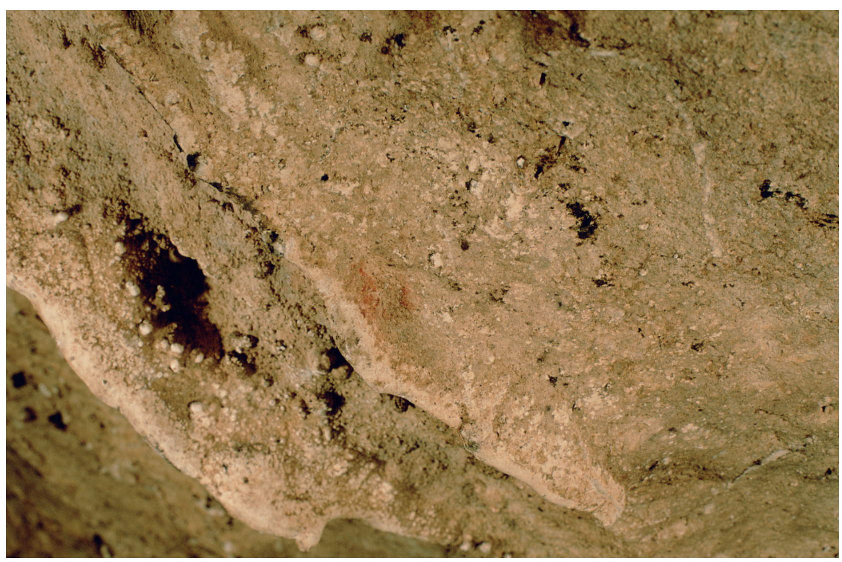

Figure 33: Motifs similar to the red dot (S3.1.1) can be observed at Cueva de los Murciélagos (strokes, dots, stains, etc.). It is important to note that this site was occupied during the Upper Pleistocene.

Sector 1 presents a red–black–red pictorial sequence of the same hue, most likely carried out synchronously. In the other sectors, we observe different hues, textures, and techniques, although there is an overall unity between the defined panels.

Early pigment analyses, carried out during the 1990s, identified complex paint recipes that were intentionally prepared (Clottes, Menu, & Walter, 1990). Since then, this kind of study has been innumerable, and many cases point to the simple use of terrigenous materials, abundant in the immediate environment (Fernández et al., 2018; Mas Cornellà et al., 2013a).

5 Conclusions

Due to their simplicity and state of preservation, the newly identified paintings are an evident interpretative challenge, although the physical, chemical, and typological analyses point to a prehistoric date. Their formal

