Anthropogenic hydrological staging of an upper Palaeolithic carved shelter in Paris basin

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Abstract

The Ségognole 3 carved shelter in Noisy-sur-Ecole (France) is known for its Palaeolithic-style panel engraved with two horses. They are arranged in file on either side of three slots, initially assumed to be natural, evoking a pelvic triangle. A thorough re-examination revealed the artificial character of the slots as well as numerous anthropogenic interventions to modify the hydrology of the shelter to drain water to the slot representing the vulva.

The shelter has two galleries offset in height and separated by a thin wall. The upper gallery passes behind the engraved panel. It encompasses a basin that overhangs the pelvic triangle and often fills with rainwater. This disposition is the key part of the hydraulic system. Two particular interventions were made: (1) the slots at the front of the pelvic panel had been widened by percussion and grooving; and (2) the basin at the rear of the panel had been deepened by percussion, thus opening fractures on its floor. As a result, infiltration of meteoric water into the sandstone was encouraged and directed to the base of the pelvic triangle.

An experiment demonstrated that filling the basin with 50 L of water caused the vulvar slot to drain after two days. The Palaeolithic people could potentially have operated the 'vulvar outflow' on demand and without weather constraints. It is likely that this setup had symbolic and ritual purposes and formed with the parietal arrangement an integral part of a complex and dynamic installation linked to the feminine sex symbol.

Keywords:

Palaeolithic; rock art; percussion; grooving; hydraulics; female symbolism; ritual

1 Introduction and issues

A substantial aggregate of more than 2,000 engraved shelters occurs within the sandstone that crops out along the valleys incising the Beauce Plateau, south of Paris in the Fontainebleau Sandstone region, and extends over nearly 1,500 km^2 (Fig. 1A) (Bénard, 2014). The engravings are essentially non-figurative and geometric. The most characteristic patterns are parallel straight grooves and grids (Tassé, 1982; Collective of authors, 2016). Human and animal representations are rare. The lithic artefacts collected in the engraved shelters, mainly grooving tools, suggests that at least some of these non-figurative engravings were made by hunter-gatherers at the end of the first part of the Mesolithic Period, i.e. VIIIe millennium BCE (Guéret and Bénard, 2017).

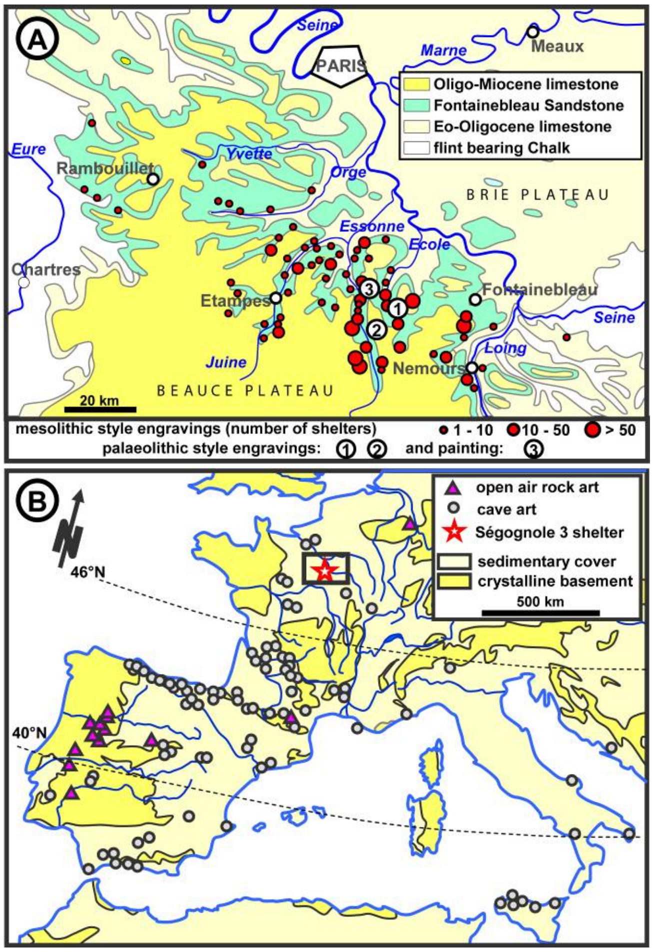

Figure 1 – Location. (A) Geological sketch of southern Paris Basin with location and number of engraved shelters in the Fontainebleau Sandstone. Point 1 corresponds to the Ségognole 3 shelter presented herein. Shelter count from Bénard (2016). (B) Location of Ségognole 3 shelter within European Upper Palaeolithic rock art with frame of map A. Modified from Aubry and Luis (2012).

Amongst this body of engraved shelters there are only three known to have figurative representations of Palaeolithic style: a painting of an incomplete animal on a split plate from a shelter destroyed by a quarry (Leroi-Gourhan, 1976); an engraved aurochs in a shelter located at Buno-Bonnevaux (Essonne) (Bénard and Valois, 2014); and the engraving of two horses at the site Ségognole 3 in Noisy-sur-Ecole (Seine-et-Marne) (Bénard, 2010). These Palaeolithic rock art occurrences are invaluable as only a few are known above 46°N latitude (Fig. 1B). As the scarcity of open air rock art in northern regions is mainly due to more intense weathering in these regions than in drier southern ones, shelters in the Fontainebleau Sandstone provide a chance for engraved panels to be protected from weathering.

The Ségognole 3 shelter shows the fine engraving of a horse (right profile) about thirty centimetres wide, accompanied by a second one, eroded and incomplete, which essentially is only the front portion of a horse (Fig. 2). The proportions of the complete horse as well as some parallels with several horses in the Lascaux cave led to it being attributed to a chronoculture between the Solutrean and the early Magdalenian (Bénard, 2010; Guy, 2017; Petrognani, 2018), which make it an exceptional feature in the regional context. The horses are arranged symmetrically on both sides of three slots that distinctly evoke a female pelvic triangle: two slots were suspected have been locally reworked to enhance resemblance (Bénard, 2010). The overall composition with an enhanced female sexual figuration associated with the engraving of two horses, gives an indubitable Upper Palaeolithic character to this panel and thus reinforces the chronological attribution (Tosello, 2016).

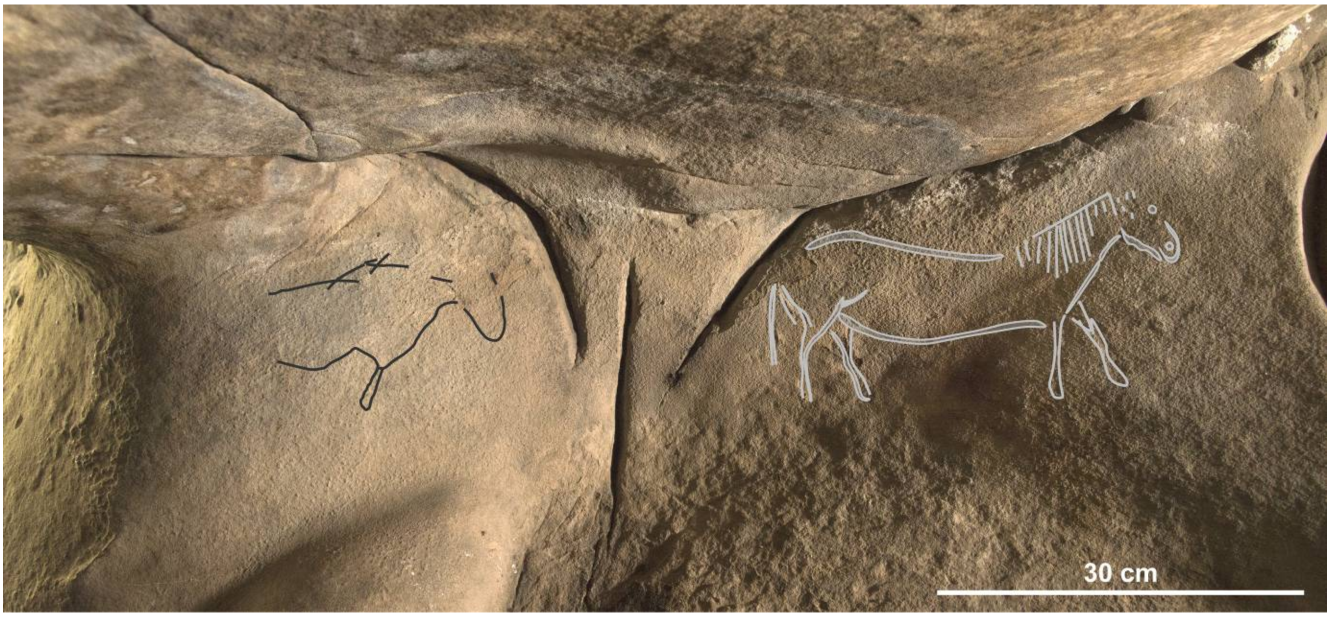

Figure 2 – Engraved panel of Ségognole 3 shelter with two engraved horses arranged on both sides of a female pelvic triangle. Photo by Émilie Lesvignes/PCR ARBap; horses drawn on photography after Bénard 2010.

The slots in the carved panel will be one of the foci of our investigations, as well as the surroundings of the horse engravings and several natural morphological elements that have been modified.

2 Methodology

With regard to Paleolithic rock art, studies of the artificial arrangement of caves, shelters and their walls are just beginning (Lorblanchet, 1993; Rouzaud *et al*., 1996; Theunissen *et al*., 1998; Lorblanchet, 2010; Delannoy *et al*., 2012; Jaubert *et al*., 2016). The analysis of the Ségognole 3 shelter actually takes the form of geomorphological studies applied to underground sites (Burns, 2005; Heydari, 2007; Delannoy *et al*., 2004; Ferrier *et al.,* 2017). The approach aims to distinguish and explain, by means of objective criteria, the morphogenetic processes at the origin of each of the elements that make up a shelter, thus distinguishing natural morphologies from those related to anthropogenic action or modification and then to demonstrate the intentional character of the latter.

In the landscape we are studying, the approach is based on deciphering the morphologies that make up a shelter by interpreting them in terms of their origin, namely: silica cementation of sands to form sandstone, post-cementation alteration, and alteration after exposure at the landsurface by erosion and thus direct or indirect exposure to weathering. The method requires an in-depth knowledge of sandstone morphologies as they occur in situ within modern sand quarries and of characteristic morphologies resulting from weathering of outcrops (Thiry et al., 1984; Thiry, 2005). Added to this are the specific alterations that have occurred and overlap them in the shelters (Thiry, 2017). Observations are mostly made at the decimetric and metric or even the centimetric scale and method could be termed ‘meso-geomorphological archaeology’.

