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## 3D IN THE CAVE: HEY YOUNG DEER, WHY THE LONG FACE (AND NO TAIL)?

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**Abstract.** Grotta di Cala dei Genovesi on the island of Levanzo, part of the Egadi Archipelago off the western coast of Sicily, contains one of the most important records of Late Glacial rock art in the Mediterranean region. Its discovery in 1949 and publication marked a turning point in the history of rock art studies in Italy and gave the start to a great season of new finds in other caves and shelters of Sicily and a general growing interest for pre-Historic art. But despite the efforts of few, this interest gradually declined over the course of the years. The author's aim is now that of building a new digital documentation of the rich Late Glacial rock and mobile art record of Sicily, and of reconsidering it under the light of the recent research in the field. A survey carried out inside the Grotta di Cala dei Genovesi in June 2012 by an Italian-German team was the first step to build a basic routine investigation valid for the whole record: together with other techniques of analysis, the team used a 3D structured light scanner to record many of the engraved panels of the cave. The use of 3D scanning technology proved very reliable and made the documentation of rock art more detailed, objective and efficient. Consequently this study has succeeded in detecting several new, previously unknown figures. In this paper one test case will be examined, to show what the 3D scan can add to the autoptic examination and how it raised new doubts and helped to ask new questions.

In 2012 a team composed of several colleagues and me began a brief survey of the Grotta dei Cala dei Genovesi (Tusa et al. 2013), a small cave on the north-western side of the island of Levanzo, part of the Egadi Archipelago, a few kilometres off the city of Trapani, on the western coast of Sicily (Fig. 1).

The cave is famous for the presence of a rich record of schematic figures painted in black, traditionally dated to the Eneolithic ('cautiously', Graziosi 1962: 32), and for the engraved animals that have been unanimously attributed to the late glacial phases of the occupation of the cave (Graziosi 1962).

The different excavation campaigns that started as early as 1952 confirmed the human frequentation of cave. A number of absolute dates led to a better understanding of the chronology of this presence (Fig. 2). The occupation falls into the younger phase of the Epigravettian (roughly starting around 14 ka calBP, at the onset of the Allerød interstadial).

### *The excavation campaigns (1951, 1953 and 2005)*

Three excavation campaigns (Fig. 3) took place in the Grotta del Genovese, one in 1951 (the Jole Bovio Marconi excavation), a second in 1953 (the Paolo Graziosi excavation), and a last one in 2005 (Tufano et al. 2012). Graziosi also mentions a 'small test excavation', performed by him from 1950 to 1951.

We will now briefly have a look at the material found in layer 3, dated to the late glacial (Fig. 2). The most up-to-date synthesis on the lithics (Lo Vetro and Martini 2007) proposes a periodisation of the Sicilian Younger Epigravettian into 3 phases (1, 2 – with sub-phases *a* and *b* – and 3). Despite the efforts, some difficulties caused by a chronic lack of data about the Sicilian record<sup>1</sup> as well by the sub-optimal excavation practices used from time to time in the past campaigns (i.e. the dispersion of the lithic collections) leave this categorisation attempt as an open proposal. Comprehensive publication of the already excavated sites and future additional investigations could definitely help in supporting the assumptions made in the past.

Nevertheless, according to this categorisation, the Levanzo lithic complex, together with S. Teodoro stratigraphic unit A industry, falls into the latest stage 3. This stage seems to amplify some of the characteristics already noted in the sub-phase *2b* (exemplified by the Grotta dell'Acqua Fitusa complex):

- Significant reduction in the geometric pieces (0.1% at Grotta di S. Teodoro – only 1 piece – and absent in Levanzo).

<sup>1</sup> For example, absolute dates are few and often old, the number of sites fully excavated and published is scarce, etc.