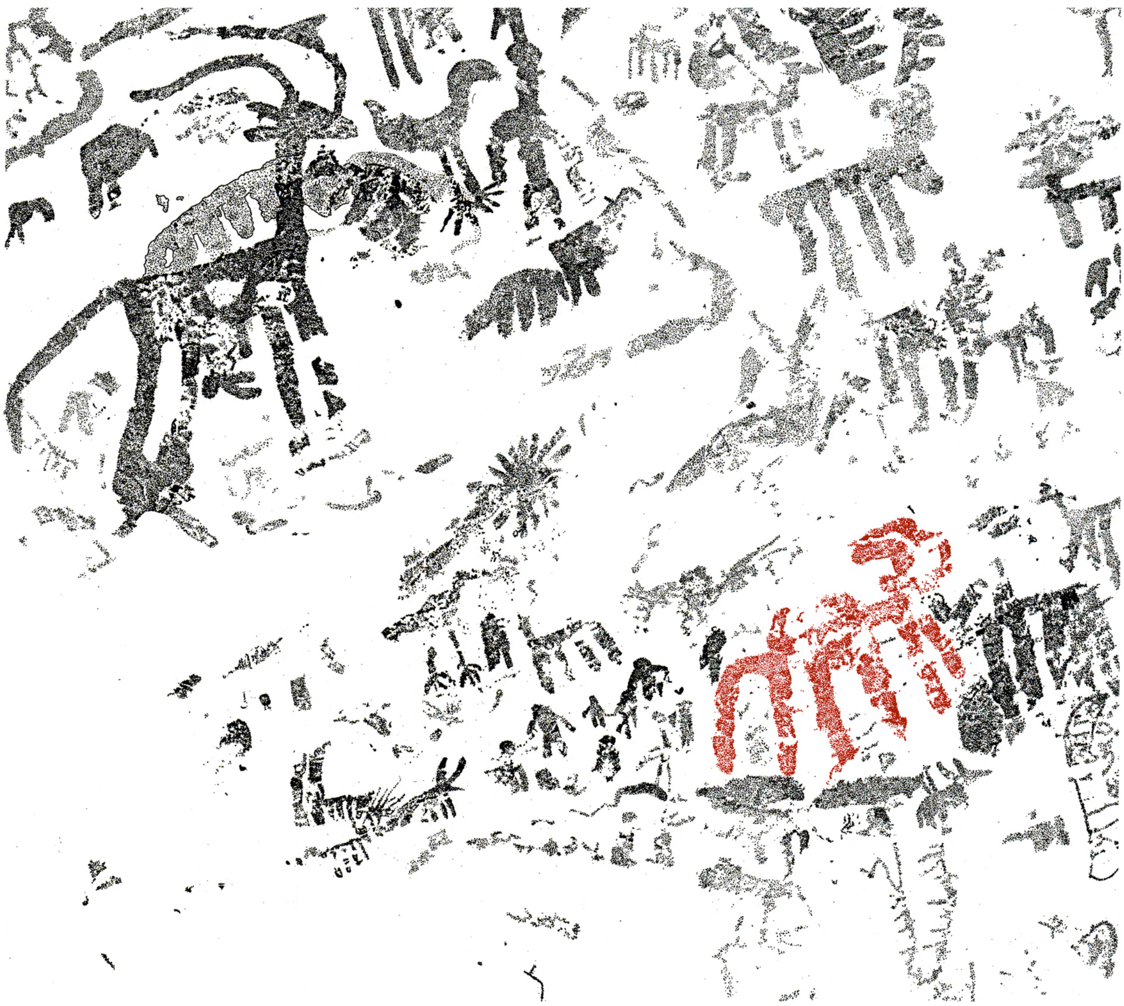

Figure 34: Goat drawing at Cueva del Tajo de las Figuras, a rock shelter showing a wide sequence starting in the Early Holocene.

diversity, different hues, and techniques, in addition to the disparity of the patinas that cover the paintings, suggest that Dehesilla Cave has a diachronic graphic sequence.

The depiction of Sector 1, characterised by bichromy and the use of a paintbrush, seems to be the result of a single pictorial performance, since red and black are indiscriminately superimposed, which is a very singular observation. While the red paint displays some technical complexity, the black paint may possibly be the product of having collected simple pigment materials, perhaps even from the cave itself, thus leading to a heterogeneous mixture rather than the result of an intentional mixing process. In this case, we interpret a synchronic graphic sequence made with a red pigment of the same shade.

The partial Greek phi-shaped figure (S2.2.1) drawn in haematite may tentatively be technically and typologically linked to the graphic repertoire of schematic art (Neolithic and Copper Age) documented at other underground cavities. The finger paintings and stain on Panel S2.1 display similar characteristics as those found in typologies also associated with schematic art in rock shelters.

The red dot (S3.1.1) may be linked to prehistoric symbolic topographic marks. Furthermore, its formal and textural characteristics are different from those observed in Sector 2 Panel 1.

Taking into account that Dehesilla Cave has not been completely excavated and that these new rock paintings have been found in the chamber next to the entrance to the cave, seemingly profiling its topographical features, these artistic or symbolic manifestations may be considered conceptually as spatial in nature, constituting peripheral markers, similar to those documented at other nearby sites.

Acknowledgements: A number of people and entities have collaborated with logistic support and diverse resources for the tasks developed by the Dehesilla Project during the 2017 season: Algar Local Council, Jerez de la Frontera Archaeological Museum, EvoCultura-Association for the study of human behaviour and cultural diversity, as well as the Díaz Romero family. Daniel García Rivero personally thanks his team of collaborators for their help during the archaeological excavation of 2017. We must be grateful to Carlos Luis Pérez Avendaño for the revision of the English text.

Funding information: This publication is part of the project *NeoProModels: Patterns and processes in the Neolithization of the South of the Iberian Peninsula*, Ref. PID2022-137946NB-I00, supported by MCIN/AEI/10.13039/501100011033/FEDER, UE, and of the project *Cueva de la Dehesilla: Estudio arqueológico y paleoambiental para el conocimiento de la ocupación humana prehistórica de la Sierra de Cádiz,* both led by Daniel García Rivero. The Fundación Palarq – Paleontología y Arqueología supported the *Dehesilla Cave Project – Cádiz* through the 2019–2020 analytical call (Universidad de Sevilla and UNED). The archaeological field season carried out during 2017 received financial support from several entities and funding programs at the University of Seville (*VI Plan Propio de Investigación y Transferencia*, *III Plan Propio de Docencia*, Facultad de Geografía e Historia and Departamento de Prehistoria y Arqueología), as well as from the Research Centre for Anthropology and Health, University of Coimbra. Figures 26, 27, 28, 29, and 34 have been taken from the archaeological research project *Las manifestaciones rupestres prehistóricas de la zona gaditana* (funded by Dirección General de Bienes Culturales of the Junta de Andalucía, 1988–1993, and led by Martí Mas Cornellà). Figures 30, 31, and 32 have been taken from the archaeological research project *El poblamiento prehistórico del Macizo de Cabra y su relación con la Alta Campiña (Córdoba): Caracterización eonómico-social, paleoecológica y ocupación del territorio* (funded by Dirección General de Bienes Culturales of the Junta de Andalucía, 1994–2002, and led by Beatriz Gavilán Ceballos).

Author contributions: All authors have accepted responsibility for the entire content of this manuscript and consented to its submission to the journal, reviewed all the results, and approved the final version of the manuscript. M.M.C. and D.G.R.: study design, fieldwork, interpretation of data, and writing the paper. M.S.D., R.M.M., B.G.C., R.T. and G.T.C.: fieldwork, interpretation of data, and writing the paper. E.P.G. and P.P.P.G.: geological and chemical analysis and writing the paper. J.P.G.: fieldwork and photography. J.A.B.V.: fieldwork and 3D topographic model of the cave.

Conflict of interest: Authors state no conflict of interest.

Data availability statement: All data generated or analysed during this study are included in this published article.

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