With regard to Ségognole 3, the walls of the shelter and the engraved grooves are covered with an infra-millimetric crust, mainly formed of gypsum crystal rosettes (see supplementary file 1 for detailed description). This crust, combined with the granular nature of the sandstone, makes it impossible to discern microscopic wear traces of tools such as those sometimes found on bones (Fritz, 1999) or on other more homogeneous rocks such as shale or limestone (D’Errico, 1998; Mélard, 2008; Rivero, 2016). On the other hand, the crust does not obliterate milli- to centimetric traces. In our studies, these traces were analysed by direct observation and three-dimensional photogrammetry. The 3D models were acquired using a Nikon 750D camera (35.9 x 24 mm sensor, 24.93 million pixel resolution), equipped with an AF-S Micro NIKKOR 60mm f/2.8G lens and a ring flashlight. The models were generated and processed with ©*Agisoft Photoscan*, ©*MeshLab* and ©*GeoMagic* software. In addition, experimental engravings were made on hand-picked sandstone blocks and *in situ* in cavities accessible in modern quarries (Cantin, 2019a) to determine particular properties that could affect anthropogenic working of the Fontainebleau Sandstone and to analyze the morphometric characteristics of test grooves in comparison with those in the shelters.

3 Shelter description

The Ségognole 3 shelter is in a sandstone block that had its origins in a sandstone ridge which broke apart, releasing quadrangular blocks that slid downslope into a jumbled mass (Fig. 3). It is an elongated non-silicified structure from which the loose sand was drained, leaving a tubular cavity within the sandstone. The horse engravings were made in a friable sandstone cortex, partially silicified, that marked the transition zone between the hard sandstone and the uncemented sand (Thiry, 2017; Cantin, 2019a, b).

Figure 3 – Oblique view of the sandstone blocks on the slope of La Ségognole hill. SEG3 is Ségognole 3 shelter, notice its SE entrance. Picture by Summum 3D.

3.1 Layout of the shelter

The Ségognole 3 shelter slopes from SE to NW and has a bifid morphology (Fig. 4A & B). It is open to light at both extremities and consists of a succession of distinct volumes (see supplementary file 2 for detailed morphological description and photographs). Upstream, in the SE, there is an ample accessway about 2 m wide opening into a roomy cavity. This divides downstream into two narrower galleries separated by a wall about 30 cm thick. The openings in the NW are smaller than in the SE and are offset in height by about 1 m.

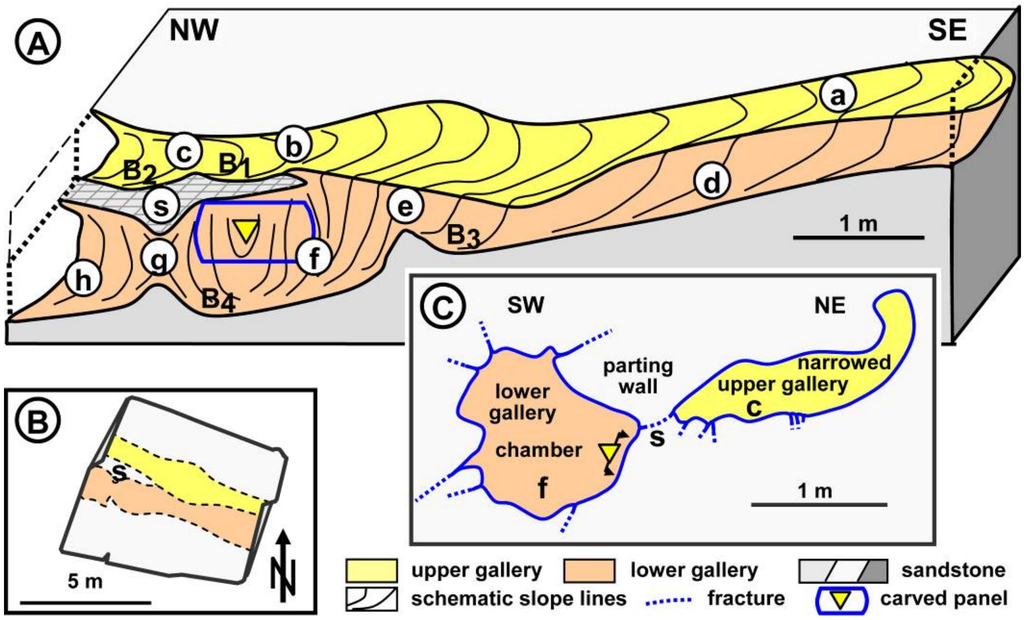

Figure 4 – Shelter layout. (A) Block diagram showing the morphological features of the shelter. (a) flat terrace, (b) bottleneck, (c) narrows of the basins, (d) ramp, (e) threshold, (f) chamber, (g) narrowing, (h) vestibule, (s) parting wall between upper and lower galleries, (B1 –B4) basins. (B) Plan view of the two galleries. (C) Section through the carved panel. Note the height offset between the two galleries and the meagre sandstone wall (about 30 cm wide) separating them. The upper gallery passes behind and above the carved panel.

The upper gallery forms a rather regular terrace (a), which is approximately horizontal until it reaches the opening in the NW. The ceiling height is 80 cm at the SE opening but restricted to 30-40 cm at a bottleneck (b) near the bifurcation of the two galleries (Fig. 4).

The lower gallery is more complicated. The floor at the SE opening forms an inclined ramp (d) that extents to the middle of the shelter, then crosses a rather low threshold (e) and settles about 80 cm below (Fig. 4). A characteristic feature of the lower gallery is its widening downstream of the threshold (e) that delimits a larger and more comfortable chamber (f) that contains the studied carved panel. The chamber (f) closes by a narrowing (g) before widening into a vestibule (h) that gives way to the NW opening.

The cross-section of the galleries through the carved panel (Fig. 4C) shows the differences in section, their height offset and specifically their proximity, with a thin wall (about 30 cm thick) between the floor of the upper gallery and the top of the panel. This configuration was key for the hydraulic layout of the shelter.

3.2 Carved panel layout

The carved panel of interest is approximately 1.2 m long and 0.60 - 0.70 m high. It occurs on a concave wall sloping 60° southwards at the top and flattening to 30° at the floor (Fig. 5A; supplementary file 1). It is clearly delineated and framed by the morphology and structure of the surrounding sandstone. The top of the panel is marked by a slightly curved fracture F1 and the right-hand part is limited by a second fracture F2 which is vertical and also curved. The base is marked by a third fracture F3 that continues towards the NW opening of the gallery. Finally, the panel is limited to the left by the narrowing (n) that opens the chamber to outside. The fractures that frame the panel at the top and bottom tally with the transition of the inclined panel surface to the roof and the floor of the chamber (Fig. 5B). Two decimetric hard sandstone bulges (hb) occur at the base of the panel.

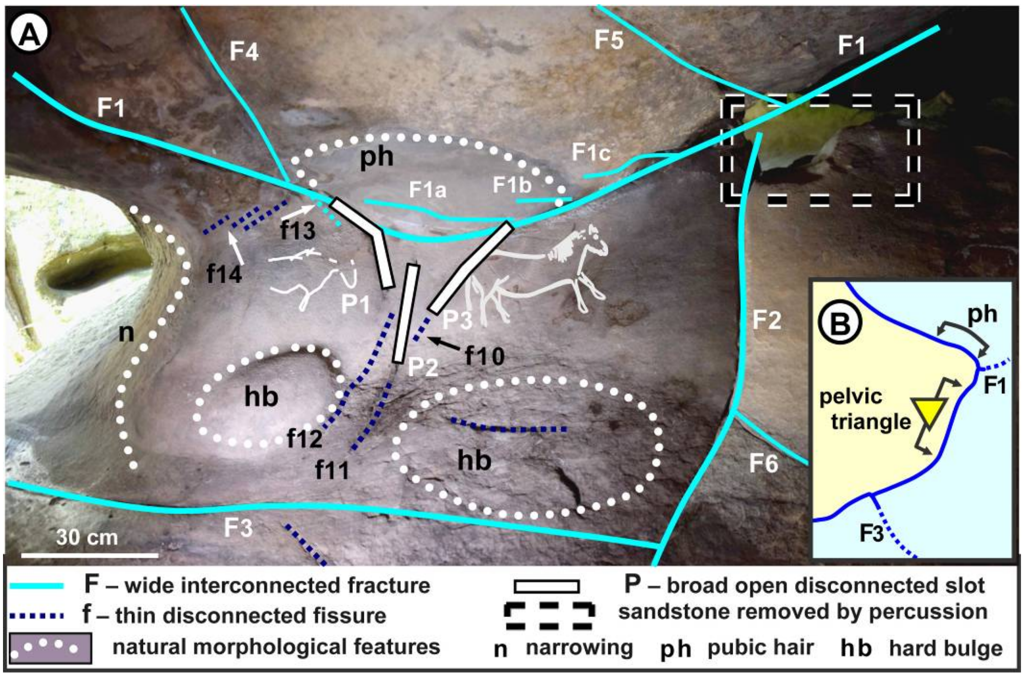

Figure 5 – Carved panel layout. (A) Structural and morphological elements that frame the panel and placement of the two carved horses. The large interconnected fractures that frame the panel and the more limited unconnected pelvic slots are clearly different. Slots and fractures have been numbered for easier identification. (B) Panel cross-section.

The horses were engraved on either side of three slots (P1, P2 and P3) that evoke a pelvic triangle. The left hand horse is now fragmentary: only its front is visible and relatively blurred whereas its back seems to have been largely altered by moisture coming in through the NW opening (see supplementary file 1). The horse image on the right, in a more protected position inside the shelter, is complete and there are only small patches of scaling of the sandstone surface on its rear.

Another element of this arrangement is a natural, dark, organo-mineral coating above the pelvic triangle and which, given its position and extent, could evoke pubic hair (ph) thus strengthening the sexual figuration (Thiry and Cantin, 2018; supplementary file 1). The geometric configuration of the dark coating displays growth in concentric aureoles from a wet area linked to fracture F1 at top of the triangle.

Finally, the curve of the fracture F2 that closes the panel on the right and the narrowing (n) that delimits the chamber on the left, facing each other, could evoke the widening of thighs at the pelvic belt.

