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Reconstructing Paleolithic cave art: The example of Marsoulas cave (France)

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ABSTRACT

3D technologies are now widely applied in the study of decorated caves and rockshelters because they provide unique volumetric representations of the art. In the cave of Marsoulas (Haute-Garonne, France), which has engravings and paintings which date to approximately 17,000 BP, 3D modeling and other image processing techniques have been combined into an analytical system of documentation that addresses the unique challenges and questions that this site presents to researchers. 3D modeling is used as a new tool for producing easily understandable graphic renderings of the cave walls (essential for interpretation), while also creating a publicly accessible reconstruction of the cave art and its environment.

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1. Introduction

3D techniques have been applied to the study of decorated caves and rockshelters with great success. Not only does this present an opportunity to represent parietal art in its full volumetric dimensions, but it readily allow for these reconstructions to be accessible to a wider audience. Most often, these 3D technologies are used in the final phase of analysis, to synthesize the body of data collected and to construct a holistic view of the site.¹ Even so, in France, the cost of these operations and of making them publicly available online limits these virtual visits to major national sites.

However, the application of 3D techniques presents many possibilities for all phases of research (among many examples: Pinçon, 2004; Pinçon et al., 2010; Azéma et al., 2012, 2014; Bourrillon and White, 2015; Feruglio et al., 2015; Fritz et al., 2010a; Delannoy et al., 2012). Since 2003, we have employed these tools in the interpretation and documentation of engravings and paintings from the cave of Marsoulas, which date to approximately 17,000 calBP (Fritz and Tosello, 2004, 2007). The constant evolution of 3D modeling techniques has allowed for considerable advancement in data acquisition in the cave environments as well as their reconstruction both for researchers and the greater public.

1.1. A fragile cave with a complex past

Marsoulas is a straight narrow gallery of moderate size, about 100 m long, and can be navigated easily to about 27 m from the entrance at which point the walls narrow drastically and the ceiling lowers, forcing the visitor to proceed by crawling. At 40 m from the entrance, the floor curves downward at an abrupt angle, while the roof maintains its height, for about a dozen meters. At 44 m in, one can more stand upright again on a steep surface until an underground stream is reached at 50 m. In cross-section, the cave has an asymmetrical triangular profile (3 m wide and 4 m tall in the largest sections). The right wall is slanted, inclining to form the roof and eventually meeting the vertical left wall. Parietal art has been documented along the entire length of the chamber (Fig. 1).

Marsoulas has a long research history. An excavation trench from 1883 to 1884 is still visible today at the base of the left wall, 13 to 18 m from the entrance (Cau-Durban, 1885). In addition to substantial archaeological material, the primary significance of this excavation remains the exposure of engravings and paintings that were obscured by infill until that point (Fig. 2).

In 1897, F. Regnault discovered the paintings that form the principal panel (Regnault, 1897). Throughout the 19th and 20th centuries, numerous researchers have studied the cave (e.g. Cau-Durban, 1885; Cartailhac and Breuil, 1905; Bégouën and Russell, 1933; Méroc et al., 1948; Leroi-Gourhan, 1971; Breuil, 1952; Plénier, 1971; Vialou, 1986; Foucher, 1991; Lacombe, 1996). Despite the previous work, a considerable area of the site remained unexamined, which led us to embark on a renewed study in 1998. Both the material culture items and the parietal art suggest the primary occupation phase occurred in the beginning of

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E-mail addresses: fritz@univ-tlse2.fr (C. Fritz), willis.arch@gmail.com (M.D. Willis), gilles.tosello@wanadoo.fr (G. Tosello).¹ In France, we cite as examples the sculpted rock shelters of Chaire-à-Calvin (<http://www.sculpture.prehistoire.culture.fr/fr/la-chaire-calvin.html#visite>) and Roc-aux-Sorciers (<http://www.sculpture.prehistoire.culture.fr/fr/le-roc-aux-sorciers.html#visite>), and the painted caves of Lascaux (<http://www.lascaux.culture.fr/>) and Font-de-Gaume (<http://font-de-gaume.monuments-nationaux.fr>).

