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# In search of a representation of the Gavrinis megalithic tomb (Morbihan, France)

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## Resumen

*Gavrinis, en el estuario del río de Vannes (Bretaña, Francia), es conocido por la abundancia extraordinaria de grabados conservados en los pilares monolíticos de la pared. Nuestro objetivo es calificar de nuevo a estas representaciones usando un nuevo marco de referencia, basado en una nueva recopilación de signos grabados por escáner y fotografías, incluso su contexto arquitectónico y posición en el volumen de la roca. Un registro de los datos topográficos, arqueológicos, petrográficos y acústicos del tumulo y de la tumba permiten una representación tanto de la arquitectura como de los signos grabados y pintados.*

**Palabras Clave:** NEOLÍTICO, TUMBA MEGALÍTICA, ESCÁNER 3D, SIGNOS GRABADOS.

## Abstract

*Gavrinis, on the estuary of the river Vannes (Brittany, France), is known for the extraordinary abundance of engravings preserved on the monolithic wall pillars and capstone. Our objective is to re-qualify these representations using a new frame of reference, based on a new corpus of engraved signs, including their architectural context and position in the volume of the rock. Recording of the topographical, archaeological, petrographic and acoustic data of the cairn and the passage grave provides a representation of both architecture and engraved and painted signs*

**Key words:** NEOLITHIC, MEGALITHIC TOMB, 3D SCANNER, ENGRAVED SIGNS.

The scientific programme opened in Gavrinis (Larmor-Baden, Morbihan) gathers archaeologists and « archaeometers », architects and topographers, in order to acquire and restore information on a Neolithic tomb built at the beginning of the IVth millennium BC, which is one of the most famous example of European monumental heritage.

After its closing (towards 3400 BCE), the monument was of course recognized by observers, at different epochs, but it caught again the attention of the antiquarians and scholars only with the explorations of the XIXth century (first in 1832, then between 1884 and 1886 with G. de Closmadeuc). The outer limits of the burial mound enveloping the passage and the chamber will be later recognized (during the 1970s by the archaeological service of Brittany directed by C.-T. Le Roux) and the excavations will show a classical structure of the cairn including facing and successive walls, set in a more or less concentric design. These researches were therefore extended by restorations, which allowed discoveries of major architectonic elements and new spectacular engravings. These engravings are however inaccessible to the public (because of their location on the back side of chamber's uprights and on the upper face of the roof slab), and were published in an incomplete way. The engravings of the roof stone over the chamber allowed to attach this slab to another one disposed over the chamber of the famous monument of La Table des Marchands in Locmariaquer,

3 km away from Gavrinis. A perfect correspondence between the truncated engraving of an animal (caprine) known from the XIXth century, and its graphic continuation recorded in Gavrinis' roofstone made it possible to join these two broken fragments of an ancient single stele.



Figure 1. Gavrinis passage tomb under the cairn restored in façade (aerial photo CG56)

More generally, the extraordinary abundance of engravings, perfectly preserved (seemingly) on monolithic pillars forming walls, contributed to the reputation of the site, to such an extent that the terms "temple" or "sanctuary" have spontaneously added themselves to the notion of sepulchral space which is generally applied to this family of Neolithic architecture.

Our objective is to re-qualify these representations using a new frame of reference, based on a new corpus of engraved signs, including their architectural context and position in the volume of the rock. Recording of the topographical, archaeological, petrographic and acoustic data of the cairn and the passage grave provides a representation of both architecture and engraved and painted signs. We wish the improvement of the constant relation in archaeology, and notably in any iconographic study, between representation and interpretation.

More generally, the extraordinary abundance of engravings, perfectly preserved (seemingly) on the monolithic pillars forming the walls, contributed to the reputation of the site, to such an extent that the terms "temple" or "sanctuary" were spontaneously added to the more usual notion of sepulchral space that was applied to this family of Neolithic architecture. Our objective is to re-qualify these representations using a new frame of reference, based on a new recorded corpus of engraved signs, taking into account their architectural context and position in the volume of the rock. Recording of the topographical, archaeological, petrographic and acoustic data of the cairn and the passage grave provides a representation of both architecture and engraved (or painted) signs. We wish to improve the constant relation in archaeology, and notably in any iconographic study, between representation and interpretation.

Surveying consisted of a recording of geolocation data (32 million points), on different scales of acquisition. This stage allowed to measure the cairn as a whole with a first scanner based on a Time-of-Flight camera (Leica Geosystems C10), enlarging the acquisition to the ambient soil ; the walls of the tomb and the upper face of the roof slab were recorded with a second scanner with infra millimetric resolution (linear CCD cameras, Nikon Krypton K610). Different softwares processing the point clouds were tested to keep the best tool allowing then to restore engravings by means of a graphic tablet.