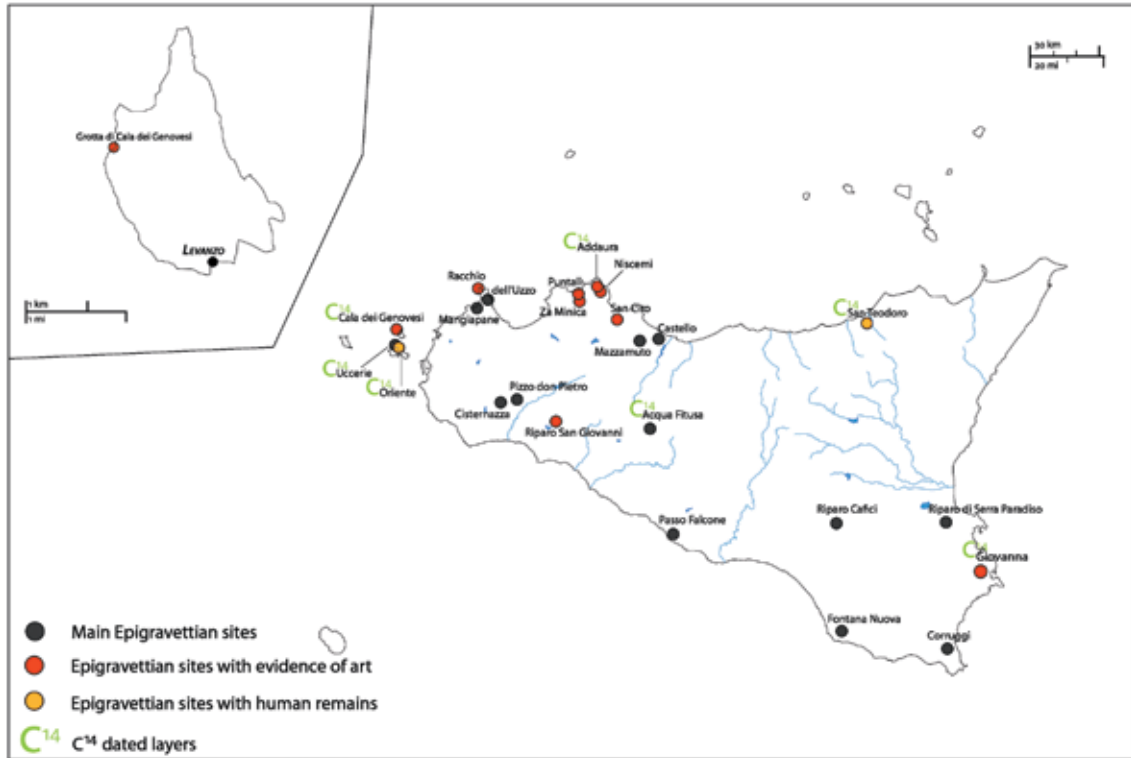


Figure 1. Map of Sicily with principal sites of the Epigravettian. In the box, Levanzo and the Grotta di Cala dei Genovesi (map by G. di Maida).

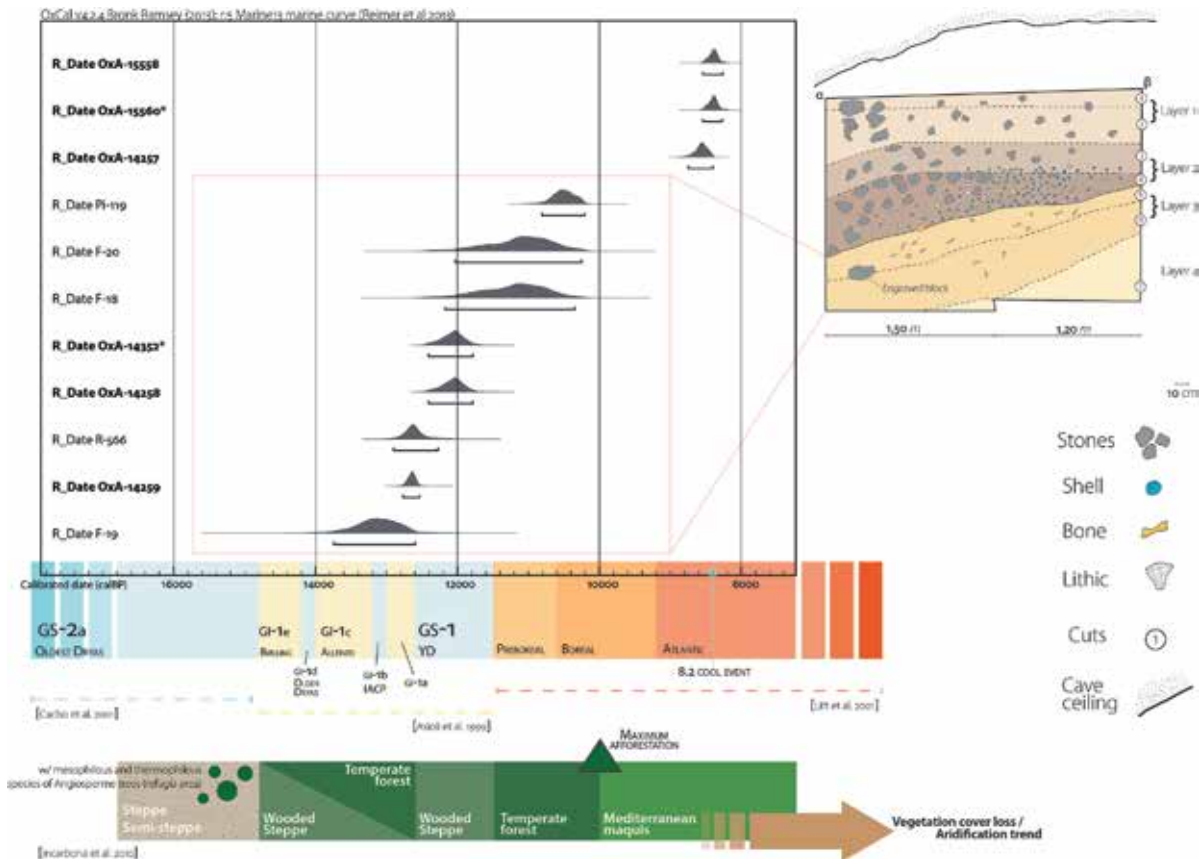


Figure 2. Absolute dates from the Grotta di Cala dei Genovesi deposit: in bold, AMS dates; with (\*) dates obtained on the same samples used for OxA-15558 and OxA-14258 (for experimental purposes). All the AMS dates are from Tufano et al. (2012). In the lower part, indication of the climate phases according to the GRIP and NGRIP cores (Cacho et al. 2001; Asioli et al. 1999; Litt et al. 2001) and reconstruction of the Sicilian vegetation cover (Incarbona et al. 2010). On the right,  $\alpha$ - $\beta$  section (see Fig. 3) of the deposit of the Grotta di Cala dei Genovesi, with the indication of the position of the engraved block (redrawn by G. di Maida and H. Piezonka after Vigliardi 1982).