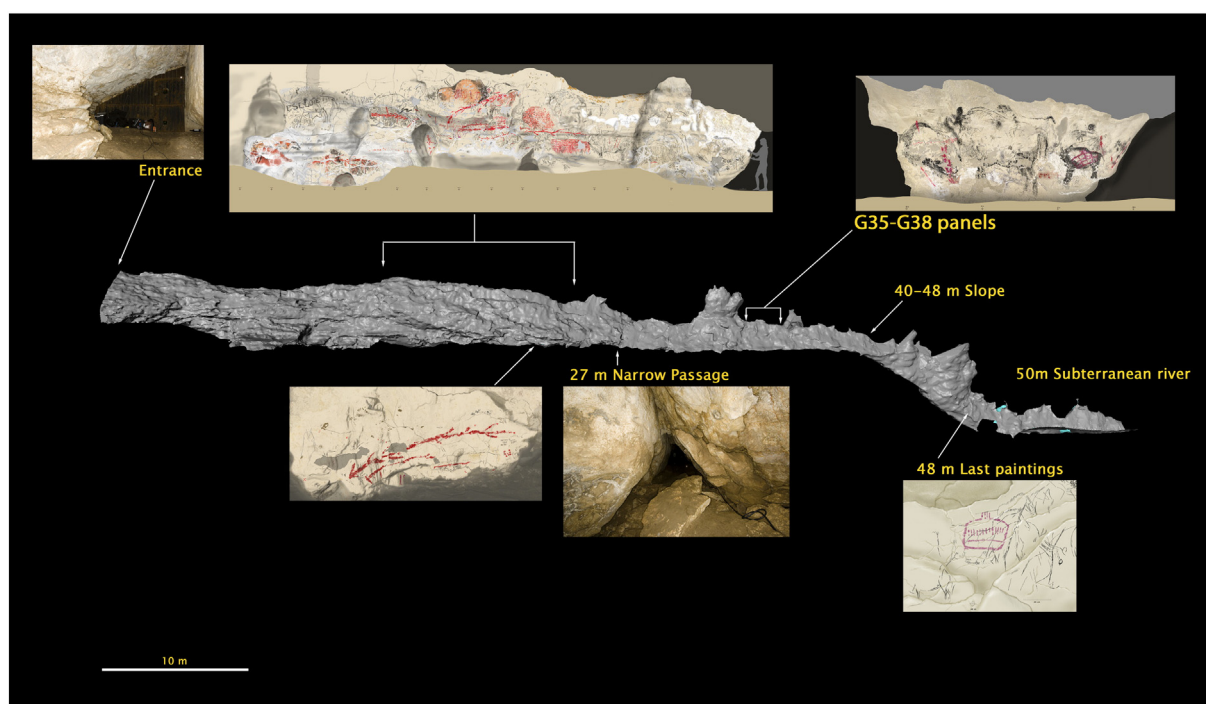


Fig. 1. Marsoulas cave. Complete 3D profile of the cave from the entrance to the end. In the present paper, the panels G35–G38 are presented as examples of the methodological protocol (doc. G.Tosello/C.Fritz).

the Pyrenean Magdalenian, around 17,000 calBP (Fritz and Tosello, 2005).

Early notoriety, significant and enduring scientific interest, and ease of access have had heavy impact on the conservation of the cave by attracting several generations of visitors who, through ignorance or vandalism, have damaged the walls in all areas within easy reach. The site was closed to the public in 1996. Even though research remains authorized, rules of conservation impose restrictions on maximum working time in the cave. This limits the impact that human presence can have on the subterranean climate, whose maintenance and stability are crucial to the conservation of the parietal art. With limited time to spend in the cave each year, we began to look for a way to continue portions of the documentation process from the laboratory.

1.2. An original style of cave art

At the end of 2015, the inventory of themes represented at Marsoulas (based on the analyzed panels, which comprised 60% of the cavity) included more than 340 animal and human figures, geometric motifs, and diverse markings. Overall Marsoulas is thought to comprise 500 motifs based on our survey to date. Among the repertoire we note several large bison and horses painted in red and black and accentuated with engravings; one of the bison is covered in red dots, and another in black dots. Geometric motifs are grouped on the left wall and include: tectiform (Figs. 3 and 4), rectangles, clusters of lines, dots and dashes, inverse “T” shapes, grids, large “harpoon” forms, and shorter groups of oblique marks. The art of Marsoulas is of profound stylistic originality



Fig. 2. From the entrance to the back of the cave, the gallery is straight in plan and triangular in section. The trench from early excavations is visible at left (image C. Fritz).



Fig. 3. Panel of paintings and engravings on the left wall, between 37 and 38 m from the entrance. In addition to the black bison on the right, once can discern vestiges of red pigment belonging to geometric signs (see also Figs. 8–12) (image C. Fritz). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

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