4 Anthropogenic workings

Analysis of the horse engravings and their setting raised questions as to whether the pelvic triangle slots were natural or anthropogenic. It was pointed out that the right pelvic slot and the central vulvar slot may have been 'rubbed' (Bénard, 2007, 2010). A re-examination of the panel revealed numerous additional and more extensive human interventions than initially suggested.

All morphological features of the sandstone, particularly the slots, were examined using objective criteria to distinguish elements linked to natural processes or anthropogenic alteration. Subsequently, this meso-geomorphological survey was backed up using parietal traceology to identify and analyse features that could be related to lithic reduction and grooving techniques in order to demonstrate anthropogenic action.

4.1 Fracture patterns

Whatever their origin, fractures and fissures in rocks are a response to deformation. In the near-surface environment, fractures are always interconnected, overlapping or intersecting, geometrically coupled, and form networks characteristic of stress and strain regimes that generated them (Peacock *et al.*, 2018). In sandstone shelters, somewhat protected from the weathering environment, the fractures are sharp and narrow, generally with matching sidewalls and irregular openings; the sidewalls do not flare or gape at the surface. The floor of the Segognole 3 shelter has good examples of natural fractures (Fig. 6). At their extremities fractures become progressively thinner and commonly taper out into fewer and finer fissures, never ending abruptly.

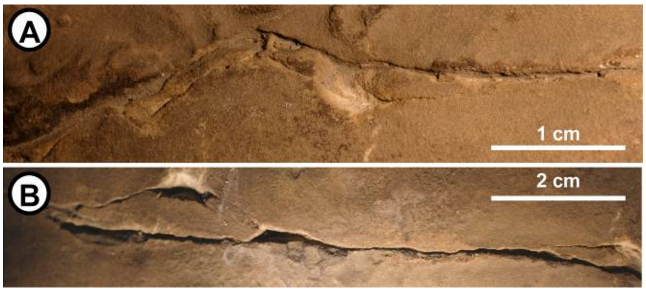

Figure 6 – Irregular and chipped pattern of natural fractures on floor of upper gallery (in between basins B1 and B3). Pictures Fantine Bellanger/PCR ARBap.

The main fractures delineating the panel, namely F1, F2 and F3, are interconnected (Fig. 5A). Their pattern reflects natural fracturing in response to stress in the sandstone. The

F1 fracture at the base of the 'pubic hair' is accompanied, in the centre and to the right, by thin oblique ones (F1a, b and c) which also conform to the pattern of fractures set up during global tension. Three major fractures at the periphery of the panel (F4, F5 and F6) are connected to the others and are also part of the natural fracture network.

However, the three pelvic triangle slots P1, P2 and P3 are of restricted extent and do not intersect. This arrangement suggests a non-natural origin. The wide lateral slots of the triangle (P1 and P3 averaging 8-10 mm of width) merge with fracture F1. Slot P1 consists of two segments that touch without intersecting and form a wide open angle: this does not match a natural fracture pattern, nor does its abrupt closure. A tiny fracture f10 reaches out of slot P3 (Fig. 7A). The 'vulvar' slot P2 ends abruptly at its upper end but has a fine and irregular crack f11, poorly outlined and crooked, extending it downwards (Fig. 7A & C). Another oblique fracture occurs to its left f12. The contrast between the large pubic triangle slots and the fine infra-millimetre cracks that accompany them is obvious. It is not consistent with a distribution of physical stresses, nor with a widening by weathering that would be more irregular and more progressive at the extremities.

A fine crack f13 also occurs on the left of the pelvic triangle (Fig. 5A) more or less extending fracture F4. A series of 6 other sub-parallel fissures f14 is perpendicular to f13 and '*en echelon*' in conformance with extension stresses associated with fracture F4.

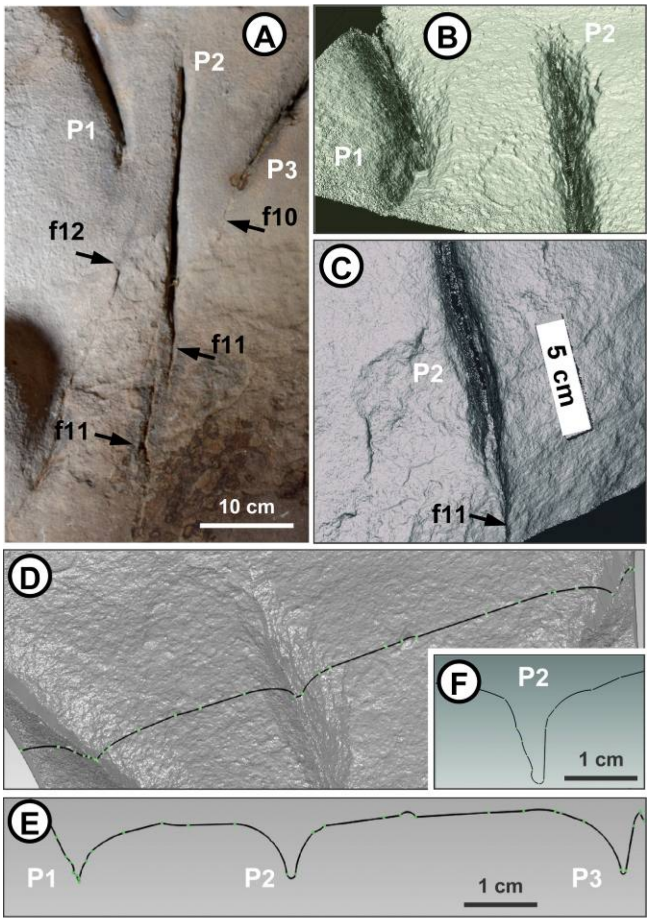

Figure 7 –Opening and profiles of the pelvic slots. (A) Side slots P1 and P3 close abruptly at their lower and upper end respectively. On the other hand, fine cracks f11 extend the vulvar slot P2 at its lower end. (B) 3D model showing the abrupt closure of the pelvic slots P1 and P2. (C) 3D model showing the contrast between regular wide open section and irregular fine crack f11 extension of vulvar slot P2. (D) General view with indication of the profile shown in next picture. (E) Profile of the pelvic slots P1 and P3 in their middle sections and vulvar slot P2 at its top. (F) Profile of the vulvar slot P2 at its lower part (same scale as picture E).

4.2 Fracture openings

Analysis of the mutual relationships of the fractures and slots has been supplemented by analysis of the morphologies of their openings. They all have a regular and symmetrical opening with a wide-open V-profile and smooth sidewalls. This is distinct from the irregular and chipped natural fractures seen elsewhere in the shelter (Fig. 6) and clearly suggest anthropogenic morphological modification.

Profiles of the pelvic slots extracted from the 3D photogrammetric model (Fig. 7D) show that they are alike (Fig. 7E), with slight asymmetry for lateral slots P1 and P3. On the other hand, if the vulvar slot P2 is quite comparable to the lateral pelvic slots at its upper end, it is deeper and narrower in its middle part (Fig. 7F). This deepening without widening is contrary to a weathering effect that would widen the slot at the same time as it would deepen it. These properties and those described above are consistent and suggest that the pelvic slots have been made by widening existing fine cracks, or even created *ex nihilo* in the case of P1 since there are no cracks extending it.

Fracture F2 has likewise a regular and smooth opening, without chipping or ripping of the edges, as well as a very regular V-profile that point to its anthropogenic modification.

The opening of fracture F1 is variable along its length. It is closed (without a clear opening between the two edges) in its middle part beneath the ‘pubic hair’ but wide open with a regular V-profile on either side of this (Fig. 8). It closes again abruptly to the right and to the left of the pelvic triangle. Fracture F1 is therefore only open in the extensions of the lateral pelvic slots P1 and P3. These strong morphological contrasts in different sections of the fracture F1 suggest anthropogenic reworking in the extension of the pelvic slots P1 and P3.

At the rear of the panel, in the upper gallery, the extensions of fractures F1 and F2 at the bottom of basin B1 are as irregular as natural fractures elsewhere in the shelter, and their openings are variable and marked by associated oblique cracks.

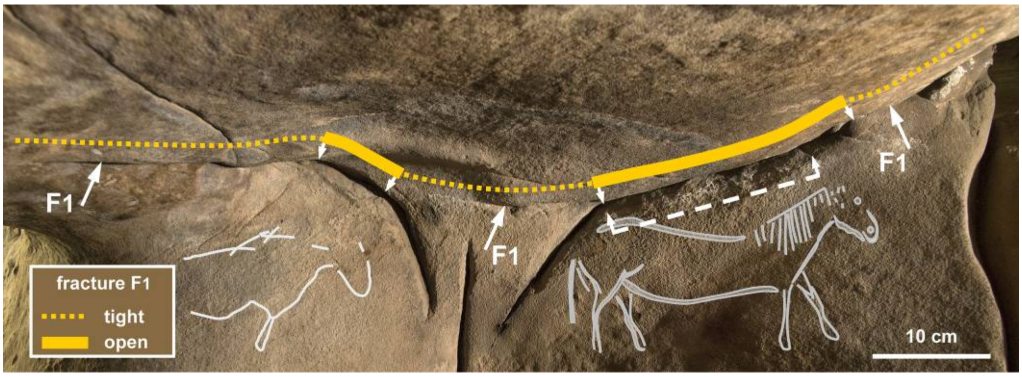

Figure 8 – Fracture F1 between 'pubic hair' and pelvic triangle shows successive openings and closures. The fracture is tight and partially concealed by the organo-mineral crust that forms the pubic hair. It is enlarged on both sides, and then becomes tight again to the left and the right, with an especially abrupt closure to the right. White doted line with arrows shows extension of Fig. 11C.

4.3 Enlargement of the slots and fractures

Parietal analysis of the slot sidewalls shows various features related to anthropogenic grooving and percussion actions.

4.3.1 Grooving marks

Grooving consists of deepening, widening and regularizing a slot by unidirectional or bi-directional movements of a tool (Guéret and Bénard, 2017; Cantin, 2019a). Traces on the grooves can reflect the dynamics of the working.

Fracture F2 is not rectilinear but curved to the right (Fig 5 and 9A). At the top of this curve, the right hand side of the slot has distinct facets (Fig 9B & C) which are typical of grooved furrows and result from the involuntary friction of different parts of the working tool in the curve. A change in direction of movement together with the amplitude of movement has tended to pressure the tool against the right side as it scraped. The lack of facets on the left side of this curve suggests a one-way grooving movement going from top to bottom. The deepest facet could match what remains of the natural fracture or correspond to a last and deepest grooving phase (facet 0 on the profile on Fig. 9B). The narrowing of fracture F2 downwards on the panel (40 mm width at top and 4 mm at bottom near slot F6) could match its natural opening but it is also possible that it results from anthropogenic action. In this latter scenario, the narrowing would result from a stronger pressure at start-up as in other types of uni-directionnal engravings (D'Errico, 1994; Fritz, 1999) and/or an easier grooving gesture in the wider upper part of the chamber than in the lower part where it is more cramped. Concerning the cupules on the upper facet of the right flank (Fig. 9A & B), we cannot decide if they were formed as a result of percussion chipping during working or an alteration by natural scaling of the sandstone before or after shaping of the slot.