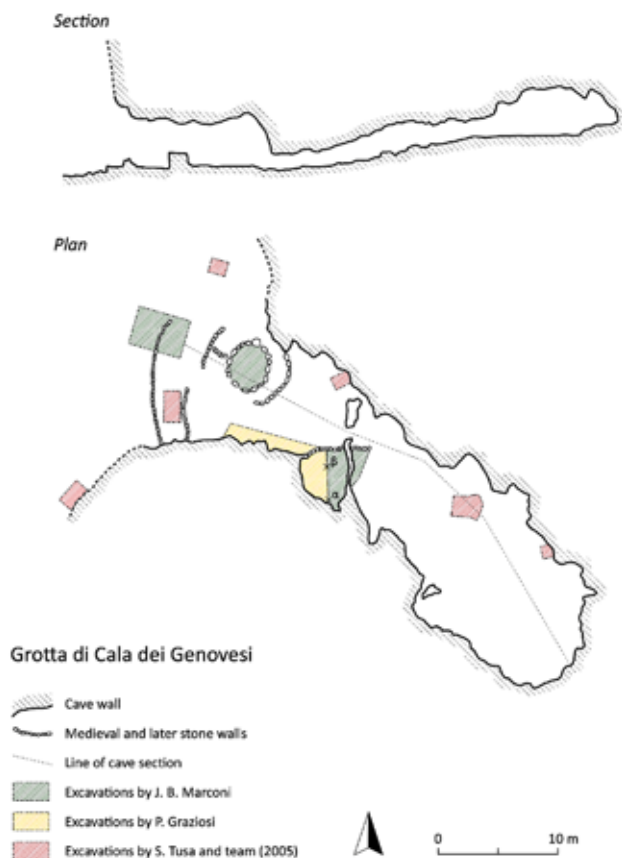


Figure 3. Grotta di Cala dei Genovesi, section and plan of the cave (redrawn and supplemented by H. Piezonka after Tufano et al. 2012).

- Relevant number of backed points.
- Strong presence of scrapers (about 18.2%), with a possible peculiar evolutionary element of the Levanzo complex (which is not recorded in S. Teodoro).
- Decreasing trend of the blade index.

Concerning the macrofaunal remains (Colonese et al. 2007), the data indicate unanimously *Cervus elaphus* as the most represented species in the faunal assemblage. In layer 3 of Genovese Cave, *Cervus elaphus* is predominant (62.7%) — in line with the other sites of the island; followed by *Bos primigenius* (15%) and *Equus hydruntinus* (8%). In all the assemblages of Sicily the most represented carnivore is the fox (*Vulpes vulpes*), even if with very low percentages (<7%): Levanzo is not an exception, with *V. Vulpes* at 3.3% (Cassoli and Tagliacozzo in Vigliardi 1982). These data let us conjecture ‘the presence of diversified environments with mixed forests, an ideal habitat for deer and boar, and open areas, ideal for the *Equus* and the aurochs’ (Colonese et al. 2007: 233, my translation).

But the most important result of the past excavation campaigns (namely the 1953 one, led by Paolo Graziosi) was the discovery of an engraved block in layer 3 (Figs 2 and 3): this fortunate coincidence let the archaeologists and the researchers rely on a strong, albeit indirect dating for the engravings that cover the walls inside the cave. This is how Graziosi describes the bovid on

the engraved block: ‘[t]he figure resembles the ones engraved on the walls of the inner part of the cave, despite its more rigid and coarse design. [...] It is important to point out once again that due to their more naturalistic character, those figures [*the ones engraved inside the cave*] could be, perhaps, ascribed to an earlier phase than the bovid engraved on the block, that shows a more coarse naturalistic character’ (Graziosi 1973: 52, my translation).

As it appears clear from what we said until now, Levanzo is one of the best documented cave sites of Sicily, with a long tradition of studies going back to the early 1950s. And that is why we decided to test a new methodological approach, starting from there.

#### The 2012 survey

The small field campaign of June 2012 was focused solely on the Palaeolithic engravings and was aimed at the

macroscopic assessment of the original engravings on the cave walls in comparison to the published drawings, with the aim to identify possible changes in the state of preservation since the original documentation in the mid-20th century. At the same time it was to be tested whether new, previously undocumented engraved lines and images could be found with modern light sources. [...] The team also had the task to evaluate the potential of 3D surface modelling for a new systematic recording of the Palaeolithic engravings and their surroundings, not least because the contextualisation of Ice Age cave art has immensely gained importance over the last few years (Tusa et al. 2013: 10).

The exceptional results obtained — despite the briefness and the character of the survey itself, intended as a pilot study — were presented (Tusa et al. 2013): among the most relevant ones were new, previously unseen figures, completion of previously unrecognisable figures and tentative attribution to a species, and a reassessment of the total number of figures.

We will focus our attention here on the 3D methodology and on one practical example of the use of the 3D files, not only for documentation or conservation purpose but also as a tool for performing rock art research.

