A Methodological Approach to the Study of Prehistoric Cave Engravings: the Case of Cova Eirós (Galicia, Spain)[1]

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Abstract

Cova Eirós is located in the province of Lugo, north-western Iberia. The cave site contains a number of Palaeolithic engravings—narrow and shallow grooves—that are dispersed on the walls of the cave. As direct contact with the panel would be extremely harmful for the rock surface, we have decided to use 3D methods to record the motifs. Thus, we applied different techniques based on dense photogrammetry, for example the Radiance Scaling, in order to accomplish a better visualization of the motifs, removing part of the subjectivity that the previous recording methods presented and avoiding direct contact with the panel.

Keywords: Cova Eirós, photogrammetry, Palaeolithic.

1. Cova Eirós and the Palaeolithic period in Galicia

Galicia is located at the westernmost area of the Cantabrian region. Despite its proximity to one of the most important Palaeolithic cave art areas, the Franco-Cantabrian region, Galicia has been aloof from Palaeolithic research. This gap could be initially explained by the scarce development of the limestone formations in this region and the limited number of surveyed cave sites. The only known references about Upper Palaeolithic rock art in NW Iberia were the outstanding open-air stations found in the mid-1990s at Foz Côa and other northern tributaries of the Duero River in NE Portugal (Baptista and Reis, 2009). In Galicia, the presence of Upper Palaeolithic occupation has been reported in several sites, but unfortunately only a few of them yielding evidence of portable art, such as Férvedes-II (Ramil Soneira and Vázquez Varela, 1983), Cova de Valdavara and Cova Eirós itself (Fábregas Valcarce *et al.,* 2015).

In 2011, the identification of painted and engraved motifs in the Main Hall of Cova Eirós meant the first discovery of cave art in NW Iberia. Thenceforward, a systematic research program was carried out in order to identify, locate, date, and analyse the

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representations of the inner galleries (Fábregas Valcarce *et al.,* 2015; Steelman *et al.,* 2017).

The engravings amount to the 46% of the motifs at Cova Eirós. However, due to their thin and shallow character, the severe incidence of post-depositional alterations (graffiti), and the nature of the rock surface, several methodological approaches have been tested in Cova Eirós in order to clearly identifying them. In this paper, some preliminary results obtained by Photogrammetry Structure from Motion (hereinafter SfM) are presented.

This technique has been successfully applied in Galicia on megalithic art and Bronze Age open-air rock art sites (Ortiz Sanz *et al*., 2010; Gil Docampo *et al*., 2011; Vázquez Martínez *et al*., 2015; Vilas Estévez *et al*., 2015; Carrero-Pazos *et al*., 2016; Vilas-Estévez *et al*., 2016), although in those cases the technique and, consequently, the grooves are quite different as they are broader, deeper and usually bigger. Now, our aim is to test the reliability of this technique in the case of the small, thin and shallow Paleolithic engravings located at Cova Eirós.

2. The Engravings of Cova Eirós

Cova Eirós is located in the eastern Sierras of Galicia, in Triacastela (Lugo, Galicia) at 780 m a.s.l. The cave is related to the Cándana Limestone Formation (Lower Cambrian), and it is situated in the NNW slope of the Monte Penedo. The cave is 104 m long and the entrance narrows after the first 7 meters into a 15 m long neck, followed by the cave's largest space, the Main Hall.

Cova Eirós has been known to researchers since the 1980s, and several works on palaeontology and archaeology have been carried out since then. Systematic archaeological fieldwork started in 2008, mainly focusing in the entrance. There, several Middle and Upper Palaeolithic occupations were reported, the latter ranging from the Aurignacian (Level 2), the Gravetian (Level 1), to the Final Magdalenian (Level B) (Rodríguez Álvarez *et al.,* 2011; de Lombera Hermida *et al*., 2014).

In the course of the 2011 fieldwork season—after the first three years of activity—a series of painted motifs and engravings were discovered on the walls at the Main Hall or Mammoth Hall, within the cavity (Figure 1).

Figure 1. Photograph of the Main Hall or Mammoth Hall.

However, at first the state of preservation of the motifs offered no specific or easily identifiable shapes. The painted and engraved manifestations are dispersed along the 104 m of Cova Eirós, but cluster in the Mammoth Hall and the Southeast Gallery. To date, a total of 13 panels that display rock art have been identified (Figure 2).

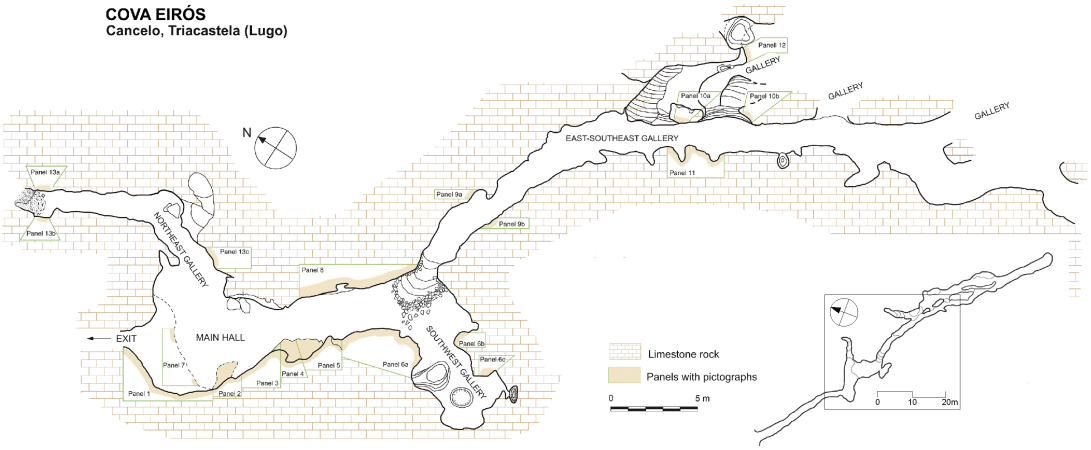

Figure 2. Topography of the Cave and location of the Panels with rock art.

