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Portable art from Pleistocene Sulawesi

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Supplementary Information

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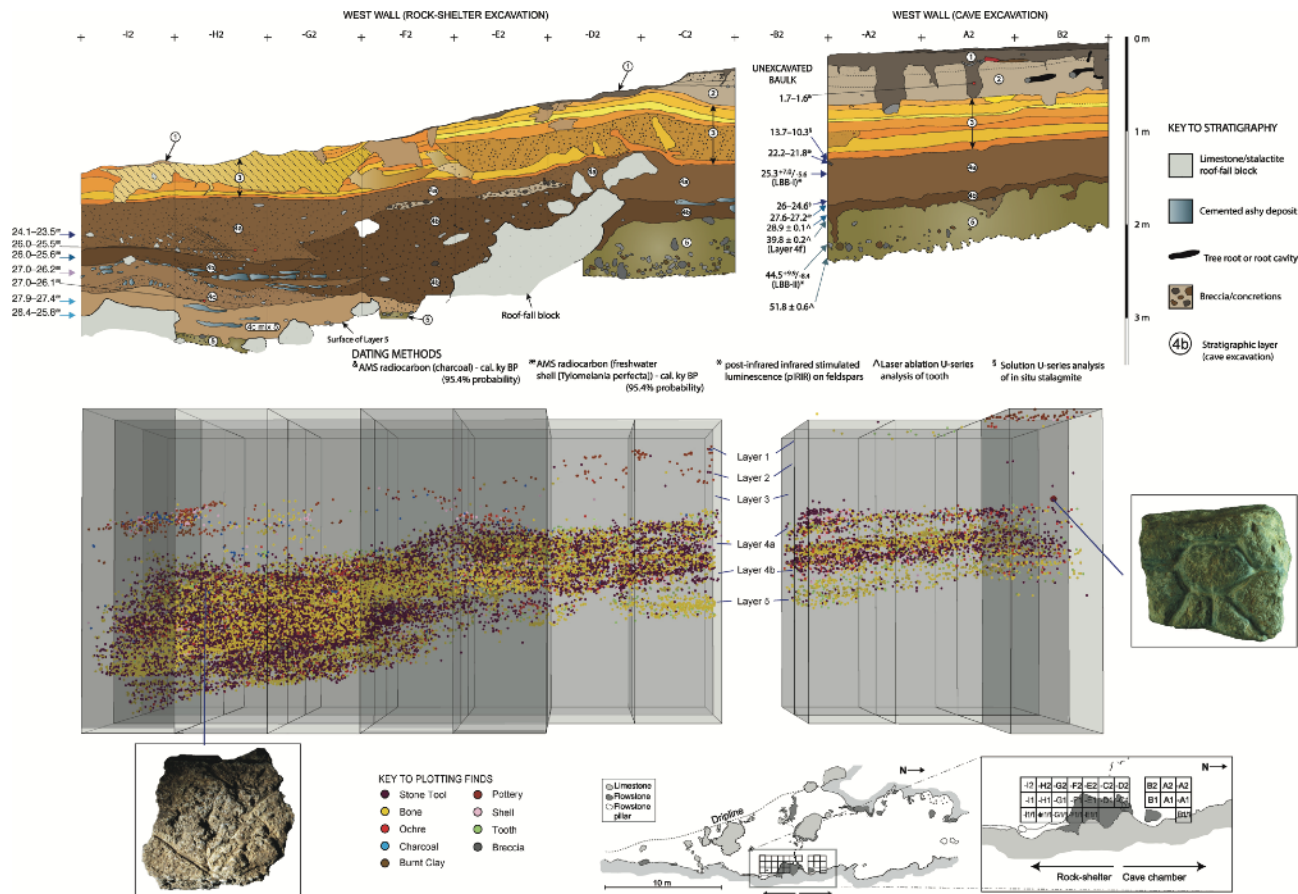
Archaeological Context

The cave and rockshelter complex of Leang Bulu Bettue (LBB) (4°59'31.18"S, 119°40'5.53"E) is situated at the foot of a limestone tower in the Maros-Pangkep karst area, which lies between 4°7'S and 5°1'S on Sulawesi's southwestern peninsula. The topography of this extensive karst landscape (~450 km²) is dominated by plateau-like hill masses formed by rivers cutting through intersecting joints in the limestone, and, in areas of advanced plateau dissection, steep-sided towers surrounded by alluvial plains that extend to the western coastline at an elevation of ~5 to 30 m a.s.l..

LBB is located within a precinct of major prehistoric sites: Leang Burung 2 is 1.5 km to the south; 1 km to the southwest is Leang Timpuseng, a rockshelter with a hand stencil and large figurative painting of a female babirusa 'pig-deer' with minimum Uranium-series (U-series) ages of 39.9 ka and 35.4 ka, respectively; and 300 m to the northwest is Ulu Leang 1 cave.

LBB is currently situated 20 km east of the modern coastline and comprises a valley floor entrance rockshelter with a roof height of 15.6 m, and an adjoining, slightly more elevated cave chamber that is 27.3 m long, 12.6 m wide, and up to 9.2 m high. Rock art is visible on the walls and ceiling, including hand stencils (n = 35) overlaid by Austronesian-style drawings. During annual excavation seasons at LBB conducted between 2013 and 2018, we opened up a large trench that extended southwards from the cave entrance to the central floor area of the shelter. Our trench has revealed an archaeological sequence of human occupation that is divisible internally and on stratigraphic and chronological grounds into two distinct phases: Phase II: Historical (<1790 A.D.) and 'Neolithic' (1.7–1.6 ka cal B.P.); and Phase I: MIS 3/2 (~50–22 ka). The excavated archaeological findings

reported in the present study were recovered from Layer 4a in Phase I (Supplementary Figure 1). This is the uppermost Pleistocene deposits preserved at the site. A 108 cm-thick sequence of flowstones separates these sediments from overlying Holocene strata. The capping flowstones sealed-off the Pleistocene layers and protected them from erosion and anthropogenic disturbances. The Layers 4a-e sequence comprises thin silty clays (Layers 4a-b) that slope downwards from the rear of the cave and level out and thicken in the main shelter, where they inter-finger with ashy lenses (Layers 4c-e). This combined sequence is 1.5 m thick. Below this is a 50 cm-thick sandy clay (Layer 4f) that is only preserved near the eastern wall of the cave and which is underlain by a 50 cm-thick sandy clay (Layer 5).



Supplementary Figure 1: Stratigraphy of Leang Bulu Bettue and find locations of the two engraved plaquettes.

Technical Analysis of the Engraved Stones

Study of the decorated surface involved the following: (1) macrophotography of the plaquette using a Canon digital SLR camera; (2) high-resolution photography of the engraved surface using a Zeiss Stemi 508 stereomicroscope fitted with an Axiom 105 camera; (3) stitching together the microscope images to create a photo-mosaic of incised and/or carved areas; and (4) tracing of each graphic element using both the Canon macro-photographs and the microscope photographs in the illustrating programme Canvas XII. Identification of mark delineations was confirmed through

use of these photographs as well as microCT images created by the National Laboratory for X-ray Micro Computed Tomography in Canberra.

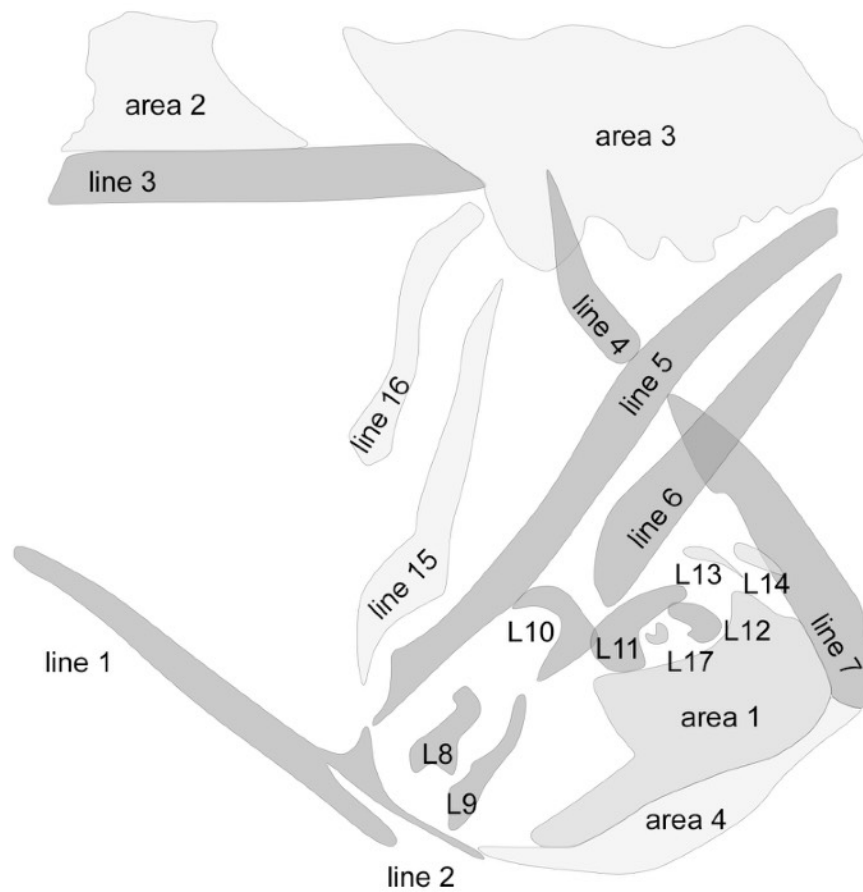
Detail of the Anoa Plaque

The plaque is made from a yellow-brown flowstone and has maximum dimensions of 54.59 mm wide, 51.75 mm long, and 13.40 mm high. Roughly square in shape, and worked on only one face, directed lighting clearly brings out the anthropogenic alterations. These alterations consist of 17 lines and four scraped and/or sculpted areas (Supplementary Figure 2 below). The assignment of an individual line was determined by identifying the initiation and termination of a single groove (see example in Supplementary Figure 3), while each 'area' was delineated by these lines and/or unaltered flowstone surface.