#### 3D scans

As mentioned, one of the aims of our study was to test the potential of 3D scan in the documentation of rock art. In recent years, the 3D scan of cave walls with rock art has become the most reliable among the different methodologies available for documentation. Although the costs remain quite high<sup>2</sup>, 3D must be preferred over the traditional methods<sup>3</sup> for many other reasons: the speed, the accuracy and finally the digital rendering per se. With the digitalisation of the cultural heritage, it is possible to set a zero point for the

<sup>2</sup> But the *structure from motion* and other similar software are rapidly changing this aspect.

<sup>3</sup> For a summary and a history of the rock art documentation, please see Aujoulat et al. 1993.

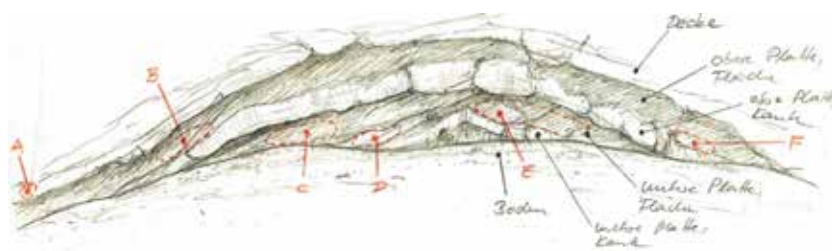
future of conservation of the cultural remains and also to make those very relics available for present and future generations of researchers.

Our team used a structured light scanner (model Breuckmann, smart-SCAN 3D-DUO), providing a high resolution 3D surface model of the image panels. 'With this device, sections of the north-eastern cave wall and the ceiling were scanned at a resolution of 0.35 mm per pixel in order to create a 3D model of the engravings and their surroundings' (Tusa et al. 2013: 10).

The resolution chosen for the survey was aimed at the documentation of larger areas, seeing the scope of our survey was only to perform a brief test. Nonetheless, the quality was high enough to make some observations on the wall incisions and even to notice something that was not seen with the naked eye in the field. It is definitely true that autoptic examination of the wall cannot be replaced by the 3D scan, as we sometimes hear: it would be foolish to think differently. But there is still something that the 3D scan can add to the autoptic examination. I will illustrate how it raised my doubts and helped me asking new questions.

#### *The doubts about the tail*

During our brief visit to the cave in 2012, we used capital letters to denote the different areas of the cave



**Figure 4.** *Grotta di Cala dei Genovesi, north-eastern cave wall sketch with subdivision of geological units and image panels (drawn by H. Piezonka).*

with engravings, following Graziosi (1962: 17) (Fig. 4). Panel A is the first engraving that one sees entering the cave and is formed by one lone figure. Graziosi describes it as a cervid that is facing right, but looking backwards, and according to his own words, it is 'one of the most beautiful figures in Levanzo, very vivid' (Graziosi 1973: 50, my translation).

In our reanalysis of the published drawings, all the other panels showed some changes, even if minor ones (Tusa et al. 2013: 16–17 and here Fig. 12). Panel A, primarily due to being composed by only one figure, remained unchanged (Fig. 5). After our publication, though, I returned to the 3D files and — looking at the scanned output (Fig. 6), the original drawing (Fig. 7) and the photographs (Graziosi 1950: tav. II and 1962: Fig. 13)— I was not convinced by the tail of the cervid: simply as it is, in the 3D version it is not possible to see it.