The technical and stylistic characterisation studies have determined the antiquity of the prehistoric manifestations, most of which belong to the last period of the Upper Palaeolithic and the beginning of the Epipaleolithic, ascribed to the so-called Style V (Fábregas Valcarce *et al*., 2015). The radiocarbon dates obtained on two painted motifs from Panel III, yielded a minimum age of 9000 cal BP (Steelman *et al*., 2017). Interestingly, both motifs are overlapping engraved motifs, providing an *ante quem* date for the engravings of the Panel III of Eirós.

2.1. Characteristics and Alterations of the Rock Surfaces

The panels of Cova Eirós are generally characterised by their small size, due to the very irregular surface of the walls, and therefore preventing big figures being made. Consequently, both the supporting rock and the available space seem to have conditioned the format of the representations, that are medium to small sized (between 10 and 40 cm, approximately). However, the compact size of the majority of the figures also seems to follow a clear formal and stylistic intentionality (Viñas Vallverdú, 2013a; Viñas Vallverdú and de Lombera-Hermida, 2013).

It is worth noting that in the inner galleries, particularly in the Mammoth Hall, the walls show a steady flow (rainwater leakage); a somehow scouring wash of the walls that seems to have degraded a great part of the figures, as well as the countless graffiti performed in the 20th century, displaying the names and, in most cases, the date of visit of their authors (Figure 3).

Another feature we must bear in mind is the relatively malleable character of the rock support and surfaces, which has favoured the record of incised graffiti as well as the scratches caused by the cave bears (Grandal-D'Anglade, 1993), other small carnivores, and bats. The scratching and graffiti are occasionally upon the Palaeolithic engravings, making its record and interpretation extremely difficult (Figure 3). Likewise,

the walls are often affected by an external alteration, a thin layer made up of clay formed by the dissolution of the limestone, and the shallow engravings do not completely reach the rock underneath; in other words, they are made on that alteration layer –prone to erosion caused by the leakage of water– leaving the grooves barely visible.

Figure 3. A: 20th century graffiti. B: Animal scratches and graffiti.

Finally, a blackish coat covers a large proportion of the panels at the Main Hall, especially Panel VIII. The samples taken from Panel III show remnants of coal and soot, certainly related to a medieval fireplace located just in the base of the panel (Steelman *et al*., 2017).

These factors, natural processes such as water flow related to karst system's hydrological dynamics, as well as the incidence of both animal and human activity, have caused a strong alteration of the carved motifs. This could explain why many images are ostensibly degraded or incomplete; an observable fact thanks to the representation of zoomorphic figures' anatomical segments (cervico-dorsal lines, hindquarters, etc.).

2.2. Technical Characteristics of the Engravings

The engraved figures are commonly performed with a thin and shallow groove (section in 'V', even though some of them have a wider section, in 'U'), sometimes with fluted or multiple grooves, which are combined and create palimpsests where we can identify partial animals and several motifs or simple lines overlapping (in Panel VIII, especially). These fine incisions can be deeper or slightly wider and shallow on certain occasions; however, they create some complex friezes that are both technically and stylistically very homogeneous. The technical features of the engravings (thin and shallow) are in accordance with their stylistic adscription to the Final Magdalenian/Epipaleolithic (Viñas Vallverdú 2013b; Fábregas Valcarce *et al*., 2015).

With regard to the iconography, there are two categories: figurative motifs, consisting of complete or partial zoomorphic shapes, and non-figurative motifs. The images of the first group consist of bovids, equids, deer and pisciforms. The second group is made up of signs, dots and assorted lines; among the signs, groove series, fusiforms and ramiforms are easily identified. Some of these motifs could belong to earlier periods (Fábregas Valcarce *et al*., 2015).

3. Background: The First Recordings

This paper focuses only on the documentation of the engravings, since the recording methods that have been used for these are not the same as for the paintings (Rubio Mora *et al*., 2013, p. 35-39).

For the recording of the engravings, we have proceeded according to the established methodologies for prehistoric art when studying cave art, avoiding the use of direct tracing. As said before, there is a small clay coating as a result of the alteration of the walls, which is easily malleable and altered. That is the reason for our avoidance of any direct contact with the media that may erase or change the carvings.

Previous work by Ramón Viñas Vallverdú and Albert Rubio Mora undertook the first documentation of the engraved panels; a manual tracing done using digital photographs and a scale ruler. In that case, the photographic problems are not just caused because of the shine caused by humidity, but also in the difficulty in highlighting the shallow engraved grooves, which are softened by the polarised frontal lights. In order to resolve that issue, different photographs with concentrated lights and long exposure were taken from various angles, so that the resulting shades showed the engraved forms (Figure 4).

Figure 4. Review *on the spot* of Panel VIII.

Another issue we had to deal with comes from the confusion caused by the natural grooves on the rock surface. The discrimination between the intentionally engraved and those which are naturally formed was carried out in the cave, and then assessing and correcting the digital reproductions previously made.

The results of the different photographs were taken as a basis for drawing in Photoshop CC 2014, highlighting in red the lines those that form the engravings. Moreover, some of the natural cracks have been reproduced in the drawing with a different colour, in order to show the relation between the incisions of anthropic origin (Figures 5 and 13a).