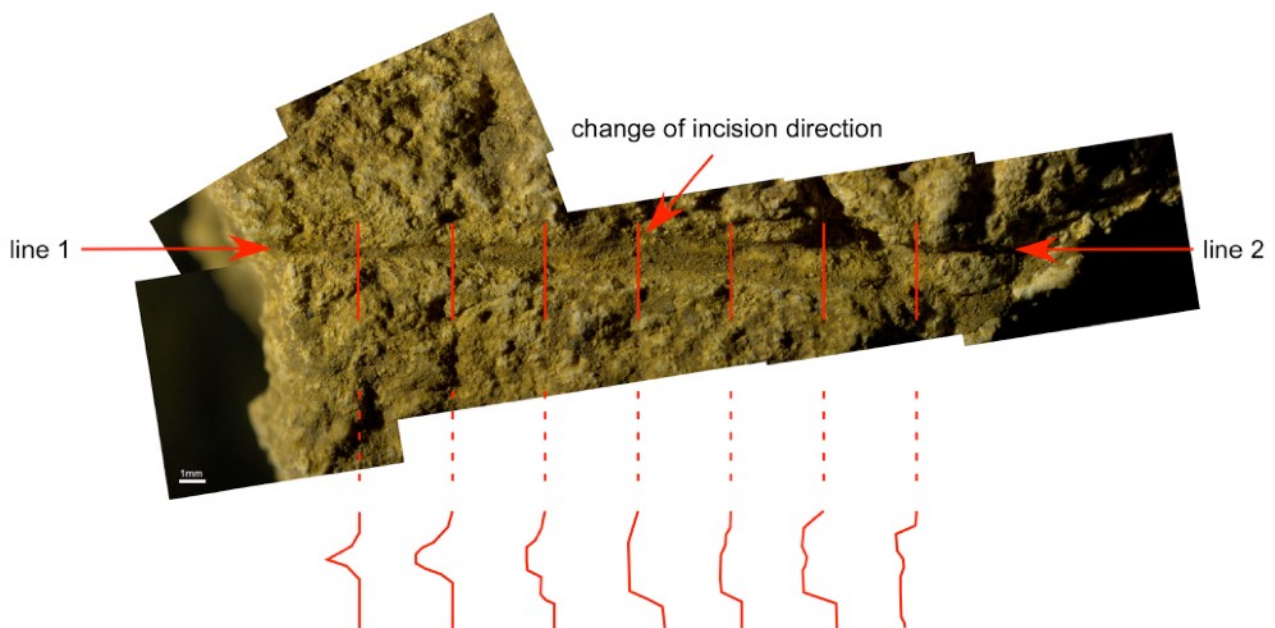
One graphic element is evident. This motif covers most of the surface of the slab, and depicts the head of an anoa shown in left profile, turned back towards its flank. The head (36.8 mm long) features a carefully curved muzzle with a simple, single-line mouth and nostril (Supplementary Figure 4). Line 5 delineates the top of the muzzle and head, and another incision (Line 10) suggests the start of the rise towards the upper head and horns.

Adjacent to this brow-line (Line 10) is a single eye created using three curved grooves. These lines (Lines 11, 12, and 17) delineate the roughly oval shaped eye (Supplementary Figure 5). Two short, deep (~3 mm) lines (Lines 13 and 14) wider at the base and tapering towards the edge of the plaque and which may represent the base of the left ear, as this would be anatomically correct (see below for comparison to living anoa in S10, S11, and S12).

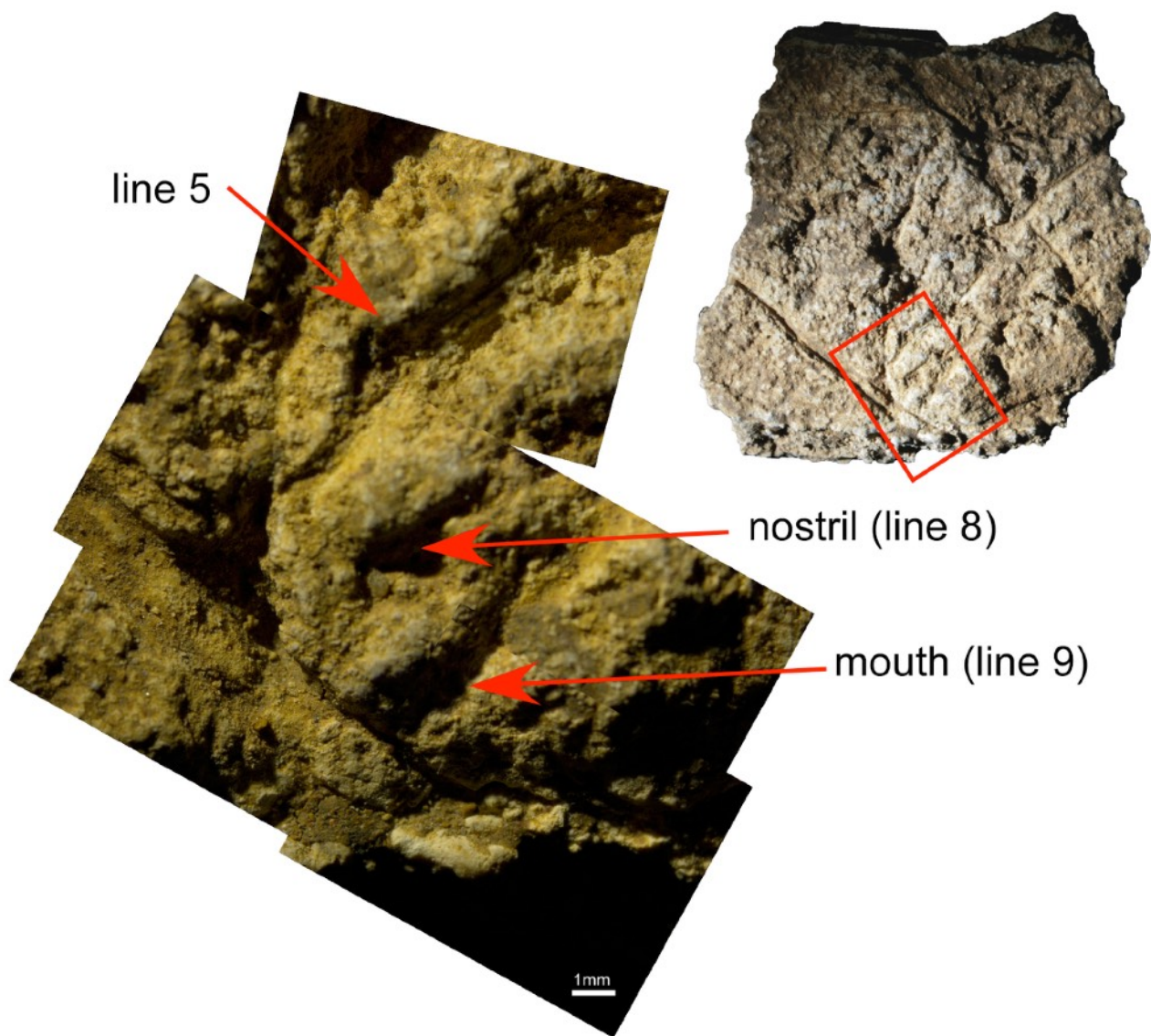
The left horn was created using a single, wide incision, inside of which the striations created by the stone tool dragging against the stone remain visible (Supplementary Figure 5). Similar striations are also clearly visible in the top of Line 5 which creates the right horn (Supplementary Figure 5).