I have been able to move the 3D file along all three



**Figure 5.** *Photo of the figure in the panel A (photo by G. di Maida).*

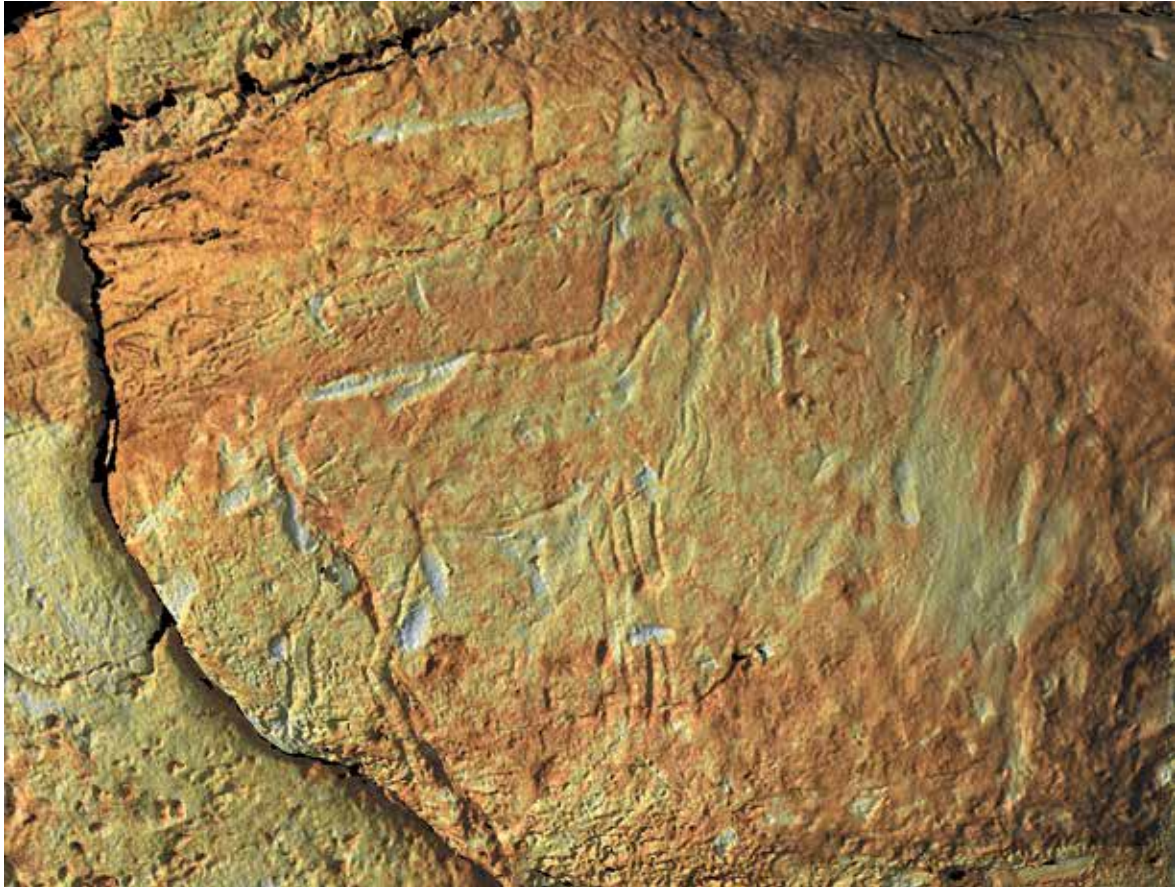


Figure 6. Snapshot of the 3D model for the panel A.

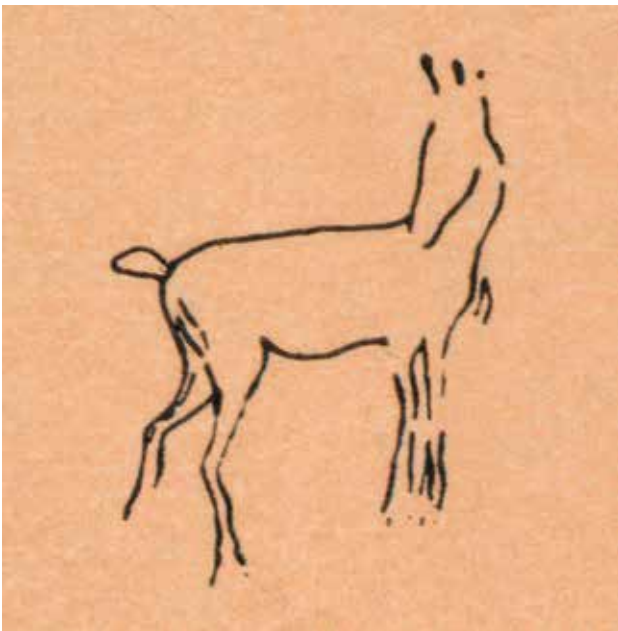


Figure 7. Detail of the drawing by Graziosi with the figure from panel A (Graziosi 1962).

axes, to change the lighting, to exaggerate the contrast and to operate with many other parameters (the cons of the 3D): nothing gave me the impression that there was a tail in that spot, as depicted in the original documentation.

At this point, I formulated three obvious hypotheses:

- The lines are very fine and they are not visible in the 3D file<sup>4</sup>.
- There are no lines at all and Graziosi misinterpreted the tail of the cervid.
- Some damage occurred to this figure (at a certain point between the Graziosi analysis and our 2012 study).

Everybody knows that after you start to question something, you will find yourself questioning the whole system; and so did I. I started to raise doubts about the overall size and shape of the tail as reported in the drawing (Fig. 7): it looked to me not natural (and thus contrasting with the general tone of the image) and frankly out of scale. In a word, it looked to me like a fake tail.

But before jumping to drastic conclusions, seeing that I could not revisit the cave any time soon and taking into account that I do not have a great familiarity with these kinds of animals, I decided to learn more about the tails in ungulates.

#### *Tail in ungulates (before returning to the cave)*

It turned out that I was wrong or at least that

<sup>4</sup> If this would be the case, the presence of lines different in depth or thickness from the other should have been signalled somehow in the original documentation (Fig. 7).

my impression was exaggerated — but not completely. The tail indeed looks to be out of scale: modern adult female red deer (hinds) have tails ranging from 12 to 19 cm, with a body length of 160 to 210 cm, so the tail is about 1/13–1/11 of the total body length (Macdonald and Barrett 1993). In the engraved picture, instead, the tail is about 1/5 of the total length: this means that a full sized animal would present a 32 to 42 cm tail length range, which is way beyond the natural proportion.

But the size of the tail is just a detail that could depend on the ex-

pressionist intent of the engraver; what will be of greater interest is to investigate the ethological base of an erected tail: do modern deer present this behaviour? Yes, they do. The erected tail is a well-documented behaviour in the ungulates (Stankowich 2008), whether it means arousal, danger, sign to predators (to let them know that they have been spotted) and so on. Very interestingly, many of these situations fit perfectly with the other relevant details of the discussed figure and thus the head: the cervid is looking backward in very precise, characteristic posture. It is just an impression, but looking at it one can imagine the animal caught by surprise, or suddenly stopping to check if a noise or a scent could reveal the presence of a threat, or more in general focusing its interest onto something: simply being in a different state from the relaxed one.