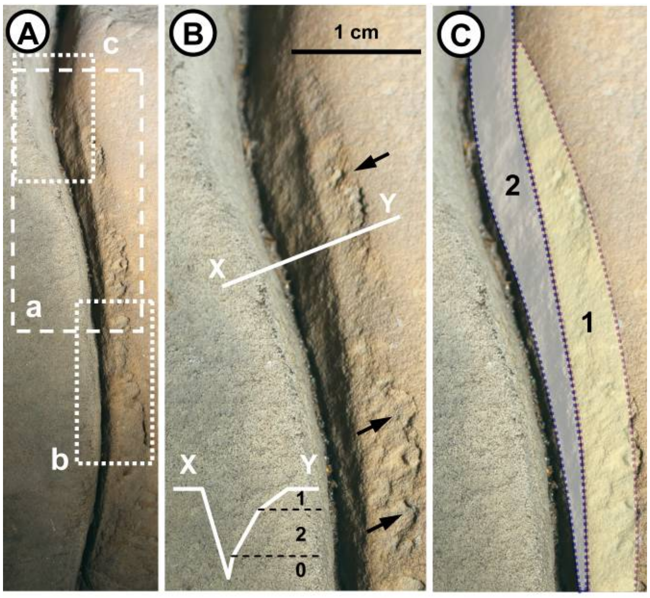

Figure 9 – Grooving marks on fracture F2. (A) Overall view. The rectangles give the framing of enlarged photos: (a) location of images B and C; (b) and (c) locations of images in Fig. 12A & B. (B) Enlargement with a schematic section of the three facets of the right sidewall: arrows indicate sites of sandstone chips. (C) Shading showing extent of facets 1 and 2.

Other marks of grooving are visible on the vulvar slot P2 that shows a fan of small converging incisions at its apex (Fig. 10B). This fan is characteristic of unidirectional grooving from top to bottom: once the tool has reached the bottom end of the slot, the engraver would withdraw it to put it back in at the top without finding exactly the same starting point, which caused a proliferation of small fan incisions. Similar incisions further down in the slot (Fig. 10C) are the application marks of the tool at the start of a second downward engagement in the slot and indicate work to extend the slot downwards and/or deepen it. Measured depths throughout this slot have been used to sketch a longitudinal section (Fig 10D & E). Two digging phases are clearly distinguished in the profile: they are characterised by a gradual decrease in depth as the downward stroke progresses and this is related to decreasing thrust force as the engraver moved away from the attack point (D'Errico, 1994; Fritz, 1999).

Finally, slot P1 is extended by small furrows at its lower end (Fig. 10F). These are likely to be incisions caused by the skidding of the tool out of the slot at the end of reach of the grooving action. These short straight and divergent grooves are in any case very different from fine sinuous and natural cracks which extend slots P2 and P3 downwards (respectively Fig. 7A & 10G).

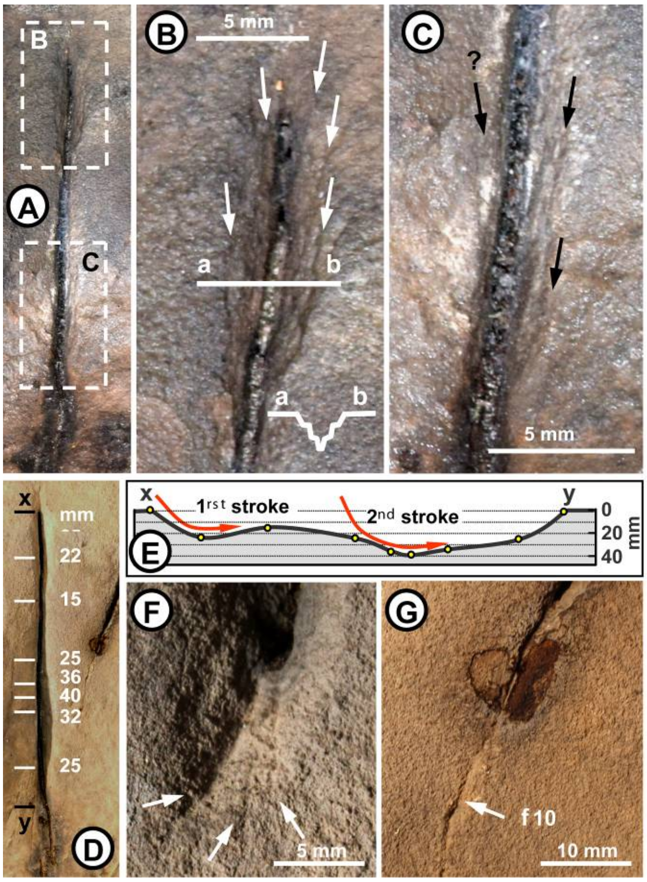

Figure 10 – Grooving marks on pelvic slots. (A) Overall view of slot P2 with rectangles locating the following images (B) and (C). (B) Sheaf of incisions at the top of slot P2 and sketch of its composite profile. (C) Second stroke point for groove generation with incisions towards the base of the slot P2. (D) Depths of vulvar slot P2. (E) Profile along slot P2 showing deepening by re-grooving the lower half of the slot. (F) Skidded grooves at the lower closure of slot P1. (G) For contrast fissure f10 in extension of slot P3. A, B, C in winter, wet weather; D, F, G in summer, dry weather.

4.3.2 Percussion marks

Percussion spalls rock using a launched tool (direct percussion) or an intermediary tool placed on the rock being struck with a hammer (indirect percussion) (Inizan *et al.*, 1995). Several marks on P3, F1 and F2 are attributed to this type of operation.

Pelvic slot P3 is marked by two depressions which have sharply widened it by opening its lower flank (Fig. 11A). Bénard (2010) had already noticed the first one (zone 1 on Fig. 11A) and interpreted it to be the result of an intentional working of the sandstone. The morphology of these depressions corresponds to negatives of removals although their pattern is more irregular than on easily knappable rocks such as obsidian and flint because the sandstone is grainier (Griselin, 2015).

The upper depression (zone 2 on Fig. 11A) is accompanied by a furrow reaching towards the full depth of the slot (Fig. 11B). This furrow was not made by grooving but rather matches the mark of the tip of a tool propelled towards the rear of the slot. Besides, small notches etched immediately above on the same right hand side of pelvic slot P3 (Fig. 11B) are likely to be softer chippings to regularise the top of the slot. Other negative of removal mark the lower side of slot F1 in its extension to slot P3 (Fig. 11C). On the other hand, the left hand side of this pelvic slot P3 is straight and smooth and reflects either its original form or has been shaped and regularized by grooving as for slots P2 and F2. In addition, slot P3 is 32 mm deep at its upper part where there are percussion marks and diminishes abruptly to only 5 mm deep in its lower part where there is no percussion mark. Thereby, percussion actions would have been used to widen and deepen the slot afterwards in particular places. It should be noted that the scaling of the gypsum crust at the edge of the slot tends to blur the detail of the marks left by anthropogenic working. However, the crust is only on the surface and when scalled off does not distort or degrade sculptural marks in the sandstone itself.

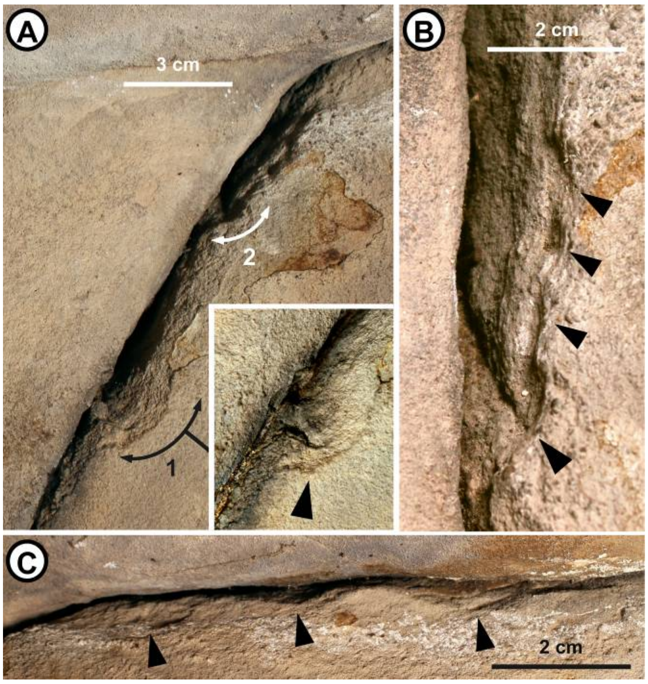

Figure 11 – Percussion marks along slots P3 and its adjoining portion of F1. (A) Overall view of slot P3 with the main percussion marks 1 and 2 and a close up view of mark 1. (B) Detail of the percussion mark 2 with hints of secondary percussions. (C) Opening percussions along fracture F1 in its extension to P3; see frame of the picture on Fig. 8. Arrows indicate probable striking points and inferred direction.

Depressions occur also at regular intervals on the left sidewall of F2 (Fig. 12A). They could match remaining negatives of removals and are comparable to those described on pelvic slot P3 and fracture F1. However, they have a smoothed and regularized appearance, and were probably scraped or smoothed afterwards by grooving. This percussion step would therefore have taken place in a preliminary phase of the fracture opening. Finally, on the upper part of fracture F2 are two small cupules on the left sidewall (Fig. 12B) and two others facing them on the opposite sidewall (Fig. 12C). Although their natural origin cannot be completely ruled out, these marks could be from the impacts of a pointed tool.

To conclude, the regular intervals between these flaking negatives, as well as the associated pointed tool marks, argue for indirect percussion with an intermediate piece of hard rock (i.e. flint or hard/lustreous sandstone available on site). Use of a percussion technique is justified by the toughness of the worked sandstone. The joint use of percussion and grooving for the digging and/or regularization of grooves has been identified in other Upper Palaeolithic rupestrian contexts such as sandstone of Qurta in Egypt (Huyge et al., 2007) and phyllites of the Côa Valley in Portugal (Baptista, 2001; Bicho et al., 2007). At the latter site, functional analysis and experimental studies have demonstrated use of local quartzite points to strike and groove the rock (Plisson, 2009; Aubry et al., 2011).