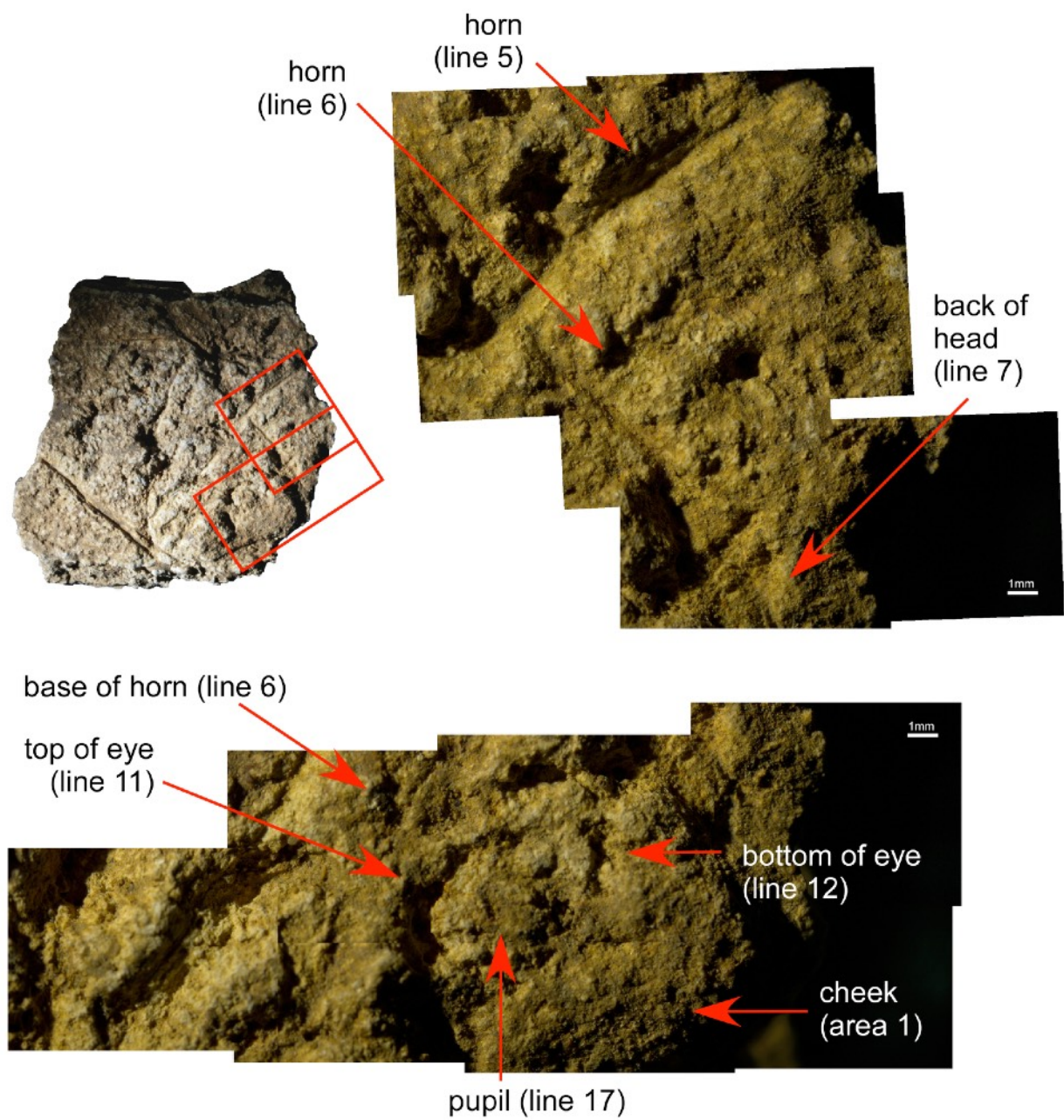
Supplementary Figure 2: ‘Map’ of the Anoa plaquette: Tracing of incised lines (‘line’) and scraped areas (‘area’).



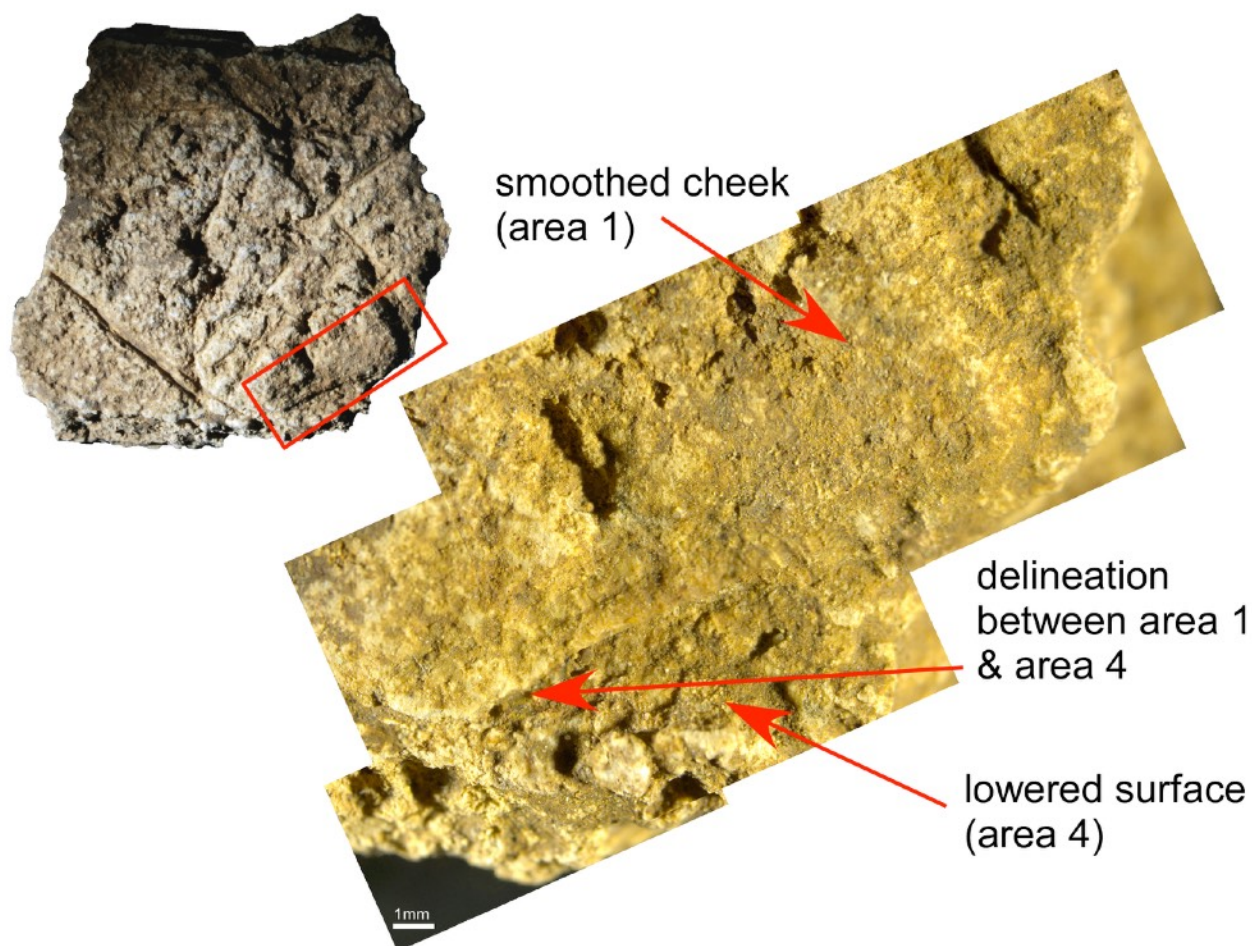
Supplementary Figure 3: Lines 1 and 2 — overlapping marks showing a deliberate change in incising direction. Cross-section (red lines) and walls of these two lines are consistent with having been made using a stone tool edge.



Supplementary Figure 4: Composite image of microscope photographs showing detail of the muzzle, nostril, and mouth.