Therefore everything made sense again: the two elements that make this figure so peculiar (head and tail) were reunited in a meaningful significance. The erected tail is a perfect detail to add to a cervid that — for some reason — is looking backwards.

My attempt of making less plausible the depiction of a tail the way it is reported in the drawing, relying on physical and ethological characters, ended up contradicting my initial doubts. The tail is truly out of scale, but the erected tail is a very common and visible trait of deer behaviour (surely very well known to hunters); and one could easily suggest that the engraver made it out of scale, wanting to stress this detail deliberately.

#### *Back to the cave*

But of course this was just a tale based on the drawing published by Graziosi, and it was valid only until it was possible for me to come back to the cave and focus the analysis on the *real tail* of the cervid engraving.



Figure 8. Detail of the 'tail' of the figure in panel A (photo by G. di Maida).

Because, obviously, the lines drawn in the original documentation were still missing from the 3D file in my possession.

At the first opportunity I returned to the cave with the sole purpose of confirming the original interpretation and finally silencing the doubts inside me.

(Un)fortunately, things went differently. The first thing that I thought once I was there, was: 'why am I thinking of a deer and a deer only? It does not look like a deer to me! It looks like an equid instead'. Until that moment my interpretation of the figure as a cervid was only based solely on Graziosi's opinion: a cervid, a young one, seeing the absence of the antlers. But Graziosi himself, in his monograph dedicated to the Levanzo Cave, makes a short comment about different opinions of other (quite authoritative, by the way) scholars (Graziosi 1962: 38): 'It is truly strange that some authors, reporting the image previously published by me, *presented it as a horse or an equid*' (my translation and emphasis). I confess that I re-read this long after I began pondering the idea that the figure was not a deer; in my defence, I read that sentence for the first time some years ago, and evidently I did not really notice it until I was ready to accept its plausibility. But the good side is that I suddenly felt less alone and in very good company indeed, because there were already others who saw the figure as I did: the elongated face surely must have suggested to Breuil (1952), Kühn (1952) and Bandi and Maringer (1952) to interpret it as an equid.

In the above-cited paragraph, Graziosi goes on and says: 'these interpretation results are even more puzzling if we take into account some morphological features of the animal, clearly reproduced in the incision in Levanzo and that can exclude them categorically. *The short tail is not the one of an equid, but typical of the deer*

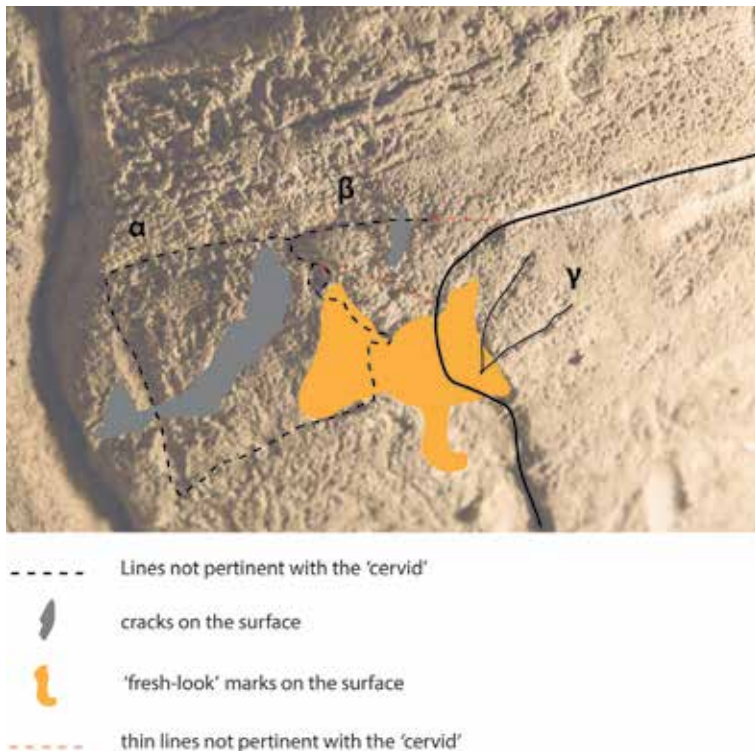


Figure 9. Schematic interpretational sketch of the 'tail' area in panel A.



Figure 10. Detail of the head of the figure in panel A (photo by G. di Maida).

and the two short horns, well visible, on the head of the animal, close to the left ear, cannot leave any doubts on its zoological determination' (my translation and emphasis).

So, according to Graziosi, the definitive interpretation of the figure can be assessed thanks to two elements: the tail and the head. Clearly, casting a shadow on these two elements would also, conversely, weaken the attribution proposed.

Let us proceed in order and start from the bottom: the area around the tail (Fig. 8) is very disturbed by natural and/or recent artificial cracks and it is not easy to separate the lines that could be part of the figure or other signs on the wall — as one can expect from looking at the 3D scan. However, some things can be said. The area marked with  $\beta$  in Fig. 9 is the one interpreted as the tail in the original documentation; in my opinion, it is composed of non-homogenous lines:

- A deeper line (black dashed in the picture) that looks more similar — and therefore is connected with — the ones in the area marked with  $\alpha$ , forming this way a square-like form (with an extended side at the top)<sup>5</sup>.
- Two very thin cracks (dashed red, thinner) in the rock surface that could represent the missing bridge interpreted by Graziosi as part of the tail.