In another work, carried out by the *Escola Superior de Conservación de Bens Culturais de Galicia*, the photographic methods were used in order to obtain, first, an orthophotography of the engraved area and, secondly, a 3D model of the panel surface (Rubio Mora *et al*. 2013, p. 35).

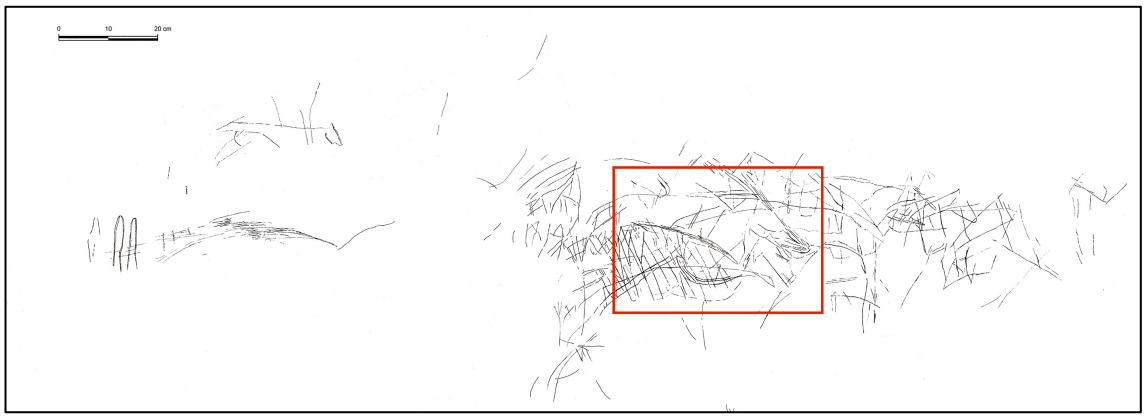

Figure 5. Hand tracing of the Panels VIII (preliminary) and Panel IV done from the digital photography (R. Viñas-Vallverdú and A. Rubio-Mora). Highlighted the section considered in this study.

The process used in this case consisted on taking at least three photographs of the whole panel from diverse perspectives; establishing a method based on flat lightning of the grooves from different angles (Rubio Mora *et al*. 2013, p. 37-39). After that, images were processed using Photomodeler Pro6.

Regarding the 3D modelling of the surface, it was done using Photomodeler Scanner 2012.0.0. Here, all the photographs were taken from a perpendicular position in relation to the surface, moving the camera parallel to it. This allowed the collection of a large amount of points that would help to define the original texture of the photographs (Rubio Mora *et al*., 2013, p. 39) (Figure 6).

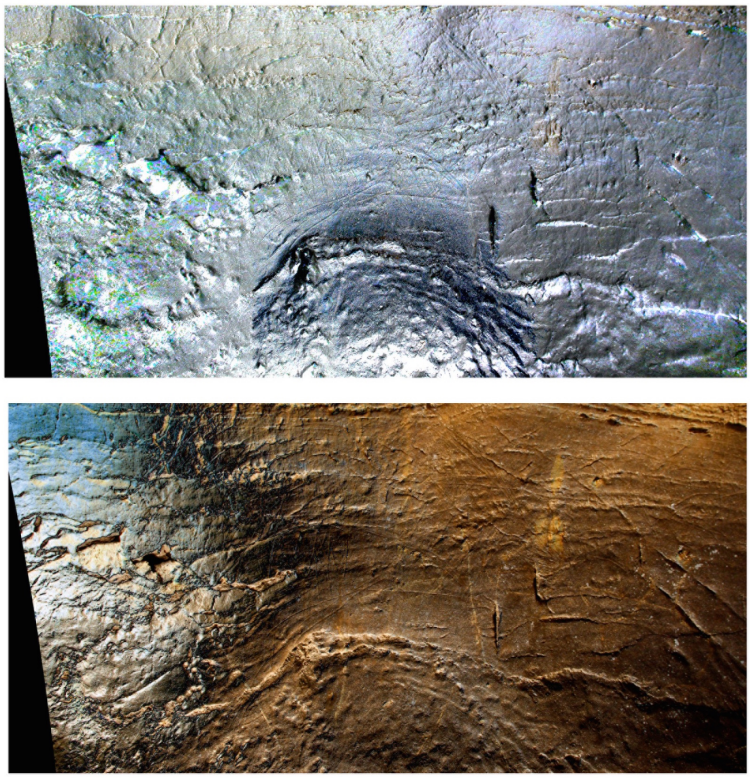

Figure 6. Orthophotos of the Panel VIII obtained by photogrammetry where some grooves can already be observed (Image: N. Cortón and A. López).

4. Methodology: The Use of Photogrammetry SfM in Cova Eirós

As stated before, the Cova Eirós' engravings have some features that make the recording process difficult. In the search for an effective method to help us faithfully reproduce the engravings, without causing any harm to their support, we proposed the use of new technologies based on the 3D modelling of the panels.

The application of these kind of methodologies allows us to obtain a digital recreation that would allow the correct identification of the engravings and grooves, as well as the possibility of creating replicas or moulds (i.e. Corchón Rodríguez *et al*., 2011; Robert *et al*., 2016). Furthermore, this tri-dimensional reconstruction helps us to understand the organisation of the motifs in relation to the morphology and the natural prominences of the walls. Understanding the volumes of the galleries and walls is important since in European Palaeolithic rock art, the artist usually takes advantage of certain features and volumes in the walls (i.e. resembling animal silhouettes) for the configuration of their motifs (Groenen, 2000).

In order to carry out the 3D models, dense photogrammetry (Westoby *et al*., 2012) was used. This methodology has also been tested in Galicia's petroglyphs (Vilas-Estévez *et al*., 2016), as well as in Roman *stellae* (Carrero-Pazos *et al*., 2015; 2016).