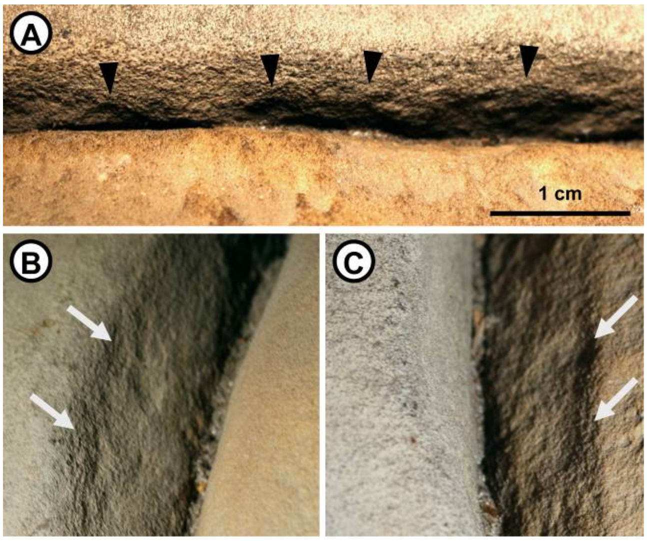

Figure 12 – Percussion marks on fracture F2. (See Fig. 9A for location of images). (A) Depressions at regular intervals on the left sidewall of F2. (B) and (C) Probable percussion marks facing each other on both sidewalls.

4.4 Morphological characteristics of basin 1

The downstream part of the upper gallery comprises B1 and B2 basins (Fig. 4; supplementary file 2) that are at the same level and just rear of fracture F1 and the ‘pubic hair’ (Fig. 13A). Natural basins in Fontainebleau Sandstone are rounded depressions, somewhat limited in size but regularly concave and with a smooth bottom. Water stagnates regularly in these depressions and regulates their morphology by slow weathering of the sandstone (Thiry, 2005). The regularity of the edges and bottoms of natural basins can be taken as reference to identify any anthropogenic modification. Basin B1 has features that distinguish it from natural structures.

4.4.1 Modifications to the margin of basin B1

Examination of the contours of basin B1 revealed a gap in the threshold (e) that separates it from the chamber of the engraved panel. The gap (15 cm long, 5 cm high and 10cm wide) corresponds to the removal of about 1 dm^3 of material at the top of fracture F2 (Fig. 5 & 13B). There are two obvious concavities that contrast with the rounded and convex morphologies of natural basin borders (Fig. 13C). These mark the locations of large conchoidal flakes of sandstone that were removed by percussion from the chamber. The flaking of the sandstone in this place was favoured by the discontinuity provided by fracture F2, the left sidewall of which remained in place. Due to their size, the flakes must have been detached with a heavy hammerstone.

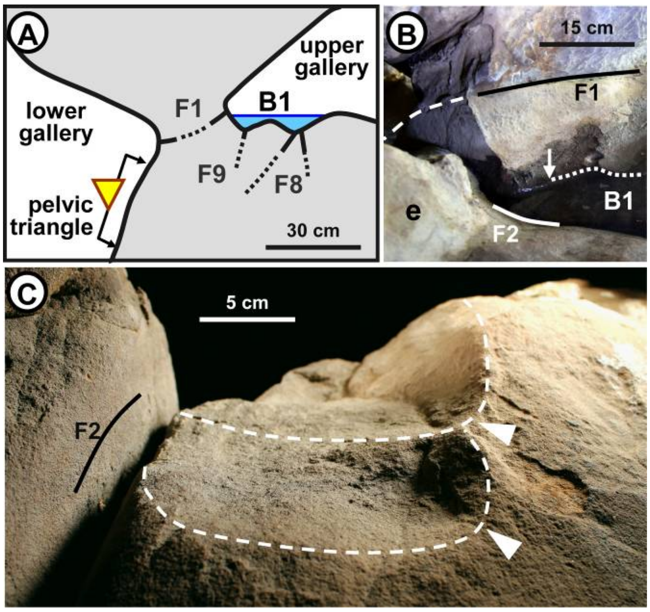

Figure 13 – Morphology of basin B1 and surrounds. (A) Schematic section showing position of basin B1 and its water-filled state relative to the pelvic triangle and estimated fracture orientations. (B) Rear view from the upper gallery showing location of threshold (e) gap between basin B1 and fracture F2 from which sandstone was removed. White arrow marks water level in basin B1 at an intermediate state. (C) Front view from the carved panel chamber showing locations from which conchoidal flakes of sandstone were removed by percussion, with probable impact at arrowed sites. See frame of this front view in Fig. 5.

4.4.2 Deepening of basin B1

Basin B1 has an atypical multi-lobed shape. It features elongated gutters separated by ridges centred on a network of interconnected fractures (Fig. 14A). This arrangement differs from natural basins which are depressions with clean outlines and smooth, regular bottoms like basin B2, immediately adjacent to basin B1, or basin B3 downstream of the ramp (supplementary file 2). When it is full, water reaches fractures F1 and F2 and covers the network of fractures F7-F8-F9 that occupy the central gutter in the basin (Fig. 14A).

Only a small concave surface, located above the modified bottom of the basin, retains the regularity typical of the bottom of natural basins (Fig. 14A & B) and appears to be residual, with material removed all around it. The flanks of the gutters centred on fractures F8 and F9 show series of depressions only explained by flake removal along the fractures (Fig. 14B & C). The most obvious are those above the fill level of the basin: those at the bottom of the basin have rounded edges and angles and appear to have been weathered by the frequency of their flooding. Effective removal of flakes of sandstone relied on natural fractures to direct and aid the effects of percussion. By examining the remnant bottom of basin B1 in relation to the new surface generated by percussion and removal of sandstone, together with the flow threshold between basins B1 and B2, it has been estimated that the main gutter centred on fracture F8 was deepened by about 10 cm.

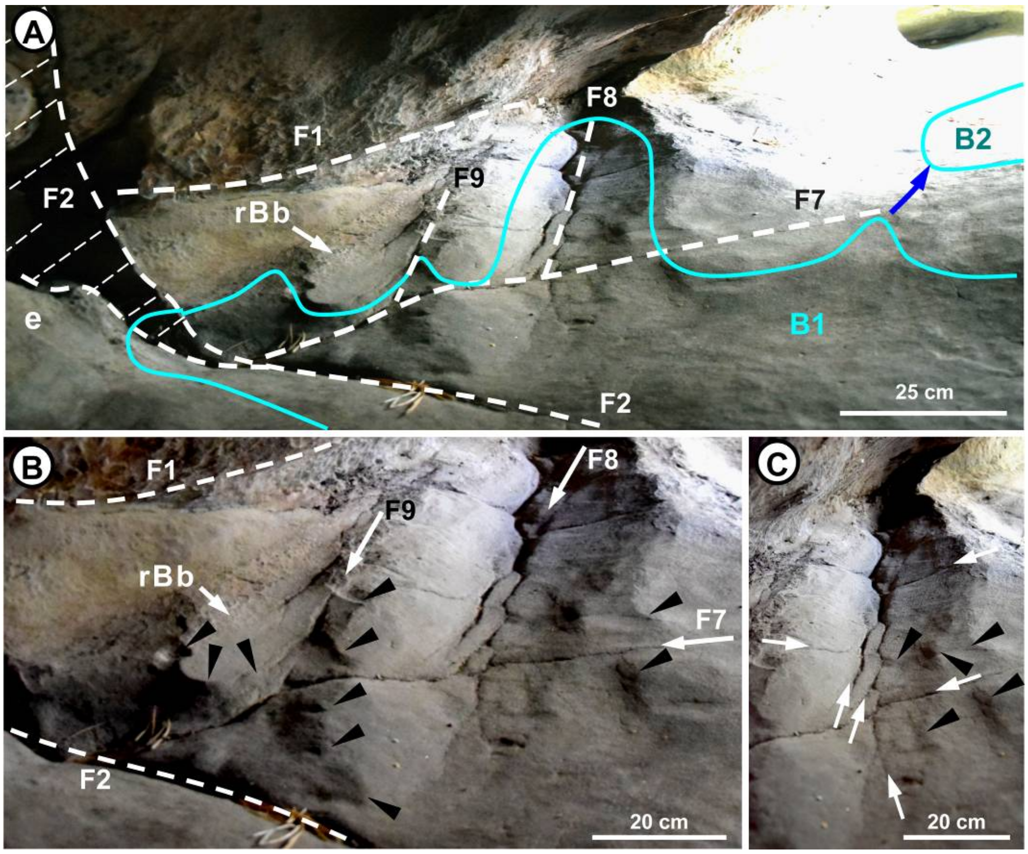

Figure 14 – Artificial morphological features of basin 1. (A) Layout of the various structural elements and the multilobed contour of basin B1 in its filled state (curved line). The pelvic panel is to the left, behind the back wall. Fracture F2 is below and left where some of threshold (e) was removed. (B) Residual parts of a regular concave bottom surface of a former basin (rBb) after flakes (black arrows) were removed to deepen the basin towards fracture F2. (C) Main gutter with natural network of fractures (white arrows) and a series of marks (black arrows) indicating sites from which material has been removed by percussion.

Photogrammetry of the end of the main gutter reveals other details that corroborate its modification (Fig. 15). A jagged micro-scarp underlines the ridge of the SW flank of the gutter (Fig. 15-1). Its irregular and angular outline getting in places over the ridge does not conform to alteration/erosion morphologies: it probably results from a series of removals; their sharpness having been eroded since they were made. The same applies to a notch on the same side of the gutter (Fig. 15-2). Finally, a series of parallel elongated depressions, oblique with regard to the greatest gutter slope, can't be explained by natural alteration linked to water flow on the flank of the gutter. They are probably what's left of man-made grooves.

In conclusion, modifications to basin 1 have resulted in a significant change to the initial layout of the shelter. Three changes have to be kept in mind: (1) opening of a spillway to allow water overflowing the basin to move towards the foot of the pelvic panel (basin B4) via fracture F2; (2) deepening of the initial basin to increase its water-holding capacity; and (3) clearing out the fractures in the bottom of the basin.

Figure 15 – 3D photogrammetric model of the central gutter of basin 1. The photogrammetric processing highlights several man-made marks and morphologies.