From the photograph (Fig. 8) it is clear that these lines (dashed red) are not consistent with the other lines (dashed black) and that it is an arbitrary decision to consider all of them as a unit. Very interestingly, two lines that look more similar to the ones that constitute the outline of the figure (and thus having more chance than the previous ones of being artificial), produce a V-shaped form *inside* the body of the animal ( $\gamma$ ), but very close to its anal area. This element looks like it is not reported in the original documentation. Even if not conclusive, this new detail could be more interesting in the discussion concerning the presence and the shape of a tail (and consequently in the attribution of the animal to a species) and it will be discussed below.

Let us now consider the second element that, according to Graziosi, removed any doubt in the zoological determination of the figure, the antlers. Unfortunately, as for the tail, no antlers are visible in the figure as it is now (Fig. 10). And even if we look at the lines reported in the original drawing, I guess that everybody could agree that they can

<sup>5</sup> Whether these lines are natural marks on the rock or artificial remains doubtful: but this does not affect the reasoning, seeing that the dimension of the dashed black lines is not in any way interpretable as a tail (Fig. 5).

also be interpreted as part of the mane of an equid (more in the zebra or Przewalski's horse fashion, than in the one of the domesticated horse, Fig. 11).

So the most plausible conclusion is that a misinterpretation of the lines and cracks in the area led Graziosi to the drawing (Fig. 7) and the proposal that the animal in the figure is a young deer.

#### *An alternative explanation*

Before going to the conclusions, one other possible explanation that must be taken into account to explain the apparently erroneous interpretation by Graziosi is that something has changed in the head and tail details of the figure along the years, perhaps due to modern frequentation of the cave. Nowadays, both areas look too different and with too few details compared with the drawing (Fig. 7) and especially the photo (Graziosi 1962, Fig. 13).

Despite the quality of this photo being better than the one presented in Graziosi (1950), allowing a clearer look at the status of the engraving some years after its discovery, there are still a couple of problems that prevent me from completely relying on it: 1. seeing its printed size, it is more a general view and so the details are not well visible; 2. in certain points the photo leaves me with the doubt that it has been somehow processed, to better show some lines and marks on the wall, as it was often done in the past.

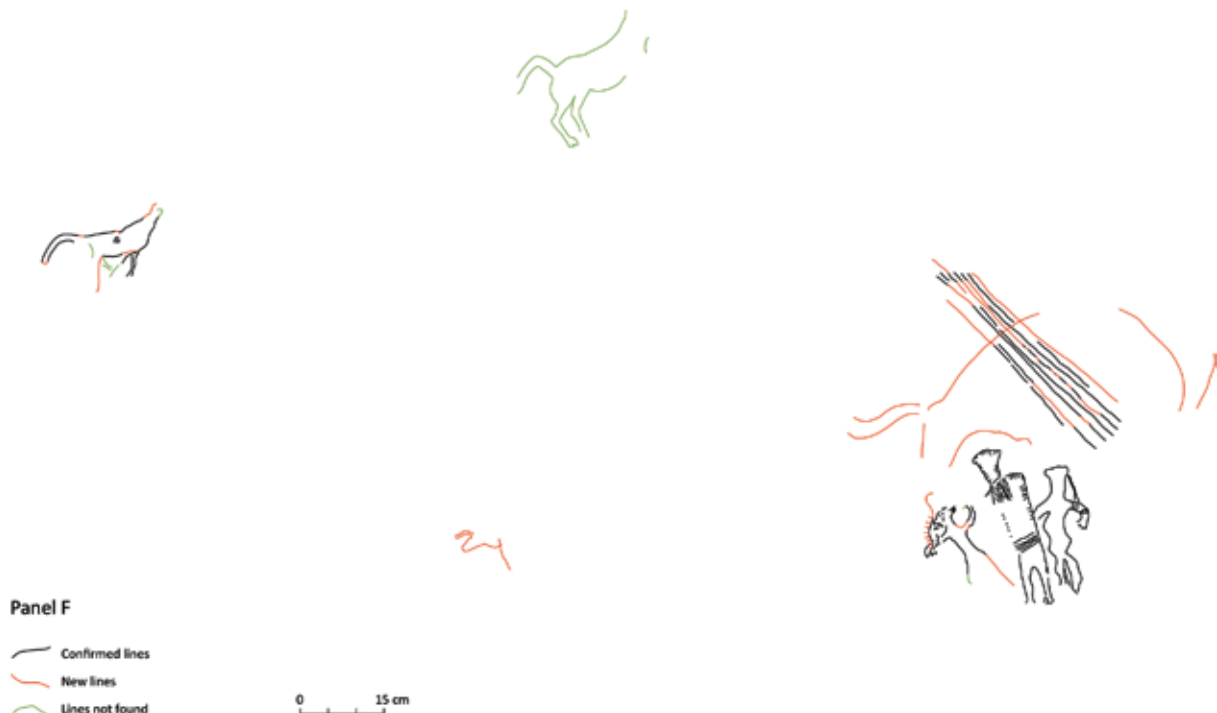
Be that as it may, if such changes truly took place, then the original documentation of Graziosi may represent a better phase in the conservation of panel A, and thus a precious source of information.