Photogrammetry SfM is a technique that requires acquisition, treatment and processing of, at least, two 2D photographs of the same area, from different angles, to create a three–dimensional model (Remondino, 2014). The main reason for using photogrammetry SfM was that little technical equipment had to be transported into the cave; a simple camera rather than a bulky laser scanner. This was an advantage in our particular case, given the difficult access to the cave. Moreover, another advantage was the low cost of the gear in comparison with laser scanners.

4.1. Materials used in the creation of the 3D model

The fact that the engravings are located in a cave and their grooves are thin and difficult to see by the human eye, the process of recording was complicated. For this reason, we have carried out several stages of documentation, starting from a laboratory research in which we have used different materials to test and to determine the best recording system, considering the type of grooves.

The equipment used in the creation of the virtual model was, on one hand, a digital camera; model Canon EOS 70D, with two different lenses. The first was a Canon EFS 18–55 mm with magnifying glass and the other, a Canon EFS 18–135 mm with a polarizing filter B+W, used in order to minimise the reflection that both water and calcite recrystallization generate. On the other hand, the information we gathered after the recording was stored and processed in a computer with OS Windows 7 with 16 Gb of RAM.

Three software applications were employed: 1) Agisoft Photoscan Pro, used to create the 3D model of the panels. 2) In order to review the model in detail, paying special attention not to be confused by fissures and other natural features of the rock, we have used Meshlab's open source software, with the post-processing filter Radiance Scaling (Vergne *et al*., 2010; Vilas Estévez *et al*., 2015). As it plays with the concavities and convexities of the 3D model's surface, it allows the highlighting of the grooves in the rock (i.e. Vilas Estévez *et al*., 2015; Vilas-Estévez *et al*., 2016; Carrero-Pazos *et al*., in press). 3) Finally, Adobe Photoshop CS4 was used to obtain a tracing

similar to the traditional tracing (Carrero-Pazos *et al*., 2016). In this tracing we are able to see the engravings, and less prominently, the natural grooves.

Along with the computer equipment, we have used 10 Watt LEDs to light the panel and an extensible tripod to support the camera (Figure 7).

Figure 7. The materials used to obtain the virtual 3D model: LED lights, photographic camera and tripod with extensible arm.

5. Case Study: Panels VIII and IV.

Among the several panels in Cova Eirós, we have selected two of them based on the different characteristics that they display: Panels VIII and IV. Thus, the reliability of the photogrammetry SfM can be tested in different conditions. These two panels are located towards the bottom of Mammoth Hall, where it becomes narrower (Figure 1). While Panel VIII is located on the left section of the corridor on a 60º inclined frieze, the panel IV is located in front of it, in a close and concave space at a height between 55 and 213 cm. Both of them show natural cracks, which could be confused with anthropic tracings.

Panel VIII is much more affected by erosion processes at the moment: the constant flow of water slightly erodes the motifs and also, along with the drying cycles, contributes to the calcite recrystallization on the surface. These handicaps favour the apparition of generalised brightness on the area, which interferes in the tri-dimensional reconstruction of the panels. Furthermore, the wall is covered by a blackish coating that reduces the visibility and contrast of the engravings, making them visible only when applying a lateral light.

Ultimately, this panel shows a great overlap of grooves, which interferes with the individualisation of both the abstract and figurative motifs it possesses.

Unlike Panel VIII (Table 1), Panel IV shows a lighter colour with no blackish coating or film, helping to the identification of the grooves. Also, there are no obvious signs of superficial erosion and there is a smaller impact of graffiti, as well as recrystallization evidences. However, small bacteria colonies—actinomycetes—can be found, which form tiny white spots (<10mm) (Rivas Brea *et al*., 2013). There are

several tracings on this panel, but we only focused on the geometric motif and the bison (GIV–G5 and GIV–G3, respectively)

In addition, the panel is broadly concave and crossed by various fissures that divide it into multiple subpanels where each motif is located. In those subpanels, the surfaces are relatively flat. Limestone sedimentation lines and tectonic cracks are fairly substantial in this panel, and they may be misunderstood as anthropic lines.

Panels' main features		
	PANEL VIII	PANEL IV
Natural processes	Incidence of natural fissures. Irregular surface in the upper part.	Presence of natural fissures that may be confused with anthropomorphic strokes. Surfaces are smoother than Panel VIII.
	Highly affected by erosion processes: - Constant water flow	No superficial erosion signs.
Natural contamination	Blackish coating.	Clearer colour of the panel, no coating nor mantle. Presence of actinomycetes' colonies.
Geometry of the panel	Tilted frieze (around 60º) spread for 7 m.	The panel is, in general, concave, divided into several subpanels where each motif is located.
Anthropic processes	20th century graffiti.	20th century graffiti.

Table 1. Main differences between the panels studied.

6. Documentation of the Engravings: The Recording Process

6.1. The First Attempt

The first step was the visual examination of both Panels VIII and IV. After assessing the characteristics of each of them, we decided to carry out several tests using the previously described equipment. In a first attempt, the technique was initially tested in Panel VIII, which was the most problematic case, in order to test the

constraints related to the panel features (coating, etc.) and those to the technique (lighting, exposure time, focal length, F number, etc.) (Table 2). Once the handicaps were identified and controlled, changes were applied again in Panel VIII and, finally on the Panel IV motifs.

Figure 8. Photograph of the studied section of the Panel VIII.

The Panel VIII features made the recording process harder (Figure 8). After the first contact, when lighting the panel and taking long-exposure, open-aperture photographs, the results were not at all satisfactory. The problems we faced were the following:

1. Brightness in the 3D model, as a result of the presence of water and calcite recrystallizations on the rock.
2. Due to the lighting, aperture and focal length conditions, the resolution of the images were unsuccessful. The pixels of the picture were wider than the grooves, making it impossible to replicate them in a 3D model (Figure 9).