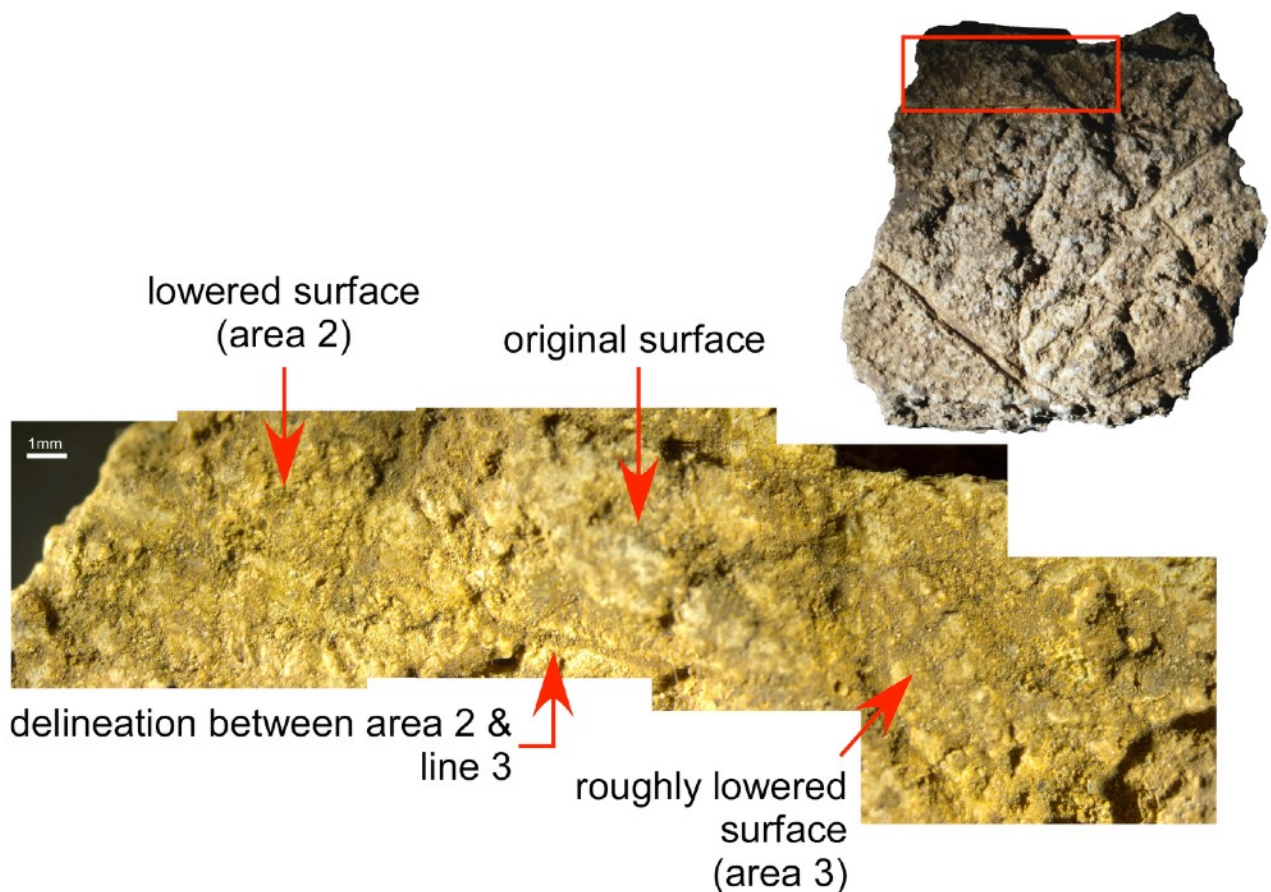


Supplementary Figure 5: Composite image of microscope photographs showing detail of the mid-facial region and horns.



Supplementary Figure 6: Composite image of microscope photographs showing detail of the smoothed cheek, chin, and lowered surface under the head.

The cheek of the animal has received the most time and attention, having been carefully sculpted to create a 3D appearance (Supplementary Figure 6). Area 4, located at the very bottom of the engraved face (refer to Supplementary Figure 2), has been lowered so that the head of the anoa is around 3-4 mm higher (as in bas-relief). The cheek and lower jaw area have then been scraped down to create a relatively smooth surface (compared to the original rugged topography of the flowstone support). A striation created by the edge of the tool used to undertake these alterations is visible about 1 mm above the very edge of the jaw/cheek (Supplementary Figure 6). The smoothed area abruptly stops under the eye and in a roughly L-shaped edge, signifying the lower jaw.

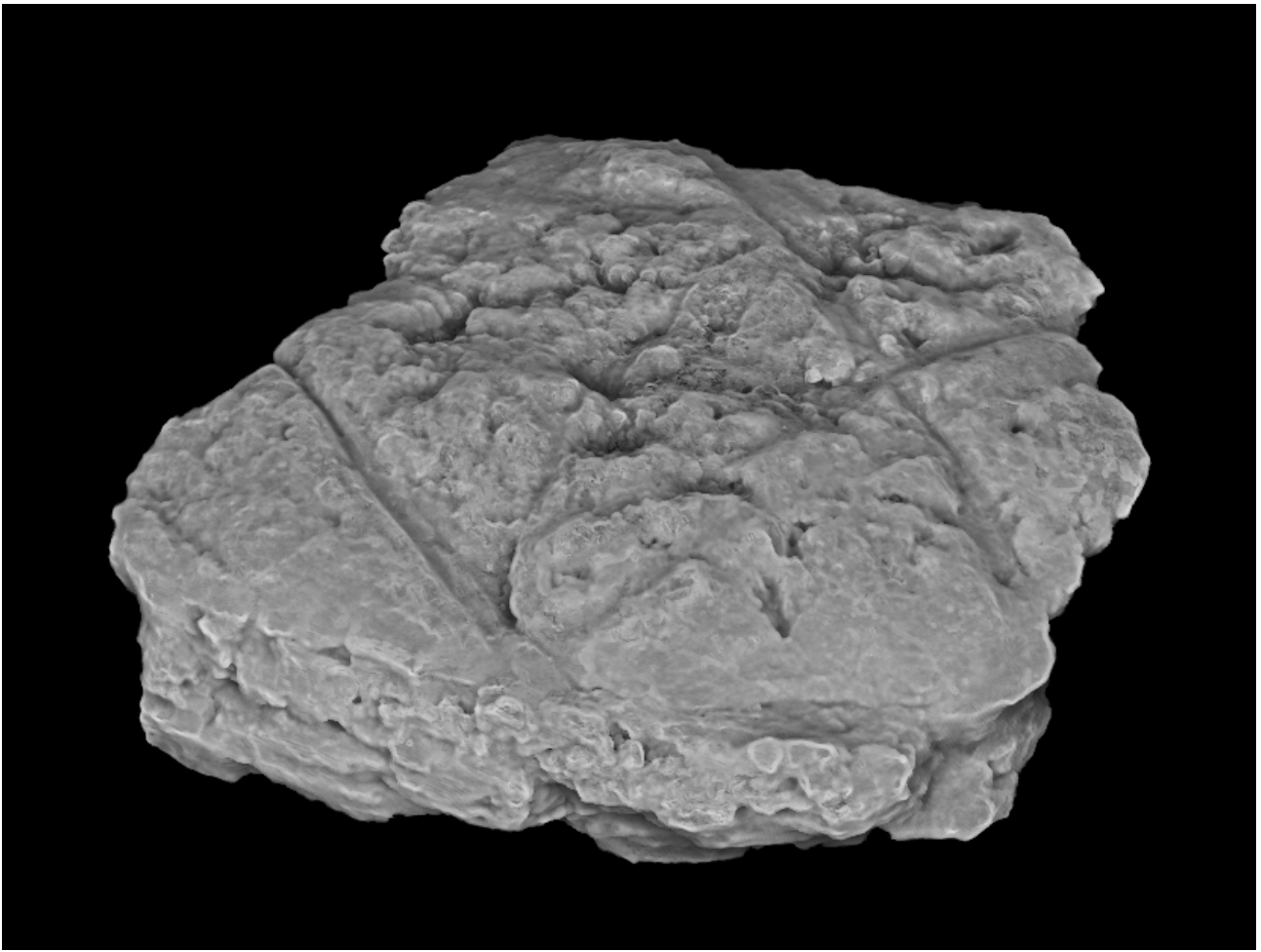


Supplementary Figure 7: Composite image of microscope photographs showing detail of areas 2 and 3. Area 3 is higher and more undulating (the original surface) than area 2 (scraped away).

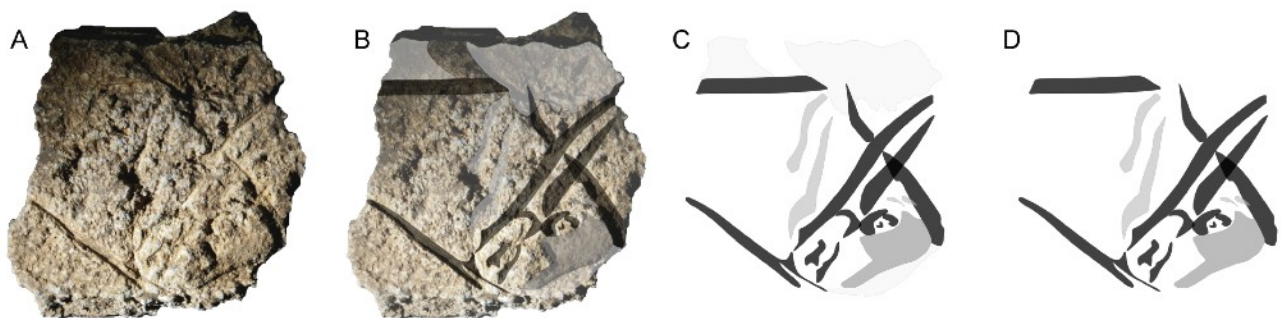
The flank of the animal is delineated by four deeply incised lines, creating a roughly arched back and flat stomach. No legs are shown. Two scoloped lines (Lines 15 and 16) are drawn on its neck area, which may indicate the wrinkled skin which is highly visible on anoa (see Supplementary Figure 11:A).

Along with Area 4 (under the jaw), two more areas have been lowered using cutting and scraping motions. As shown in Supplementary Figure 7, Areas 2 and 3, located in the upper right left and right corners of the plaquette have been first delineated and then scraped away (striations are present on the surface of both worked areas). Approximately 2 mm of material has been removed for the stone surface in these two locations. It therefore appears that the lowering of Areas 2, 3, and 4 was undertaken in order to 'bring out' the represented animal (again, as in the bas-relief method).