At least one other 'strange' case should be briefly mentioned here that could cast a light on this discussion: in another panel inside this cave (Panel F) we have not



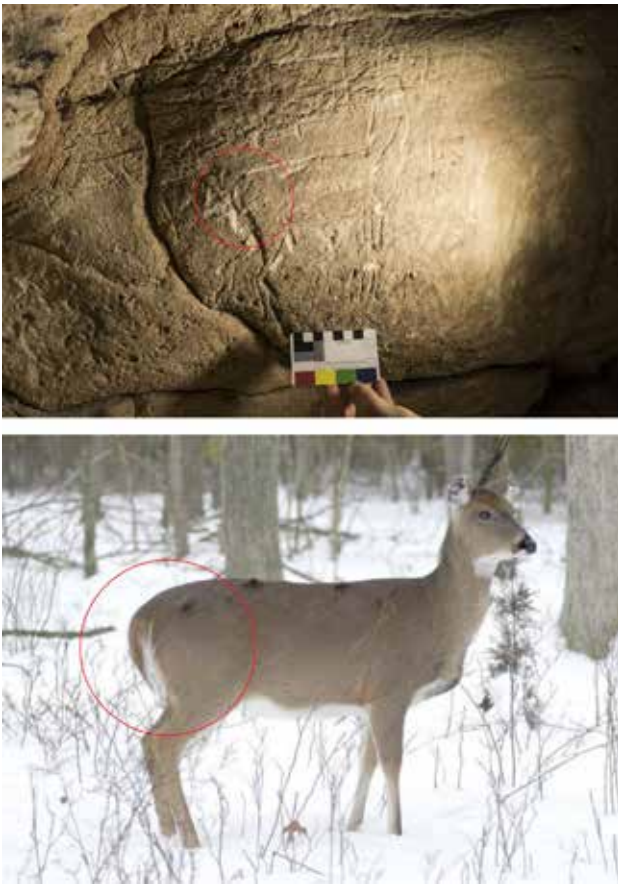
**Figure 11.** Przewalski's horse (*Equus ferus przewalskii*) (photo by Claudia Feh).

been able to find one of the figures included in the original drawing (Fig. 12, shown in green), cautiously described by Graziosi as a feline (Graziosi 1962: 41). He based his reasoning mainly on the 'slim body, slender limbs, the foot provided with tiny parallels traits that seem to reproduce retractable claws and a long and fat tail' (op. cit.: 41-42, my translation). Having not been able to have a look at the figure during the 2012 campaign, we could not check and discuss Graziosi's interpretation as a feline. Be that as it may, it is not easy to say what happened: was the figure somehow destroyed during the decades after the 1960s?



**Figure 12.** Result of re-examination of panel F (drawn by G. di Maida, H. Piezonka on the basis of Graziosi 1962).





**Figure 13.** Comparison between the figure in panel A and a white-tail deer (*Odocoileus virginianus*) (upper photo by G. di Maida, lower by Michael Hogan).

What can be said is that the two areas are very different: panel A is a vertical surface right after the entrance, located at one of the first points where the visitor of the cave can easily stand (the ceiling at the entrance is quite low). And it is also a point where, due to the slippery condition of the floor, the visitor that does not know about the incisions (and about the soft nature of the wall in this point) could think of finding a safe handhold.

Panel F, however, is a sub-horizontal surface at the very end of the small cave, distant from the passage area: for this panel the only possibility of interference by visitors must take into account someone that could have climbed the rock surface, stepping on it to reach the upper part of the rock. If the first case can be made more plausible by the high frequency of visitors, the latter looks less plausible, but clearly not impossible.

In conclusion, even if the vast majority of the engravings appears to be in good conditions, both these cases surely leave open the possibility of a gradual deterioration of the panels, or the existence of singular damaging episodes that in the past decades could have led to the decay of the rock surface and the incisions in given areas.

#### Conclusions

The 3D scan has helped in the detection of a

divergence between the figure on the wall and the original documentation which our team was not able to notice during the first visit, nor did anyone before. Without returning to the engraving, and looking only at the 3D models at the office, it has been possible to notice a divergence that would have probably remained unnoticed for a long time.

The interpretation of the engraved figure in panel A made by Graziosi was based on two elements (tail and antlers) that are not clearly visible today. Moreover, even with those elements present, the shape of the figure's head will fit better with the physical characteristics of an equid, and not of a cervid. All in all, then, the most plausible and conservative attribution is to that of an equid.

What remains to be clarified is the role of the V-shaped element inside the body of the animal, in the area  $\gamma$  (Fig. 9). If we look at the general view (Fig. 5), the upper line of the V-shaped element appears to be linked with the outline of the body and could instinctively recall the shape and size of the tail of a deer: not an erected one though, but a tail in its rest position (Fig. 13). A closer look to that area, however, does not point in the same direction and this is mainly because the whole surface (Fig. 8) is ruined by some fresh-looking marks that render it very difficult to determine whether this line is part of the figure or not. In any case, this alternative interpretation still leaves open a small possibility for the attribution of the figure of panel A to a young deer (with an exceptional long face).

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