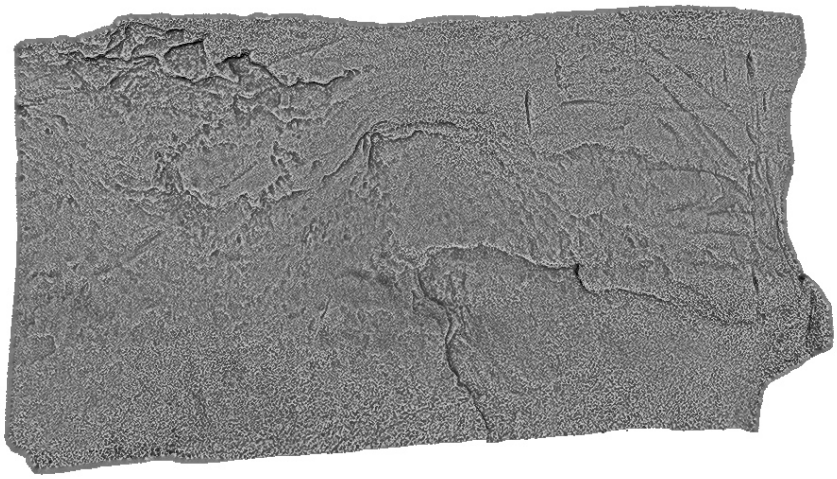

Figure 9. First 3D model of the Panel VIII.

6.2. Test under Controlled Conditions

In response to the encountered problems, we therefore developed a test in the laboratory under controlled conditions in order to design and improve the methodology and solve all the aforementioned issues. These solutions had to do with modifying the distance between the panel and the camera or adding filters to take better shots, so that we could get a higher quality virtual reconstruction. In this regard, we decided to imitate the cave conditions in the laboratory. Firstly, an engraved figure with a thin and shallow groove was made on a little limestone slab extracted from Cova Eirós using a quartz tool. Secondly, the rock was kept under water for a week in order to weathering the fresh engravings (Figure 10).

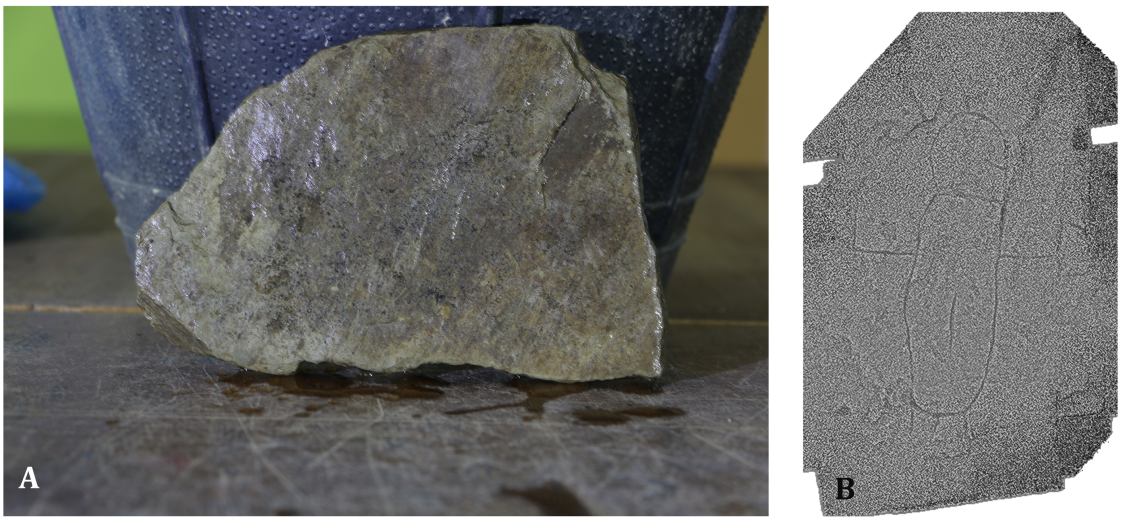

Figure 10. A: The small slab taken from Cova Eirós used to perform the laboratory tests. B: 3D model of the slab with the thin engraved motif.

The slab was illuminated homogeneously with LED lamps to minimise any gloss created by the light incidence in the water, since that was the main noisy element in the resulting 3D model. We placed a camera close to the plaque, using an extensible arm tripod, and made trials with a magnifying lens and using a polarising filter (not previously used in the cave). The results were satisfactory, though it is important to point out that the test slab had no blackish film as Panel VIII had.

6.3. Second Attempt

Once we were back into the cave, we tried to replicate the process we undertook in the laboratory, although unforeseen events occured. The extensible arm of the tripod was not long enough to get close to Panel VIII; consequently, the magnifying lens was not as effective as it was in the laboratory.

Continuing with Panel VIII, the polarising filter helped us to reduce the shine. Firstly, we attached a flashlight to the camera, in order to shed direct light on the panel. The resulting photographs, in this case, were very clear; though, as well as in the first attempt, the resulting shine posed problems for the 3D recreation. Secondly, as with the laboratory plaque, we took photographs with lateral lighting. At the same time, we positioned a camera as close as possible to the engraved panel using an extensible tripod, as well as applying open aperture and long exposure. The result was a better quality 3D model than the previous one, as it can be seen in Figure 11.