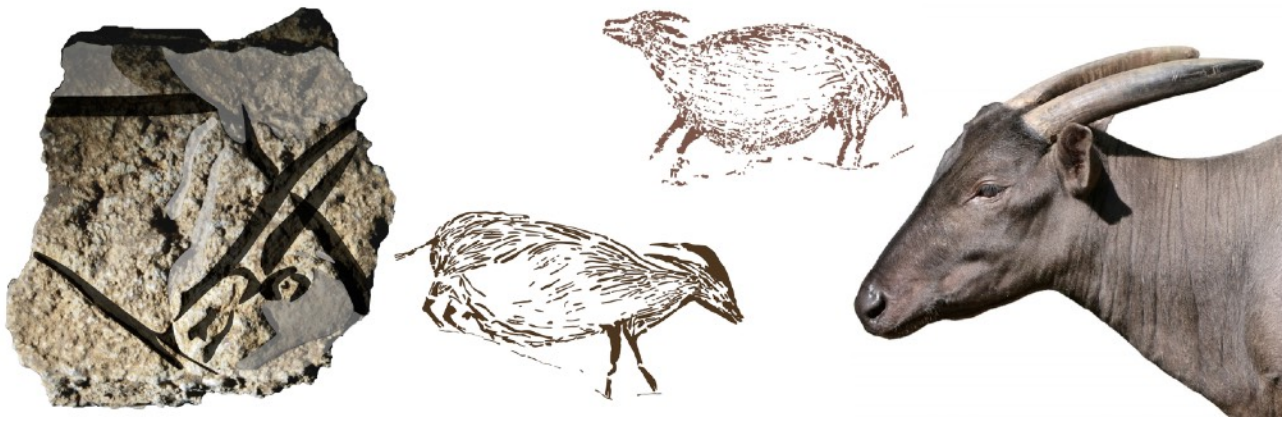
These lines as they appear under the tracing and without the lowered areas can be seen in Supplementary Figure 9 below.



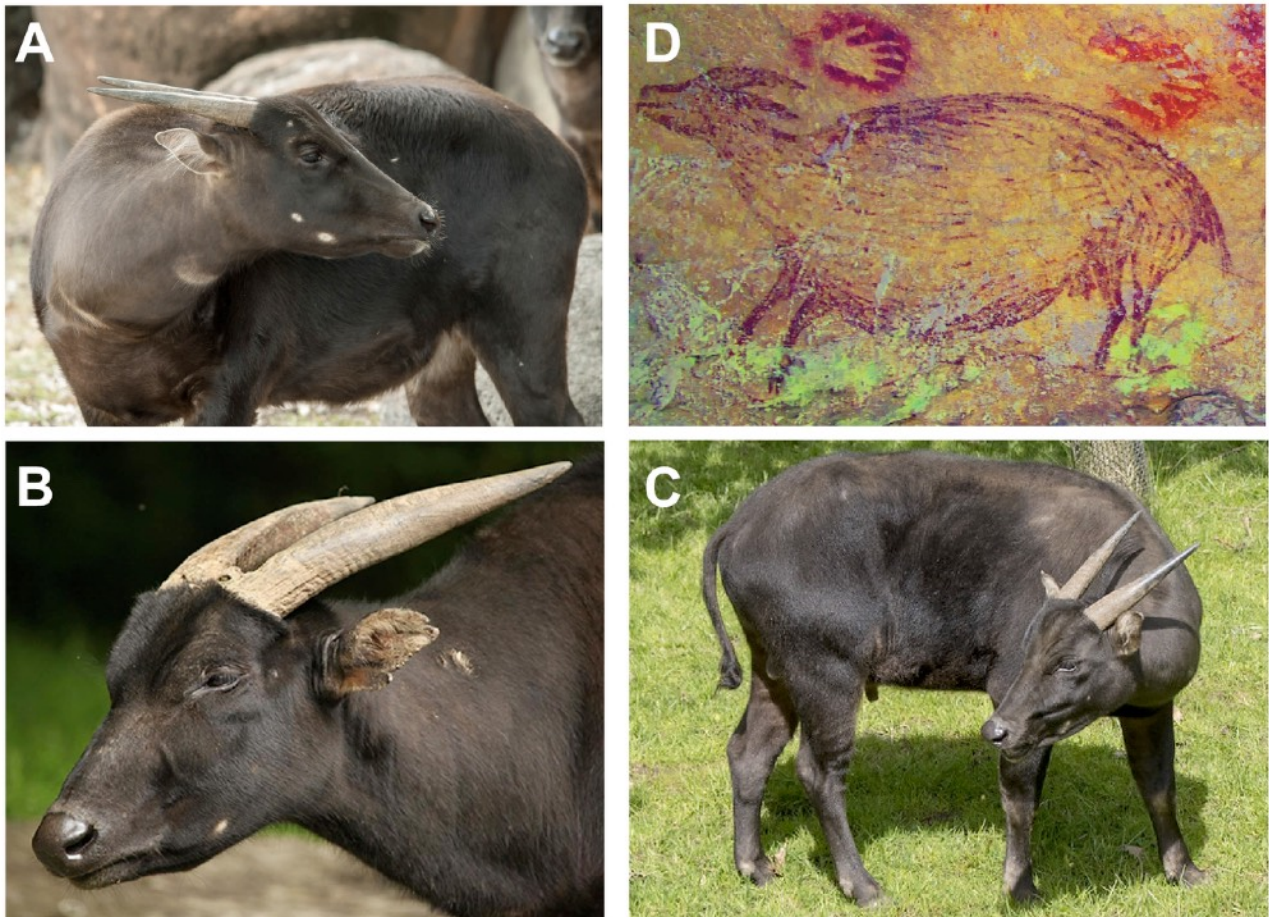
Supplementary Figure 8: Micro-CT image of the Z surface.



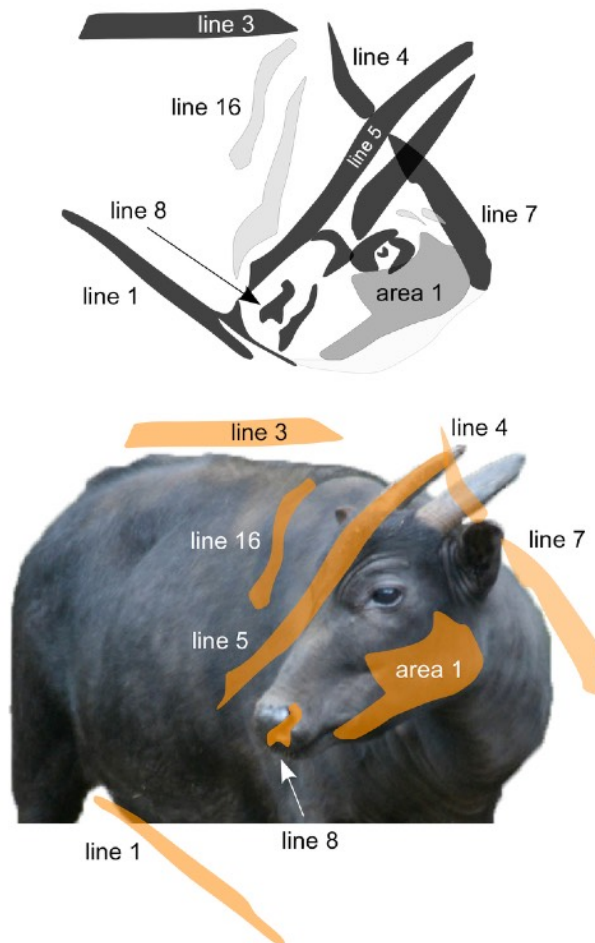
Supplementary Figure 9: Progression of tracing development. (A) Original macro-photograph; (B) Overlaid tracing on photograph; (C) Tracing; (D) Tracing without lowered areas at top of the plaque.



Supplementary Figure 10: Depicting Anoa. Engraving, pigment painting, and photography of anoa (*Bubalus* spp.) found on Sulawesi, Indonesia. Of note is the shared method of depicting the sweep of the head and horns using a single line in both paint and engraving (Photo at right: Pixabay).



Supplementary Figure 11: Anoa (*Bubalus* sp.) showing the anatomical placement of their cranial features (A, B, and C) and turning of the head towards its flank (A and C) (Image A: F. Herrera; Image B: Shutterstock; Image C: G. Christian). (D) Pigment painting of an anoa alongside hand stencils at Gua Uhallie, Sulawesi, Indonesia (A. Brumm).



Supplementary Figure 12: Comparison of the orientation and path of the lines delineating the outline of the animal on the LBB engraving as against a photograph of a live anoa (Photo: Leipzig zoo). Here you can also see the accuracy of the perspective depicted as well as of the right horn, cheek, and nostril.

The identification of the engraved animal as an anoa (*Bubalus* sp.) was based both on comparison with images of recent animals (see examples in Supplementary Figure 10 and Supplementary Figure 11), but also Pleistocene depictions of these animals found in the pigment rock art of the region (Supplementary Figure 10; Supplementary Figure 11:D).

In life, there are two species of anoa — mountain anoa (*Bubalus quarlesi*) and lowland anoa (*Bubalus depressicornis*) — which are also known as ‘midget buffalo’ or sapiutan. These small deer-like water buffalo are endemic to Sulawesi and would have been obvious prime targets for food, horn, and hide to the first human populations of the island. It should not be surprising, then, that these animals would be selected to play a role in the symbolism of early peoples of Sulawesi, and consequently, be depicted in portable and parietal art works.

Detail of the Rayed Motif

This second artefact is made from a grey limestone, and has maximum dimensions of 29.54 mm wide, 50.32 mm long, and 27.25 high (Fig S13). The primary engraved face (that with the 'sun') measures 29.91 mm by 25.40 mm and is roughly square. The maximum width of the oval at the centre of the engraving is 10.10 mm.