5 Hydrology of the shelter

The described workings, in particular the artificial deepening of basin B1 and the opening of a spillway towards carved chamber via Fracture F2, suggest that there was a specific role for water in this shelter. Particular questions focus on how all of these features relate to and interact with the symbolism of the carved panel. The various hydrological aspects, that is, the exchanges between the atmosphere and the sandstone mass of the shelter, are important, as is the arrival of water into the shelter, its distribution and its behaviour.

5.1 Water inflow

Rainwater enters the shelter through surface openings in the northwest parts of the sandstone block (Fig. 16A). The two entrances to the upper and lower galleries also receive rainfall directly from southwestern winds which are the current prevailing and rain-bearing winds and were also during the Last Glacial Maximum (Ludwig *et al.,* 2016). In addition to direct precipitation, basins 1 and 2 in the upper gallery receive infiltrating water through a network of anastomosed joints, fractures and cavities that link to the sandstone surface. As a result, both basins are flooded if rain persists for about a day. Basin 2, which is downstream of the upper gallery and closest to the NW entrance and therefore the external environment, is regularly flooded during the winter (Fig. 16B).

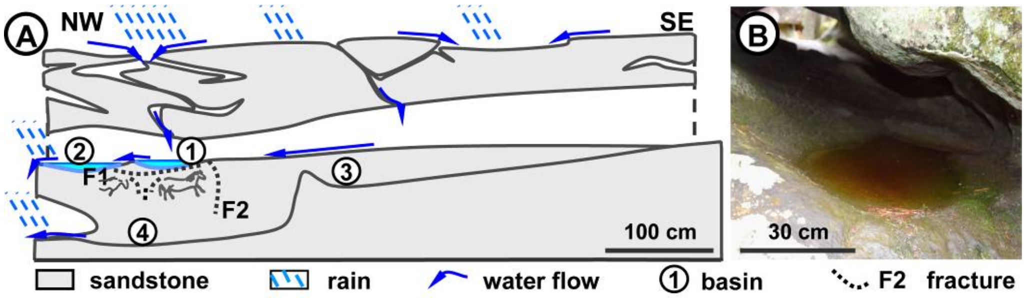

Figure 16 – Schematic diagram of hydrological flows into and through the shelter. (A) Rainfall enters from the surface openings. (B) Basin 2 at its overflow level on 23/01/2018. The organic-rich (brown colour) of the water is derived from and characteristic of peaty surface soils overlying the sandstone.

Both basins were full on 23/01/2018 after a long period of rain that led to a major flooding of the River Seine. Basin 2 actually spilled out of the shelter. Basin 1 was not full but its perimeter was wet. Thus, the level of water in basin 1 had already fallen at the time of the observation while basin 2 was at its near-maximum level.

5.2 Hydrological changes at the pelvic panel: the 'vulvar fountain'

Observations confirm that the pelvic triangle panel responds to climatic conditions in such a way that its appearance can change completely. Water exudes from its whole surface after long rain periods (Fig. 17A & B) but there are only damp patches when there are scattered rains interspersed with days or weeks without precipitation (Fig. 17C). It is completely dry during summer (Fig. 17D).

The most spectacular metamorphosis of the pelvic triangle panel was observed on 23/01/2018 after a long rain period previously mentioned. Saturation of the panel led to a 'fountain' of water outflowing from the vulvar slot (Fig. 18A). A small flow escaped directly at the basal end of middle slot P2 and was strengthening along the thin crack f11 that extends the slot. Other significant seeps occurred 5 to 7 cm below the vulvar slot, on a darker area that has many scars due to scaling of the gypsum crust. Further down, the discharge formed several flows, one of which originated on the thin crack f12 which borders the sandstone bulge at the bottom left of slot P2. The two harder sandstone bulges that are more tightly cemented and have reduced porosity were just moist. The sandstone in the lower part of the panel was saturated: water pooled on the surface of the gypsum crust, exuded from pores in the crust and flowed from cracks in its surface (Fig. 18B).

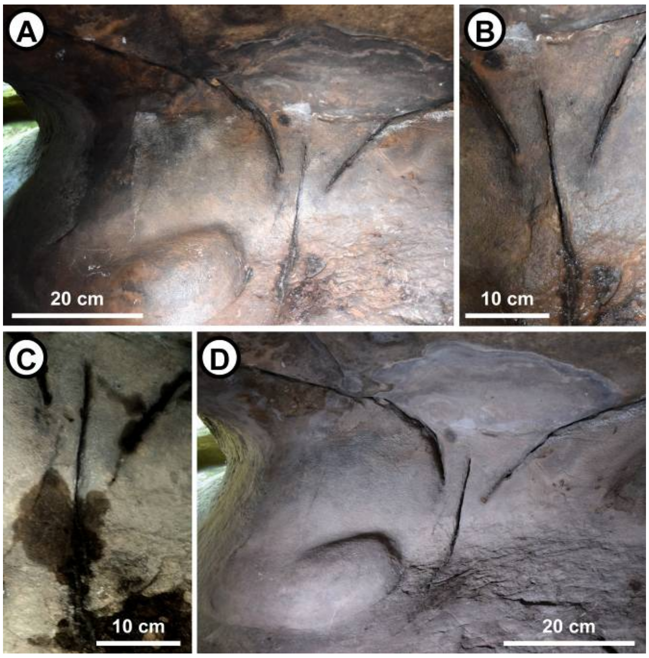

Figure 17 – Sequentially variation in wetness of the pelvic panel. (A) 23/01/2018 – after a long winter rainy period, the panel is exuding moisture as indicated by stronger colours. (B) 23/01/2018 - pubic slots seep and have lips darkened by moisture. (C) 19/02/2018 – despite some additional rain periods, the moisture on the panel has abated in less than a month. (D) 19/10/2018 – after a long summer drought, the panel is fully dry and colours pale.

The sandstone in the upper part of the panel, above the basal flow of the vulvar slot, was not water-saturated and not wet. The crust over the horse engravings was dull and dry (Fig. 18C). But there was a contrast in moisture on each side of the slots. The encrusted surface above the right pelvic slot P3 was glossy with moisture, while below the slot, the crust of the horse's rump was dull and dry (Fig. 18D). Similarly, the encrusted surfaces on either side of fracture F2, to the right of the panel, showed a strong moisture contrast with the pelvic triangle panel moist (colour reinforced by moisture) while the sandstone beyond F2 was dry (Fig. 18E).

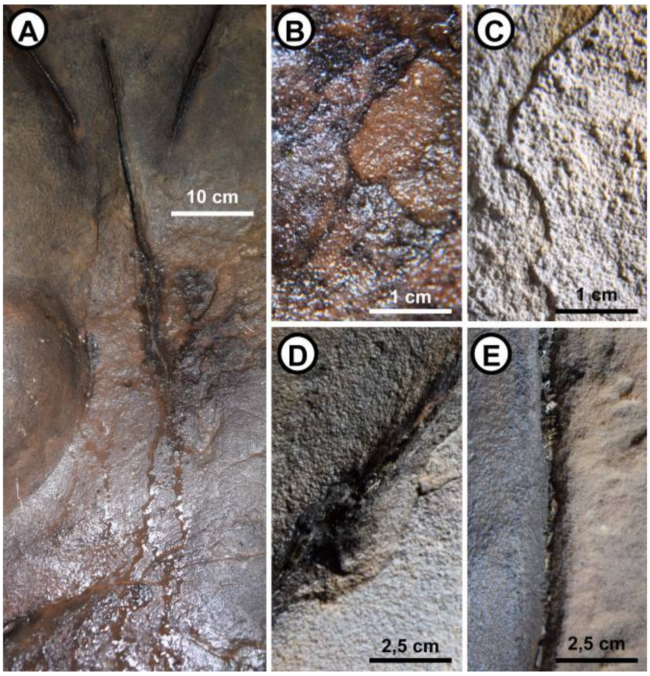

Figure 18 – Appearance of the water saturated panel on 23/01/2018. (A) Leakage and water outflow at base of vulvar slot P2. Note enhanced wetness at the lower end of the panel and less on the bulge. (B) Water exuding from cracks in the gypsum crust about 5 cm below the vulvar slot. (C) Dry crust in the upper part of the panel, below the right pelvic slot P3 on the back of the horse engraving. (D) Slot P3 with moist crust (darker colour) on the pubic left side and almost dry (lighter colour) on the opposite right side. (E) Fracture F2 forms the boundary between the wet part of the panel and the opposite dry part.

6 Hydraulic workings of the pelvic panel

Field experiments were undertaken to map the hydrological changes in the panel as a consequence of water flows through the sandstone and the shelter by supplying water to basins B1 and B2.

6.1. Field experiments

Four experiments were carried out successively during dry periods with adjustments made following each.

The first two were simple tests carried out by filling basin B1 at more or less regular intervals (between 1 and 5 hours) to allow it to drain into downstream basin B2 until it overflowed. The initial test was conducted by leaving basin B1 in its original state and the second after removing leaves and sand deposits that had accumulated in its bottom as well as in fractures F8 and F9. The tests showed that: (1) water added to basin B1 seeps into the sandstone; (2) the rate of infiltration of the water into the sandstone increased after it had been cleaned, indicating that infiltration pathways had been opened; (3) more water infiltrated in the sandstone in basin B1 than in basin B2; and (4) there was no wetting of the pelvic triangle panel.

A third experiment was conducted while maintaining the water level in the basins by electro-mechanical control over 5 days. The hydrological data and the results of the experiment summarised in Table 1 are as follows:

- basin B2 has twice the capacity of basin B1 (9 and 4 L, respectively);
- after filling the basins and thus wetting the sandstone, infiltration rates (flow rate) in basin B1 remain stable at around 0.75 - 1.00 L/h, while those in basin B2 decrease steadily from 0.75 to 0.15 L/h;
- after 5 days of continuous water supply, the uptake in basin B1 was 101 L whereas in basin B2 it was 53.5 L;
- the pelvic triangle panel became progressively wet over the period of the experiment. An outflow from vulvar slot P2 appeared after 2.5 days when basin B1 had accepted 55 L of water. Basin B4 at the base of the panel was flooded by the end of the experiment (Fig. 19);
- two days after the experiment, the panel was already dry, there remained only localized wet spots similar to those observed after 1 day water supply.