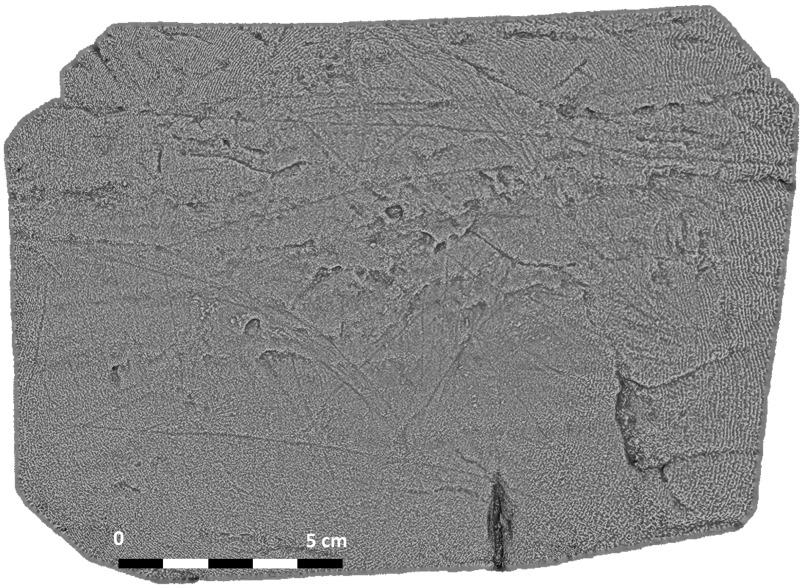

Figure 11. Photogrammetric results after the first trials.

Finally, we applied the aforementioned methodology to the recording of Panel IV (Figure 12). For the Motif PIV–G5 the results were satisfactory, helped by the fact that the panel was not covered either by water or the natural blackish film. Nevertheless, on the Motif PIV–G3 the results were inconclusive because of the presence of actinomycetes colonies on the surface interfering with the resulting model (Table 1 and 2). Thus, the results obtained in the PIV–G3 motif are excluded for this study.

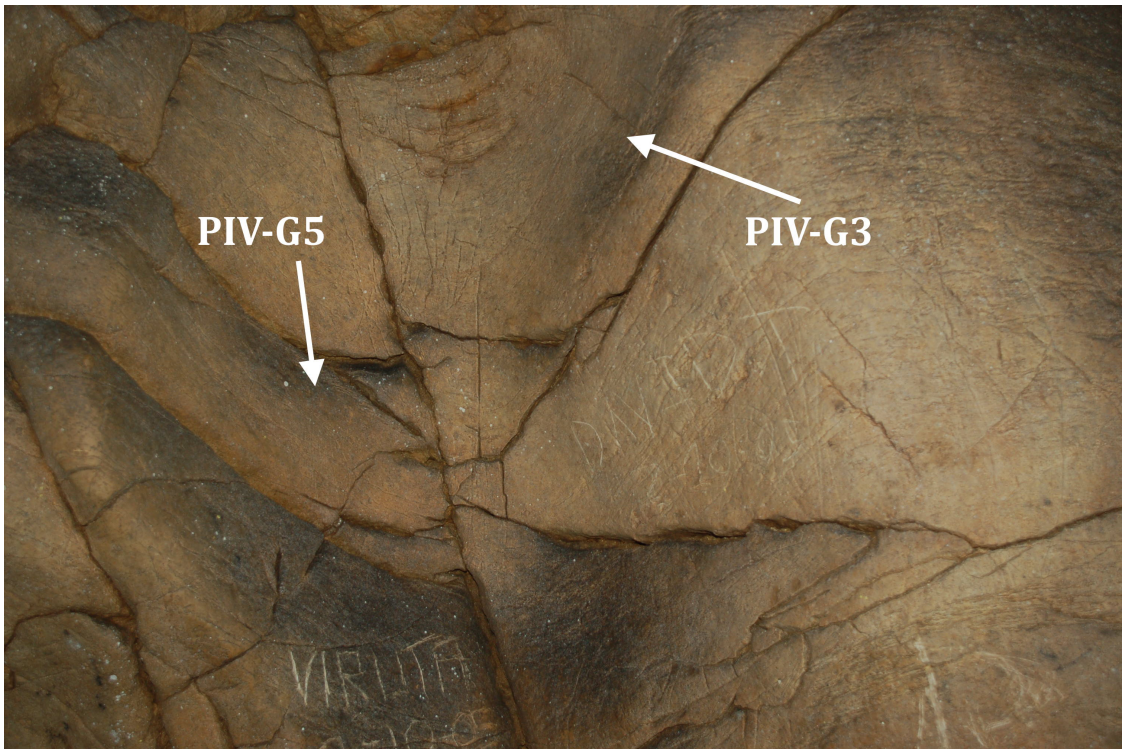

Figure 12. Photograph of the Panel IV, where the geometric motif (PIV–G5) and the bison (PIV–G3) are located.

	CAMERA: CANON EOS 70D						
	Panel VIII			Cabinet slab		Panel IV	
	Test 1	Test 2 with torch	Test 3	Magnifying glass	Polarizing filter	Geometric motif (GIV-G-5)	Motif of Bison (GIV-G-3)
Resolution	5472x3648	5472x3648	5472x3648	5472x3648	5472x3648	5472x3648	5472x3648
Focal length	18	135	135	55	18	135	135
F number	3,5	5,6	18	10	9	25	22
ISO velocity	100	100	100	100	100	100	100
Exposure time	13	1/25	30	25	30	8	30
Number of photos	30	56	19	36	22	19	102

Table 2. Information related to the photography used in the 3D models.

7. Preliminary Results

The results obtained with the photogrammetry SfM can be considered as uneven at first glance. Despite the aforementioned problems, the results obtained in both panels are helpful for understanding the handicaps that play a primary role in the image processing. Both naturally occurring features (coatings, bacterial activity, etc.) and technical problems (focal length, lighting…) impose important constraints that must be overcome in order to improve the technique.