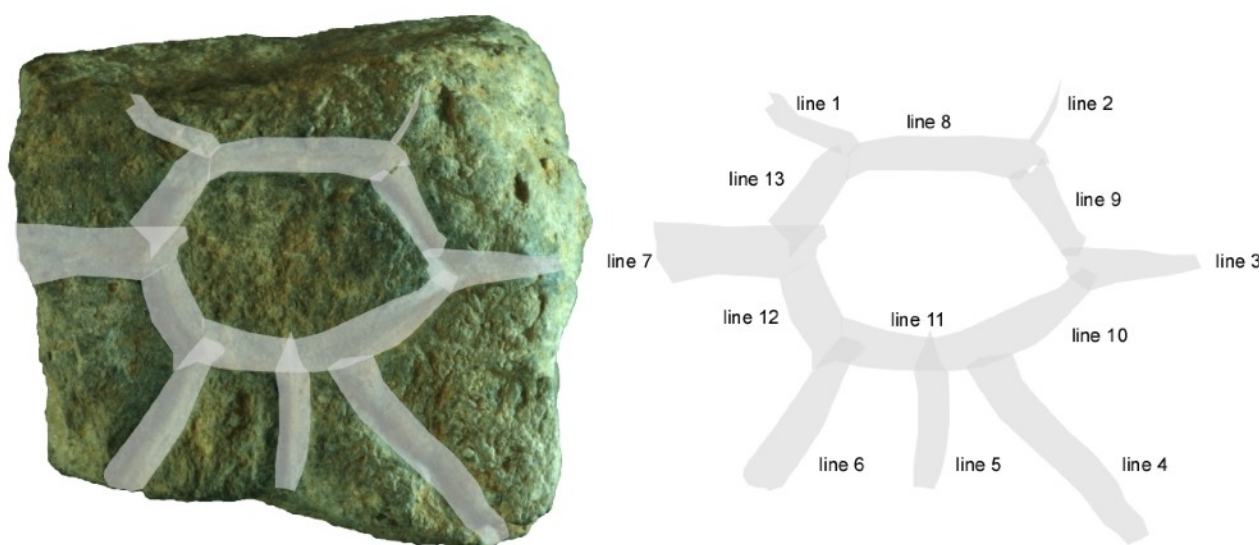
The motif is created using 13 lines (Supplementary Figure 14 below). Each is incised deeply into the rock surface, averaging 2 mm deep, and are made by multiple draws of the tool edge. Overlapping cuts are clearly visible in each case (Supplementary Figure 15), and cross-section profiles of each line are consistent with the use of a squared-off point (as seen on a typical European-style burin).

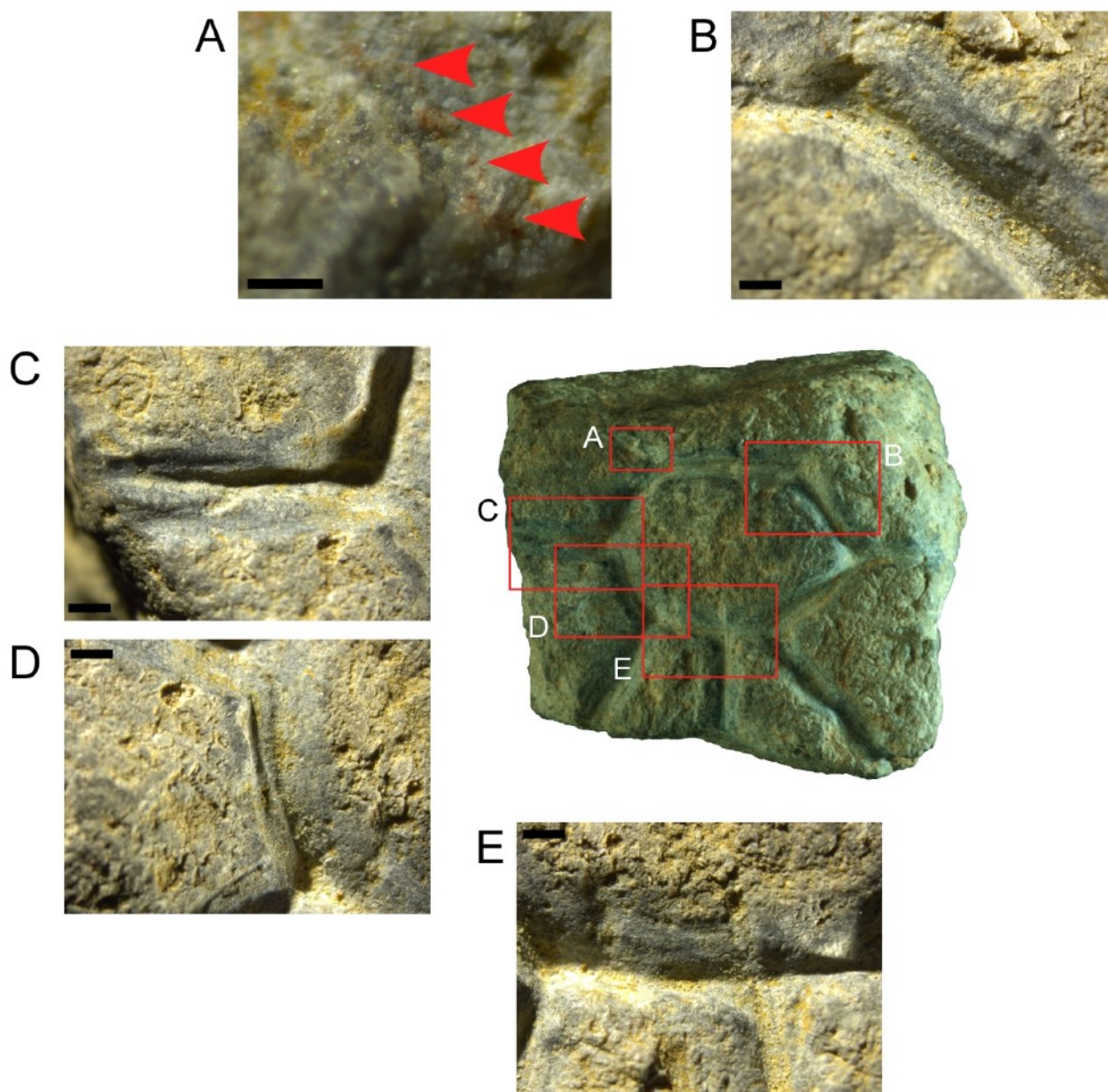
The order in which the lines were incised was able to be determined for the oval as the initiation and termination points of each incision are clear. These are shown in Supplementary Figure 16 below. Examination of the superposition of each cut found that the top half of the oval was first incised, moving from left to right. Next, the bottom half was cut from right to left. It is possible that the stone was rotated in the hand so that the artist was moving their hand in the exact same motion used to cut the first three lines (top of the oval). The 'rays' were added after the oval was completed. As no other elements overlap with these lines, we cannot determine their chronology.

Supplementary Figure 13: Engraved stone from LBB.



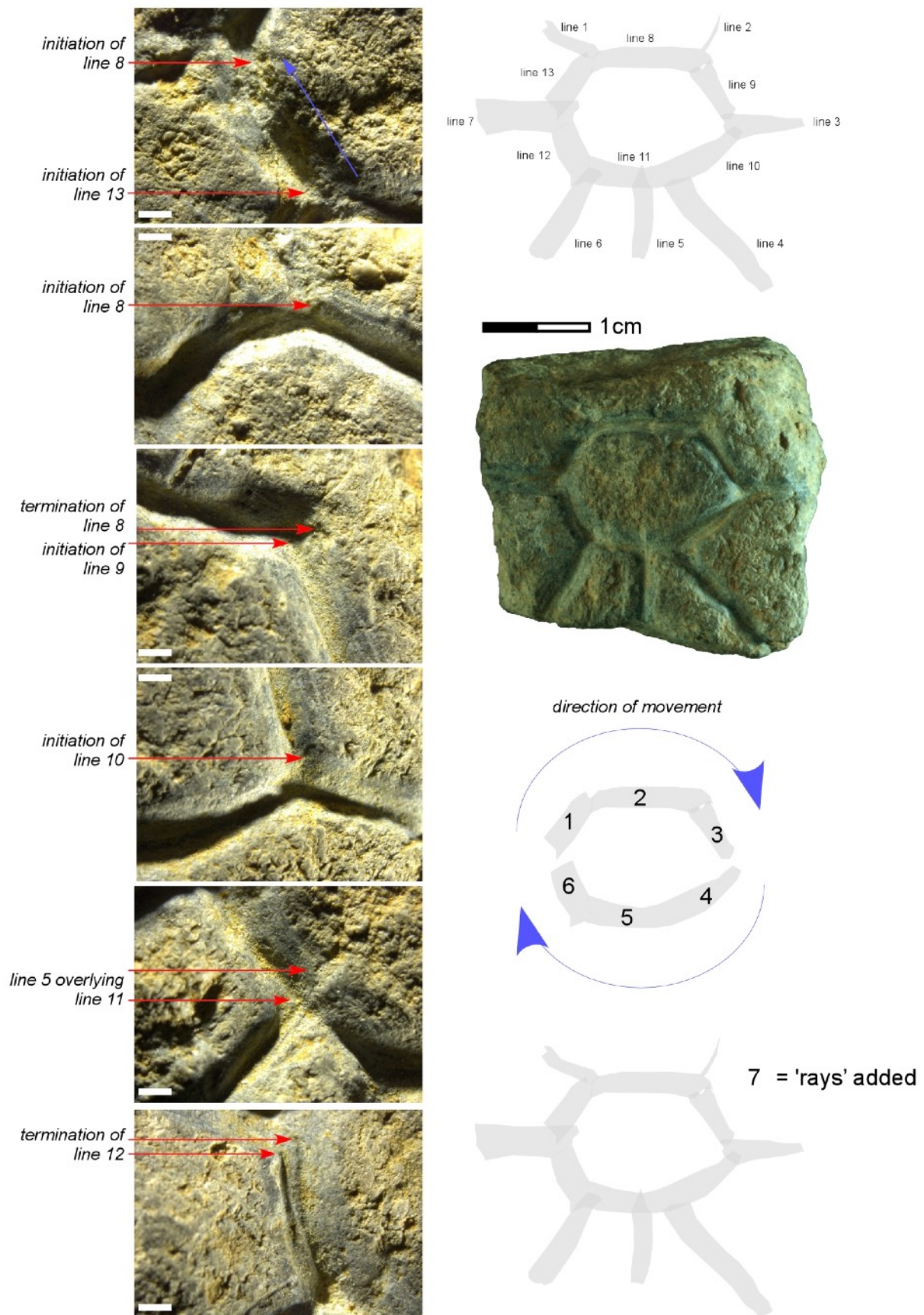
Supplementary Figure 14: 'Map' of the sun/eye engraving.