Table 1 - Data on the water infiltration from the upper gallery basins along experiment 3 with automated water level monitoring.

			bowl 1		**bolw 2**		
date	hour	Σ h	amount L	flow rate L/h	amount L	flow rate L/h	pelvic panel description
25/03/2019	16h30	0,0	4,00		09,00		dry
	17h30	1,0	7,00	3,00	10,50	1,50	dry
26/03/2019	11h30	19,0	21,50	0,80	28,50	0,72	appearance of wet spots
27/03/2019	17h00	48,5	43,50	0,74	41,50	0,44	extended wet spots
							water resurgence
28/03/2019	09h00	64,5	55,50	0,75	48,50	0,44	flow from pelvic slot P2
	17h30	73,0	63,50	1,00	51,50	0,35	flow at base of fracture F2
29/03/2019	09h00	88,5	79,00	0,95	56,50	0,32	
	17h00	96,5	87,00	1,00	59,50	0,37	5 trickles flowing out at base
30/03/2019	11h30	115,0	105,50	0,97	62,50	0,16	bowl 4 flooded (1-2 L)

A fourth experiment was carried out with intermittent impoundment after 6 to 8 hours of drying overnight. This final test generated wetness of the vulvar slot P2 after 2 days, in the same sort of time frame that had been achieved by maintaining a continuous water supply. However, there was no outflow from slot P2 and the appearance of the panel did not change for the following 3 days.

It should be emphasized that a regular water supply to basins B1 and B2, without a long interruption, caused outflow from vulvar slot P2 after a relatively short time (2.5 days) and with a relatively small water supply (about 50 L per day, equivalent to about 5 buckets). The infiltration rate is higher at the start because the sandstone in the bottom of the basin is dry and acts as a sponge. When the superficial layers of the sandstone become saturated, all pores are filled and water then continues to move downwards by gravity. Thus, the infiltration rate decreases until it attains a stable value which reflects the volume of the pores, their geometry and the interconnections between them. Faster infiltration measured in basin B1 is due to additional infiltration pathways provided by the fractures in its bottom (Fig. 14). Only continuous filling of the basins leads to vulvar flow.

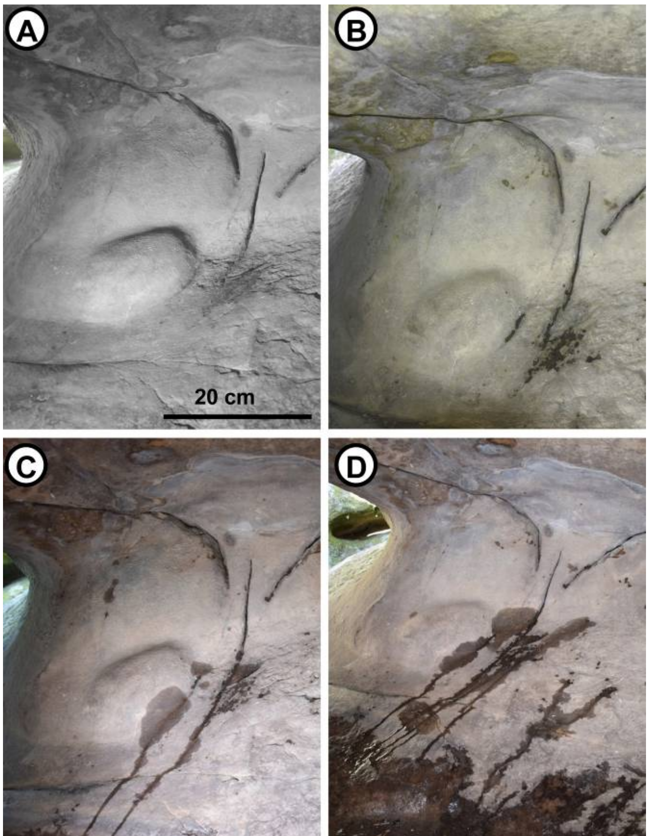

Figure 19 – Progressive wetting of the pelvic panel during the infiltration experiment. (A) Start – dry panel. (B) 1 day – wet spots. (C) 2.5 days – outflow from vulvar slit P2 and neighbour fissure f12. (D) 5 days – saturation of the whole base of the panel.

6.2 Impact of anthropogenic modifications on percolation

The superposition of two galleries (Fig. 16A) is the fundamental feature of the shelter which permits the particular hydrological system we describe to operate. Basin B1 in the upper gallery is the keystone of the installation: it feeds and saturates the pelvic triangle panel by supplying water. The staggered arrangement of the basins and the panel provides the hydrological gradient necessary for water to infiltrate and periodically saturate the panel.

However, working of the natural features of the panel has optimized and concentrated the saturation towards important components, particularly the base of the vulvar slot. The step-by-step movement of water in the shelter has to be examined to unravel the importance and shrewdness of the interventions.

The flow of water in a porous medium forms the basis for understanding the behaviour of water pathways within the sandstone in the shelter. In unsaturated sandstone, pore water is subjected to capillary forces that hold it stuck to grains and gravity that induces its downwards movement along pores (Fig. 20A). If it meets an impermeable barrier, or a less porous layer, water accumulates above that barrier and entirely saturates the pores. Then the force of gravity exceeds the capillary holding forces and the water can flow out (Fig. 20A). In an unsaturated medium with no impermeable barrier, capillary forces can hold the water around grains and prevent it from draining. Thus, cavities or fractures are bypassed by infiltration (Fig. 20B).

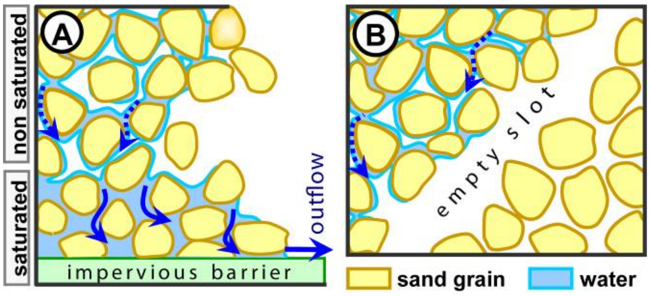

Figure 20 – Behaviour of water in porous media. (A) In a non-saturated sandstone above an impermeable barrier, water migrates around grains, accumulates, saturates the pores and then flows away. (B) In non-saturated sandstone with no impermeable barrier, water films are attached to grains and do not drop to empty holes or slots.

The water enters the sandstone of the pelvic triangle through fractures on the bottom of basin B1 at the back of the panel (Fig. 21). The fractures fill with water that gradually infiltrates the adjacent porous sandstone. The water then meets barriers that prevents further vertical percolation and forces the flow along these barriers to a certain direction.

- Voids of pelvic triangle slots P1 and P3 force percolations to flow along their slope to the tip of the triangle. It is the barrier effect of the lateral pelvic slots that explains the moisture contrast of the panel-encrusted surface on either side of the slots: moistened above the slot and dried under it (Fig. 18D). The same effect explains the similar moisture contrast on both sides of fracture F2 which closes the panel on the right (Fig. 18E). The deeper the slot, the more the barrier effect is accentuated.
- The hard sandstone bulges are less porous than their surrounds and, protruding at the base of the panel, form a less permeable horizon. They act as another impervious barrier over

which percolations accumulate and progressively saturate the panel base. The front between the saturated and unsaturated zone rises up in the panel as and when pores become saturated with water. Seeps and flows occur when pore water is no longer retained by capillarity.

Thus, the arrangement of the modified slots and the impermeable barrier at the panel base lead to panel saturation and emergence of the 'vulvar fountain' when basins B1 is filled continuously. If the water supply is not sufficient or is interrupted, saturation is not achieved or only locally achieved, producing only scattered wet spots.

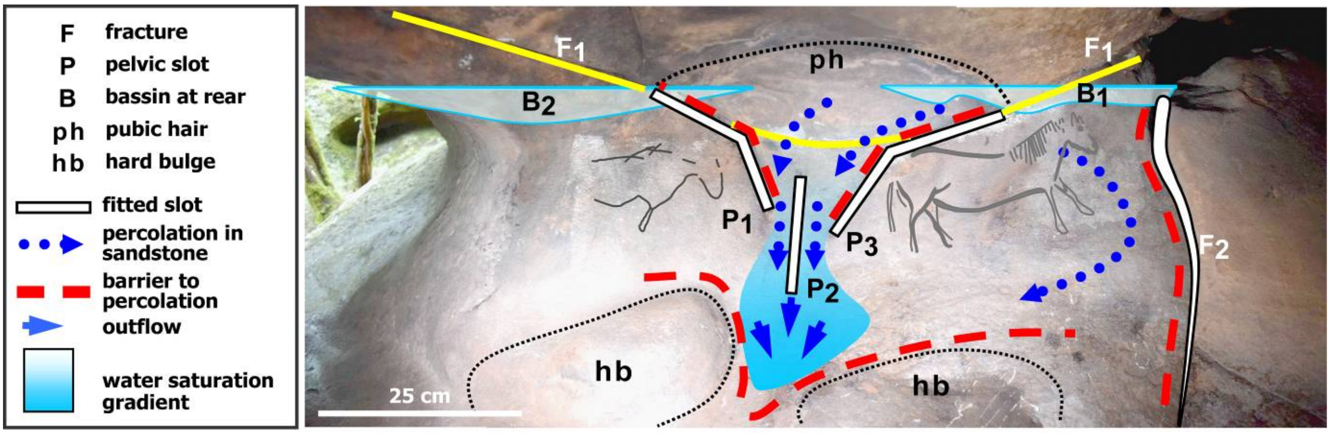

Figure 21 –Diagram of the hydrological functioning of the horse panel. Hydrological features channel pore water to saturate the sandstone and thus generate outflows at the base of the pelvic triangle.

It may seem strange that vulvar slot P2, a fundamental component of the sexual representation, is not as wide as the lateral slots P1 and P3 of the pubic triangle. It may be no coincidence. Enhanced widening of the lateral slots relative to the vulvar slot optimizes the water seeping towards the base of the pubic triangle. An expanded opening of the central part of slot P2 would have diverted some of the seepage water around its periphery. On the other hand, deepening it has made it possible to collect more water and to obtain a localized outflow on its bottom end when the saturation front rises.

Another component of this sexual arrangement is the 'pubic hair'. It is a striking organo-mineral coating with concentric halos that were formed through capillary rise of wetness from fracture F1 at the top of the pelvic triangle (Thiry and Cantin, 2018; supplementary file 2). However, events that moisten and generate seepage in the pelvic triangle panel do not currently affect this particular area of fracture F1. This suggests that the primary water regime that led to development of this particular encrusted area has been disturbed or changed since the time of crust formation. This could have resulted from the deepening of basin B1 and the opening of a spillway towards fracture F2 that lowered the fill level in the basin and deprived fracture F1 of water.