In Panel IV, an abstract motif composed by an oval-shaped geometric figure with internal segmentation and oblique grooves can be clearly identified (PIV–G5). These internal grooves are horizontally crossed by natural cracks. Studying comparatively the

manual tracing and the photogrammetric model (Figure 13a and 13b), we can conclude that the main difference between them is the higher precision of the photogrammetric model. In the hand tracing there were small errors. The projected grooves do not match the real ones due to a slight displacement caused by the concavity of the panel and the resulting perspective effect on the photography. In our model, those aberrations related to the panel volumes are avoided.

In this case, the natural features of the panel surfaces (fissures, coating) do not interfere with the results. Thus, when surfaces are clean, the use of photogrammetry SfM can be considered as a resolute technique to obtain a reliable tracing of the engraved motifs (Figure 13c).

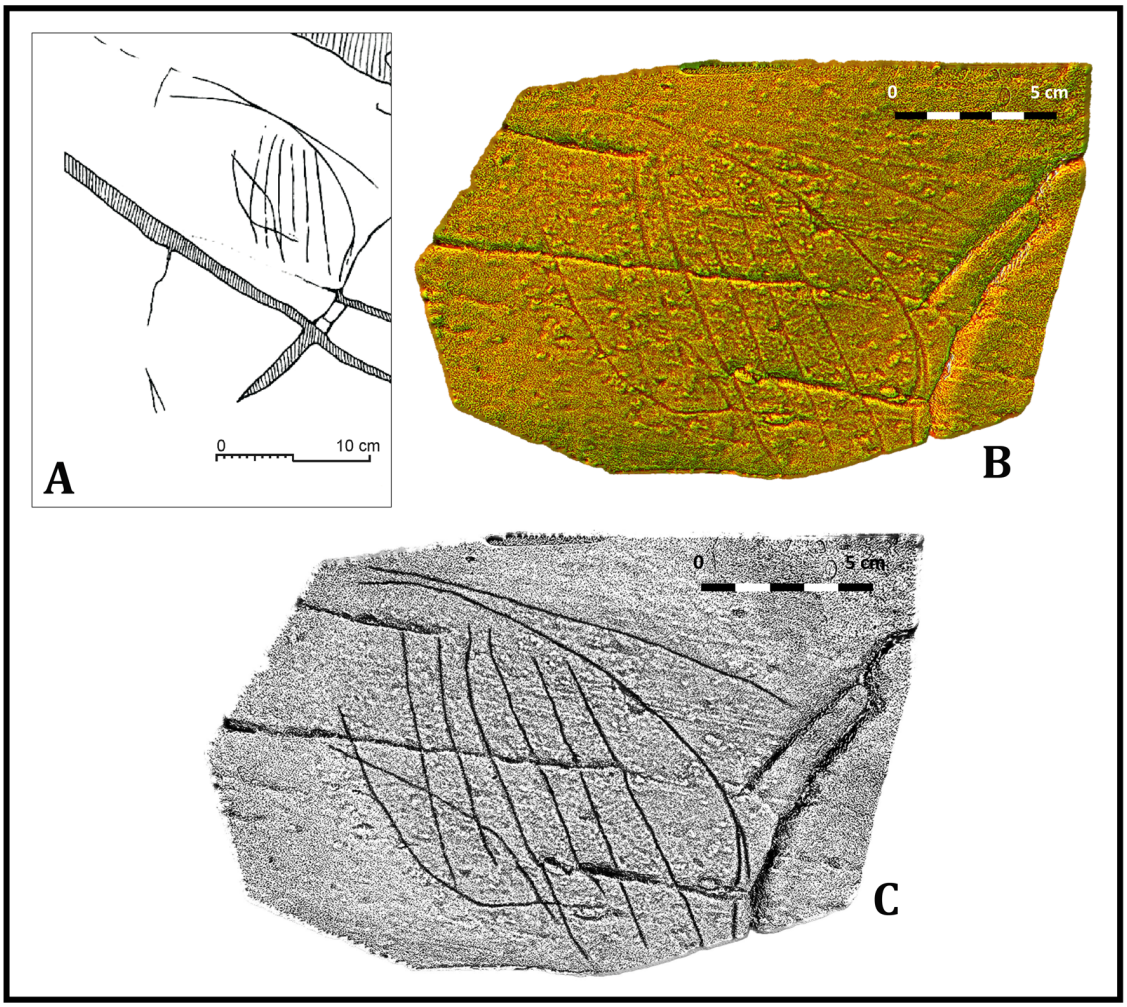

Figure 13. A: Hand tracing (R. Viñas-Vallverdú and A. Rubio-Mora). B: Photogrammetric model C: Final virtual tracing of Panel IV–G5.

Results from Panel VIII are rather different. It is harder to identify the anthropic motifs on it. Between the upper part of the panel—which is more irregular and with natural cracks and concavities—and the lower part, which is flatter, we can see a jumble of anthropogenic lines mixed with natural fissures. Altogether, they posed a great challenge to the photogrammetric restitution and the handheld tracing.

In this case, the 3D model was heavily affected by the natural coating film and the constant running water, generating reflection and noise in the final reconstruction. Thus, various grooves of the resulting 3D model are barely clear, especially in those

areas where more noise has been generated (the margins of the 3D model). However, by comparing the previous drawings and several revisions done by other authors (Figure 14a), we got an accurate tracing of the engravings (Figure 14b), although with little re-projection errors which are mitigated by the final image processing (Figure 14c).

For preliminary or fieldwork purposes the results can be considered satisfactory. As in Panel IV, the photogrammetric model overcomes the problems related to perspective effect and management of the surfaces´ volumes. Nevertheless, the identification of the anthropic grooves is problematic. Some of the grooves can be identified in the orthophotos taken by the *Escola de Conservación de Bens Culturais de Galicia* (Figure 6), although others are barely noticeable.