Supplementary Figure 15: Details of rayed motif. (A) Red pigment residue visible within the confines of Line 1; (B) Intersection of Lines 8 and 9; (C) Line 7 showing multiple incisions and a foraminifera at top left; (D) Line 12 showing multiple incisions; and (E) Intersection of Lines 4, 5, 6, and 11. The initiation points of Lines 4, 5, and 6 are visible on the wall of Line 11.

Rounding of the ovals inner edge was also undertaken, smoothing its entire circumference. Presumably, this additional attention was undertaken in order to give the centre a rounder appearance than originally achieved by cut-in the hexagon. This action occurred prior to the cutting in of the 'rays'.



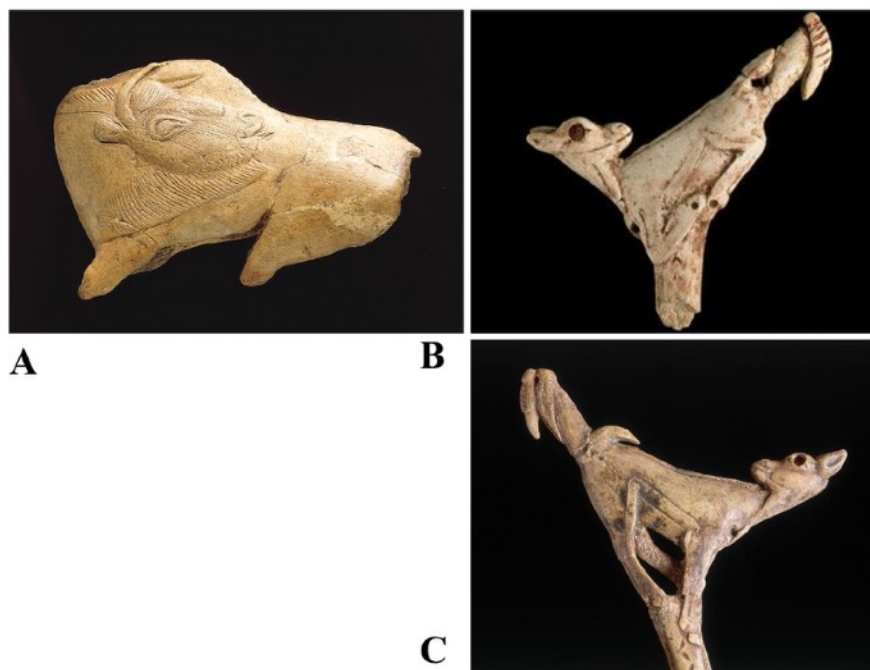
Supplementary Figure 16: Order of execution. Lines forming the oval were cut first followed by the 'rays'.

Minute traces of a red residue consisted with being a mineral-based colourant was observed within the confines of Lines 1, 13, 7, 6, and 11 (Figure 4 and Supplementary Figure 15:A). Close examination of the entire surface of the artefact found no other signs of pigment, and thus we are confident that these traces are not the produce of post-depositional transfer from ochre nodules within the sites deposit. Instead, their restriction to only within the incisions suggests intention application of red paint or powder into the cut lines. As they were found only on those Lines on the left half of the image, it seems possible that either (A) red paint/powder was applied only to these particular lines; or (B) that they were applied to the whole motif but differential preservation across the surface of the piece has resulted in their survival only on the left side.

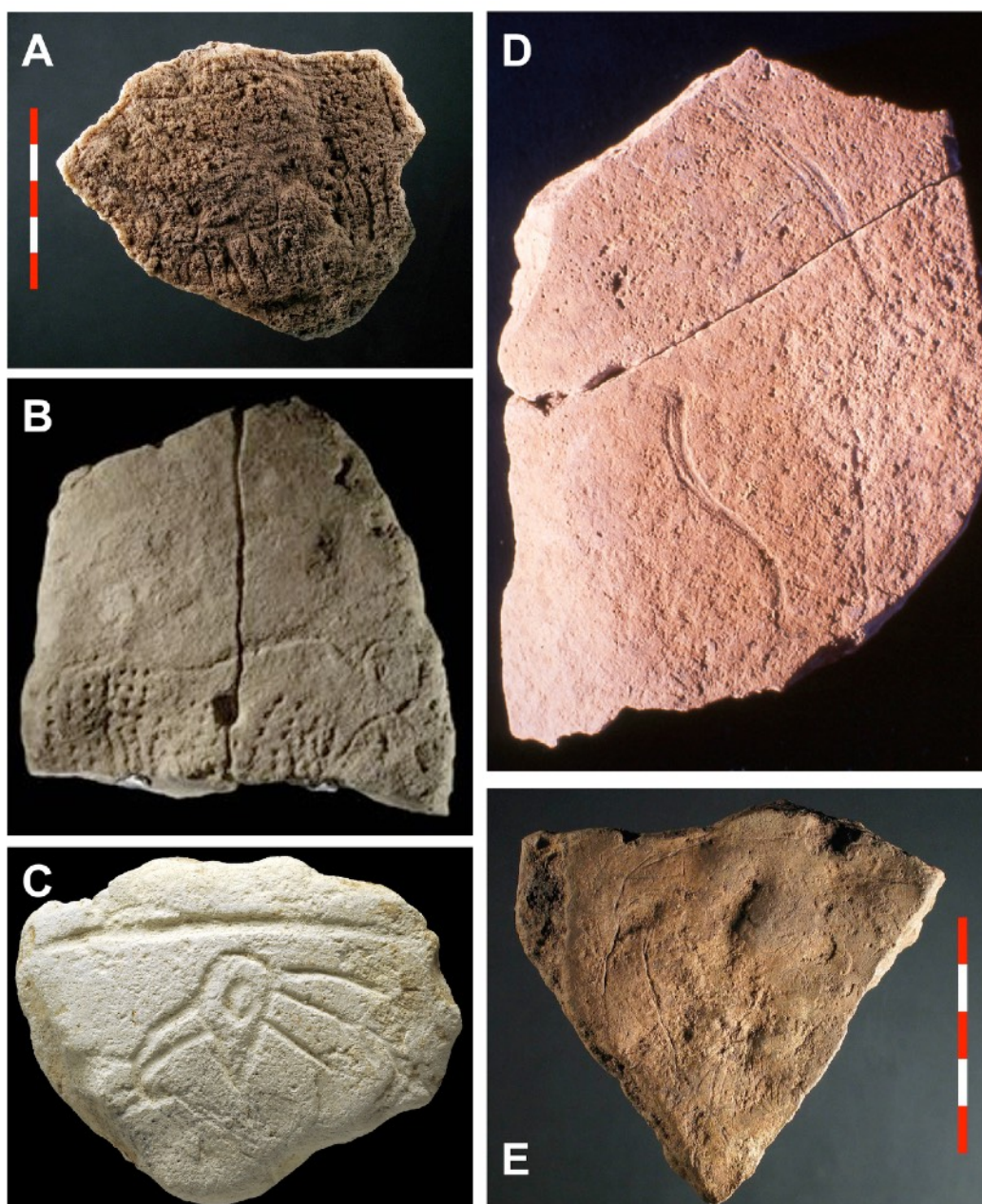
Late Pleistocene Comparisons

In fitting the anoa plaquette into the wider corpus of Late Pleistocene portable art, there are two main types of art to consider: (1) depictions of animals with their head turned towards their rump (similar perspective); and (2) stone plaquettes (similar medium).

The most famous example of an animal depicted with its head turned towards its flank, and which is similarly aged to the LBB artefact, is the 'licking bison' from La Madeleine, Dordogne, France (Capitan and Peyrony 1928). Made on reindeer antler, this Magdalenian piece was originally part of a spearthrower and features a bison with head turned to lick its side (Supplementary Figure 17:A). The LBB piece, is similar to this carving in that the head is enclosed by the outline of the body.