7 Summary

Detailed analysis of Ségognole 3 shelter has identified a number of natural features that have been worked and modified to change their properties. The results are a true 'installation' in the modern artistic sense, both functional and evolutionary, and focussed on a representation of feminine sex and animals. Considering all the components we have described, we should try to discern the many that are unquestionably intentional interventions from others that may only be side effects and were not intended.

7.1 Worthy features from a Palaeolithic perspective

The main characteristics of Ségognole 3 shelter are its two-tiered gallery arrangement and the presence of internal basins that periodically retain water. These are rare and remarkable configurations. More often than not, when water infiltrates into other shelters in the region it seeps directly into porous sandstone or sand in the shelter floor and is not retained. In addition, the overall morphology of the shelter was probably a determining factor in it being selected for this installation. Indeed, the central chamber with the carved panel is isolated within the sandstone block and curtails access (see supplementary file 2). After gaining access into the vestibule, it is necessary to crouch and then crawl to pass an oval narrowing before reaching the intimacy of the chamber where the key panel is located (Fig. 4A; supplementary file 2). The pubic triangle is therefore integrated into a natural space that possibly has feminine connotations, a characteristic not surprising in the context of European Upper Palaeolithic rock art (Leroi-Gourhan, 1965; Testart, 2016).

The pubic triangle itself has been described in the past as an essentially natural attractive element (Bénard, 2010). The analysis of the fracture networks and their morphologies now demonstrates that the three pubic slots, so apparent and suggestive, have been worked to this end. It is possible that at the origin of the vulvar slot P2 there were originally fine irregular and possibly periodically wet cracks that could have inspired engravers to construct a more formal representation of female sex. In addition to these original thin cracks, the presence of the dark-coloured organo-mineral coating evoking pubic hair may have been another decisive element to encourage engraving of the pubic triangle. While this is currently well marked, it may have been even more striking before the water flows were diverted by remodelling the hydraulics as moisture increases the contrast with the surrounding sandstone. Drying out of the pubic hair coating is clearly a side effect of deepening basin B1. Additionally, the presence of fracture F2 framing the panel should not be overlooked. Although probably less shapely before its modification by grooving, it could have reminded one with a sharp eye of a hip-thigh silhouette. This silhouette is reinforced by the extensions to the pelvic slots P1 and P3 to the modified fracture F1 to highlight 'groin folds' and complete the framing of thighs and hips. Nonetheless, the bottom-up view of the transition of the pubic triangle to the ceiling of the chamber, as it appears when one enters the chamber by crawling through the narrowing, evokes a woman's belly (pregnant?) with its pubic tuft overhanging the triangle (see supplementary file 2). This view links the whole chamber's volume to a feminine representation overlooking and dominating the visitor and is particularly striking.

The natural geomorphological characteristics of Ségognole 3 shelter thus provided appropriate disposition to imprint this fragmented representation of feminity, a theme that shows clear importance during the Upper Palaeolithic (Leroi-Gourhan, 1965; Bourrillon, 2009; Bourrillon et al., 2012; Testart, 2016), although it is relatively rare compared to animal representations in cave art (Sauvet, 2019). The integration of a modified hydraulic flow regime, that activates a vulvar flow (pre-parturial water losses ?), generated a novel and unprecedented installation that presumably had symbolic force.

7.2 Sequence of anthropogenic workings

Our proposal is that the pubic triangle was created to integrate the pubic hair feature with initial rock fractures into an evocative whole. Originally, there was perhaps also a periodically wet area at the base of the original vulvar slot P2. But the current hydraulic characters have resulted mainly from deepening the lateral slots of the triangle and modifying basin B1. Fracture F2, which limits the panel on the right, does not appear to play any obvious role in the hydraulic operation of the vulva. One hypothesis might be that it was worked to mirror the curvature in the sandstone narrowing that limits the panel on its left (Fig. 5A; supplementary file 2), thus evoking the widening of hips and thighs.

Following this line of reasoning, it may be that the initial carving of the pubic slots revealed the hydraulic potential of the panel: enhancing it was attempted by gradually deepening the slots, perhaps when successive wetting events occurred. Thus, optimization of the hydraulic system was probably made through successive adjustments, in conjunction with enhancement of the sexual representation, in the manner of an interaction between graphic and functional layout. With this in mind, the intervention by percussion on pelvic slot P3 after it had been grooved could make sense as a plausible hydrological 'retouching'.

We have pointed out the importance of the fractures at the bottom of basin B1 in terms of facilitating saturation of the pubic triangle panel by water. The efficiency of saturation of the panel depended greatly on the flow rate through these fractures and therefore on the state of the bottom of the basin. It is possible that this was also controlled by gouging open fractures F8 and F9. The configuration of the upper basin B1, in terms of deepening it and constructing the spillway, is therefore understandable in the context of organizing the whole space and water resources around the feminine sexual representation. The changes were probably made gradually according to changes in the physical appearance of the panel.

The motive for lowering the fill level in basin B1 by flaking out sandstone at the top of fracture F2 is not clear. This may effectively reduce its ability to regulate infiltration towards the pelvic panel. On the other hand, providing water to the base of the pelvic panel almost surely promoted and accelerated its saturation there. This could have been a subtle regulation of panel saturation by using excess water rather than allowing it to drain into basin 2 and then flow out of the shelter.

7.3 How far modifications were intended?

Comments made above about the interactions among the different adjustments and modifications and their succession led us to suggest that the entire installation was probably implemented gradually, in steps, based on observations and experience. Otherwise, unrestrained interventions could have completely unbalanced the system and deflected infiltrating waters to the rear of the panel. While the hydraulic mechanisms seem at first glance to be complex, ongoing water gathering experience, observation of water flows interacting with regional sandstones, and familiarity with the shelter and its environment, could well have sharpened the intuition and understanding of those who were responsible for it.

Finally, our analyses and experiments lead to the hypothesis that Palaeolithic people could potentially have operated the ‘vulvar outflow’ on demand and without weather constraints. Water supply was not a problem since the shelter is less than 500 m from the valley of the Ecole River which was a marsh before its drainage in historical times. Once the flow rates of the fractures had been adjusted so that water exuded from the panel and the vulvar fountain flowed, the system could be tested to determine the time needed to reach saturation and from there the event could have been staged in a reliable way as part of some presently unknown symbolic or cultural occasion.

8 Ségognole 3: a new perception of palaeolithic rock art

With the identification of the hydraulic anthropogenic modifications, our perception of the thematic characterising the shelter is largely renewed. The analysis of the fittings changed the pubic triangle of Ségognole 3 shelter from a pre-existing and evocative natural relief, featured in three dimensions, to a complex and functional installation including the fourth dimension of moistening and flowing cycles, for which morphological and hydraulic resources have been exploited. The vulva occupies a central place in the panel and our study highlights that major fittings have a role to stage and enhance it. The horses, which were initially considered the main subject of Ségognole 3 shelter, may have been engraved to enhance it as well. In this hypothesis it is noteworthy that the horses seem to be sized in order to be closely related to the pubic triangle, both in dimensions and symmetry, subordinating them directly to this vivid feminine sexual representation in a meaningful symbolic association.

We know that in many other cases, Palaeolithic artists have interacted with the walls in both caves and rock shelters. They have sometime been inspired by the morphologies of the location but did not modify them deeply very often. In particular, Upper Palaeolithic sites exhibit female sexual representations that have been revealed or enhanced onto morphological elements of the rock (Bourillon, 2009). These sexual representations are very variable in size, sometimes engraved, often simply suggested by a slight reshaping of a natural slot and in some cases enhanced by the application of red pigment that adds a symbolic load. In contrast, the voluntary staging of the parietal composition of Ségognole 3 shelter reached proportions unprecedented in Palaeolithic art and reveals a new and original aspect of the behaviour of Palaeolithic artists. The probable anthropic activation of the panel may also be one of the few testimonies of plausible staged ritual practices in rock art sites.

In addition, some Palaeolithic caves show parietal arrangements that also integrate water into their layout. Although it seems disconnected from the parietal figures, a hydraulic arrangement is known in the Galerie du Cierge from the Grotte Chauvet (Pont-d'Arc, 07) where two collapsed blocks have been rotated and sealed by clay in order to create basins whose meaning remains to be defined (Ministry of Culture, 2015). In general, water is obviously present in karst environments, and some sites have highlighted possible links between water flows and paintings, especially in the Quercy region. Thereby, in Pech Merle, the location of some panels is related to underground resurgences like the "pearl waterfall" that flows over the panel of the "women-bison" (Lorblanchet, 2010), while in the cave of the Moulin, two bison are on either side of a crack which overhangs an orifice on the ground where passes a stream towards which they lean. In Pergouset cave, a long narrow gallery ends with the carving of a large fish gleaming of moisture and from whose mouth flows a spring (Lorblanchet, 2001, 2010). All those examples show that Palaeolithic artists occasionally included water flows in their works but never in a way comparable to Ségognole 3 shelter.

The feminine thematic finds in Ségognole 3 shelter a central expression around a pelvic triangle powerfully staged by a real "installation". From a more general point of view, the hydrological arrangement of Ségognole 3, with the effort that was granted to its realization, testifies to an unprecedented behaviour. This should lead to special attention being paid to clues of anthropogenic modifications leading to recognition of possibly staged installations in Palaeolithic caves or shelters.

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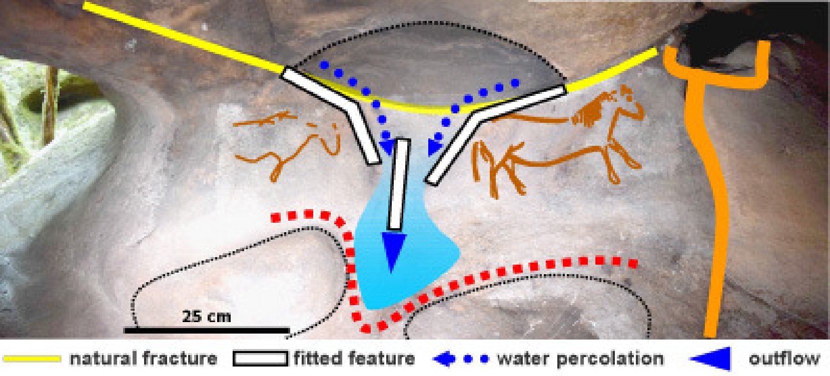

25 cm
natural fracture
fitted feature
water percolation
outflow