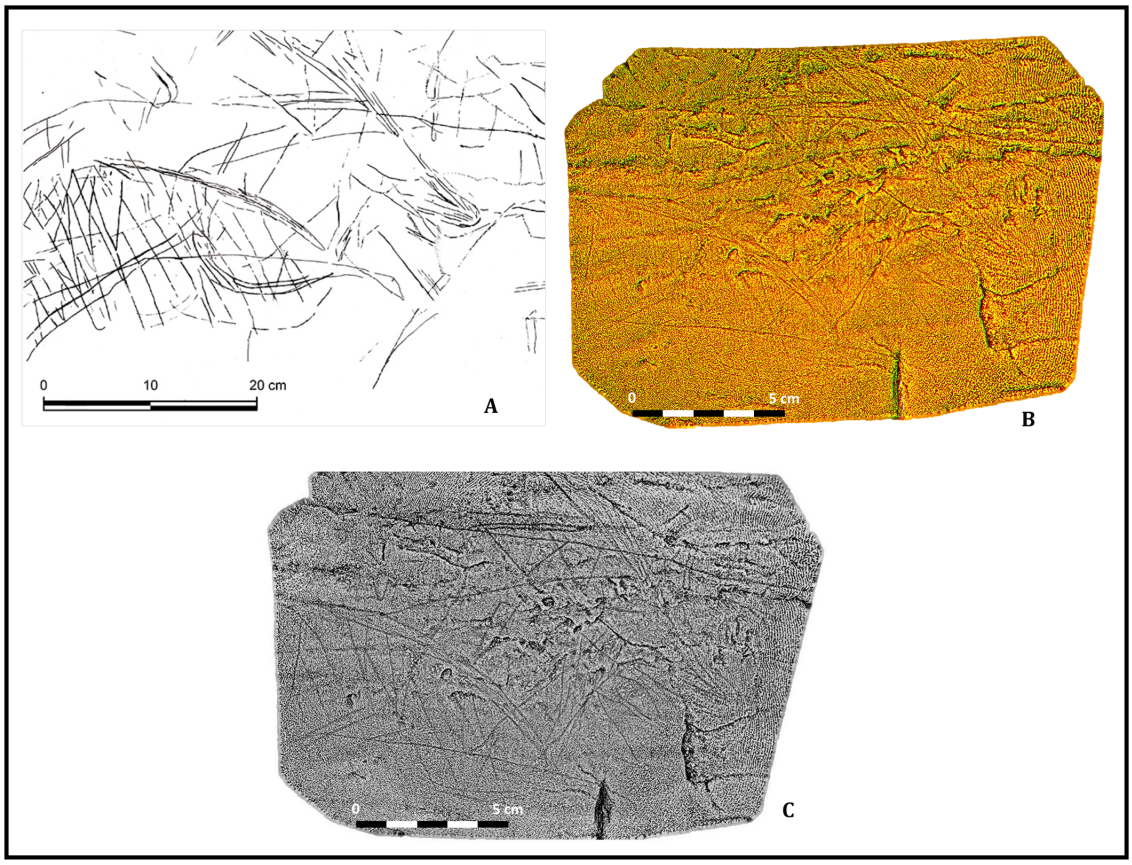

Figure 14. A: Hand tracing (R. Viñas-Vallverdú and A. Rubio-Mora). B: Photogrammetric model. C: Final virtual tracing of Panel VIII.

When the results of the different techniques are compared (specially with conventional ones), the photogrammetry SfM raises itself as a good technique for acquiring preliminary tracings that can be later used for practical fieldwork reasons, since it requires less equipment and demands less time processing data.

8. Final Considerations and Future Perspectives

The photogrammetry SfM was implemented in Galicia in recent years as a highly interesting computer tool in the field of Archaeology, especially in rock art studies. Although its use became popular because it is an easy documentation method, it

requires an intensive knowledge of the methodological process, which is often forgotten.

The work presented here show that this technique is heavily affected by the texture of the panel surfaces and the post-depositional processes, hindering the recording process, particularly with Panel VIII. The tri-dimensional reconstructions of the motifs of the Panel VIII were more problematic than Panel IV's. The resolution of the former panel is not as clear as in Panel IV, demanding a higher investment on both photographs and image processing.

Therefore, the photogrammetric methodology and the Shader Radiance Scaling applied in this work gave satisfactory but not conclusive results, due to the site's own constraints, caused by natural factors and by the inherent typology of the engravings—thin and shallow grooves. Nevertheless, as the abstract motif from Panel IV shows, when the rock support yields optimal conditions the identification of human-made thin engravings is quite reliable. Thus, the conditions of the rock surfaces and engraving techniques are more crucial here than in other case studies, such as the open-air rock art of recent Galician Prehistory.

Additionally, we do not exclude the use of traditional methods when documenting the engravings in Cova Eirós. These different techniques may complement each other in order to obtain an accurate reproduction of the panel.

So far, we managed to record a small section of Panel VIII and some of the motifs of Panel IV. We still have room for improvement and future works will advance 3D modelling techniques in Cova Eirós. However, the significance of the virtual reconstruction does not only rely on getting a good 3D model, but on further processing them in order to obtain an accurate tracing and interpretation. Currently, we have tested the post-processing technique known as Radiance Scaling, even though, in the future, we are going to test the results using other imaging techniques such as the Accessibility Shading or the Trend Removal (Carrero-Pazos *et al*., 2015; 2016). If feasible, it could become a useful technique for recording thin cave engravings and also portable art from other Palaeolithic sites.

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