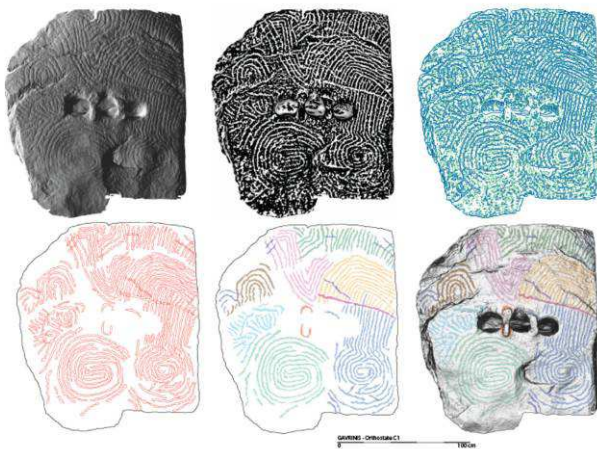


Figure 2. Different steps of recording and representation of C1 orthostate.



Figure 3. Virtual lights on C5 orthostat.

In addition to the classical data processing (generation of a high definition mesh size from the point cloud; treatment of this mesh size to extract engravings in plan; highlighted of the morphology of the orthostate) we examined the metrology of engravings in order to study the differential alteration of the figures. Our hypothesis stipulates, indeed, that several orthostates in the passage and chamber are reused stele which, previously to the construction of the tomb, were exposed in the open air. Stone surfaces exposed to the particularly dense weathering of sea coast contexts show different alteration according to their exposition to the atmospheric agents.

For what regards the engraved signs, a comparison of methods is proposed, showing the advantages and disadvantages of previous techniques (stamping, tracing paper, polyethylene cellophane) in relation to new techniques (digital photographs, scanner 3D). There is no doubt that the scanner enables engravings to be reproduced with the exact relief of the rock, as well as in the architectural sequence of the monument. However, the precision of scanner recording of carved lines made on coarse rock



(granite) is not as accurate as with digital photographic recording using oblique lighting. The two methods are thus complementary.

Then analysis by X-ray Fluorescence Spectroscopy allowed to test suspicious colouring spotted from 2009 on several orthostates. To evaluate the surfaces, an infographic treatment on color photographs taken over several years (1984-2011) was produced for comparison (DStretch software).

Finally, an approach of the sound environment of the site was undertaken not to limit the qualification of accesses to the only visual and geometric data. These elements will participate of the situational in their present context of the virtual restitutions of the monument for an exploitation and communication of data to the public.

Finally, an approach of the sound environment of the site was undertaken in order to not limit the qualification of accesses to the only visual and geometric data. These elements will be used for a virtual restitution of the monument as in its actual context and for an exploitation and communication of data to the public.

From these numerical models, one recommend the constitution of a 3D model of the monument, which gives researchers important possibilities of analyses and interpretation. Beyond scientific project (renewed corpus of signs, measure of the differential alteration of orthostates, regional research of homothetic forms, validation of architectural hypotheses, simulation of restoration, etc.), the model can be exploited for communication towards the public (pictures, virtual visits, augmented reality, objects in resin, etc.). We apparently defined scientific objectives, and the purpose of needs induced the products to work out and as a result the most efficient technics to be implemented to accomplish them. Beyond the simple fact of producing sophisticated synthesis images which could eclipse any questioning, this approach is transposable into other sites, in search of a scientifically innovative synergy and an approach concerned with the general public.

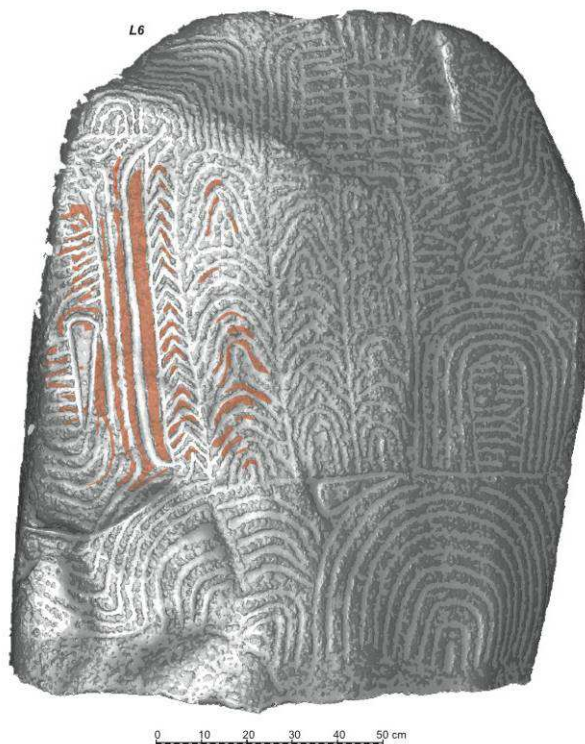


Figure 4. Colored surfaces by digital processing on the L6 orthostat.

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