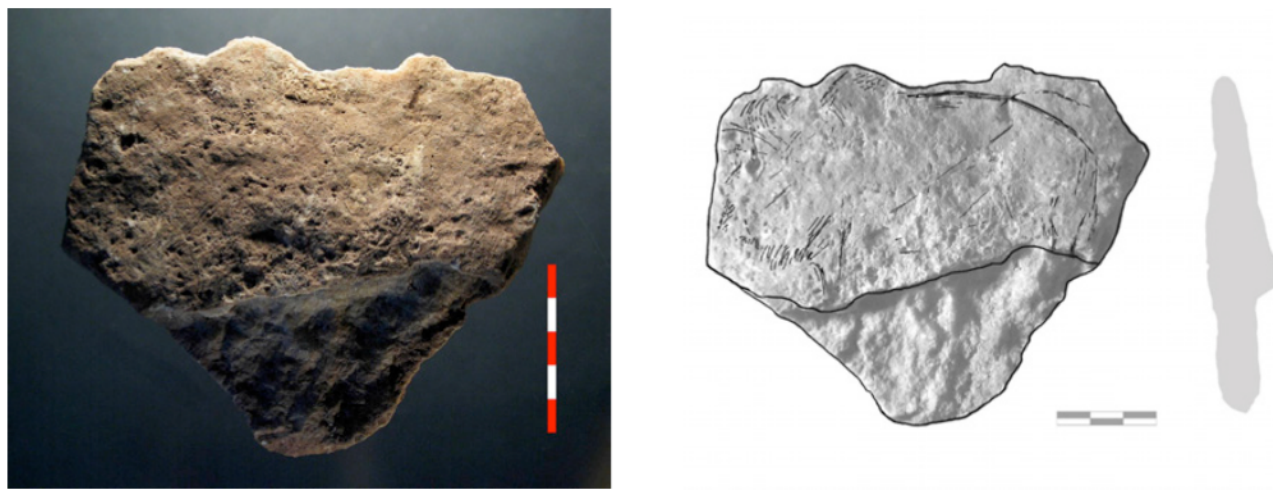
Supplementary Figure 17: Examples of European Upper Palaeolithic portable art depicting animal with head turned towards rump. (A) Bison, reindeer antler, La Madeleine (Magdalenian) (Photo: RMN-Grand Palais); (B) Ibex, reindeer antler, Bédouilhac (Middle Magdalenian) (Photo: RMN-Grand Palais / Loïc Hamon); (C) Ibex, reindeer antler, Mas d'Azil (Middle Magdalenian) (Photo: RMN-Grand Palais/ Gérard Blot).



Supplementary Figure 18: Examples of Late Pleistocene engraved plaquettes. (A and E) Ungulate and geometric patterns on flowstone, La Garma, Cantabria Spain, Magdalenian (Photograph: La Garma Research Team/Luis Teira after Ontañón and Arias (2012: Fig 7 and 11); (B) Aurochs on limestone, Abri Blanchard, Aurignacian (after Bourrillon et al. 2017: Fig.6; Photograph Ph. Jugie, Musée national de Préhistoire); (C) Image of a bald ibis (*Geronticus eremita*) from Ein Qashish South, Jezreel Valley, Israel, Epipalaeolithic, ca. 23ka and ca. 16.5ka (after Yaroshevich et al. 2016: Fig 10); (D) Horses head on limestone from Parpalló, Valencia, Spain (Photograph: V.V. Bonilla).

Also found in Magdalenian contexts are the equally renown series of 'ibex and bird' spearthrowers. Recovered from Bédeilhac (Supplementary Figure 17: B), Mas d'Azil (Supplementary Figure 17: C), Arudy, Enlène, Isturitz, and perhaps also at Bruniquel — all located along or just north of the

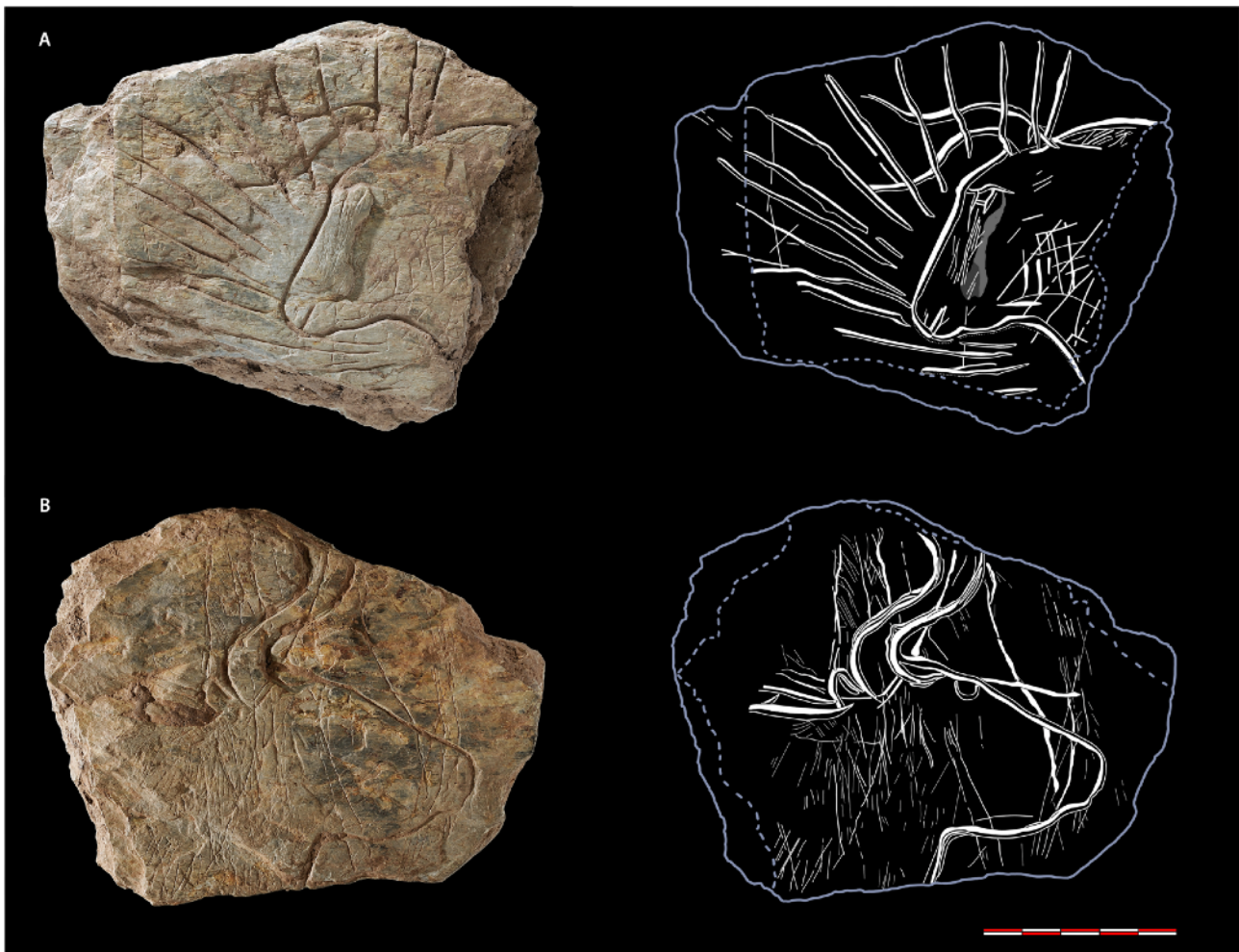
Pyrenees in southern France. These works in reindeer antler feature a young ibex with head turned back towards its rump and what appears to be “an emerging turd of exaggerated size, on which birds are perched” (Bahn 1982:257). All are dated to the Middle Magdalenian (c. 19,000-16,500 cal. BP), and thus, slightly younger than the LBB plaquette.



Supplementary Figure 19: Engraving of a bison into stone found at La Garma, Cantabria, Spain (La Garma Research Team / L. Teira and N. Melard). The front of the bison is more advanced in its creation than the back end which is only roughly scratched out — as is the case for the LBB Anoa plaquette.

Plaquettes with one or both sides decorated with images of animals, people, plants, or geometrics are a common art form found in European Upper Palaeolithic, and increasingly, in Epipalaeolithic and Natufian Western Asia. Found on pieces of bone, antler, ivory, and various types of stone, these works can be either rough ‘sketches’ or carefully crafted engravings or bas-reliefs.

Suitable comparisons for the anoa plaquette from LBB include an example from Magdalenian deposits at La Garma (Cantabria, Spain). Shown in Supplementary Figure 18:A, this artefact is engraving of an ungulate along with a geometric pattern made on flowstone — the same raw material of the LBB piece — providing a like example of flowstone engraving. Others worthy of particular mention — all shown in Supplementary Figure 18 above — include an Aurignacian limestone slab featuring an image of an aurochs at Abri Blanchard (Bourrillon et al. 2018), a depiction of a bald ibis (*Geronticus eremita*) from Ein Qashish South, Jezreel Valley, Israel, dated to between ca. 23ka and ca. 16.5ka (Yaroshevich et al. 2016), a horses head on limestone from Parpalló (Valencia, Spain), and hares head and upper body on limestone from Magdalenian levels at Isturitz (France). These particular examples have been highlighted because: (1) they are all on stone; (2) they are from a range of temporal and spatial contexts and so demonstrate the widespread use of this type of portable art; and (3) they demonstrate a range of styles — both in depiction form and whether a whole or only a part of an animal is shown.



Supplementary Figure 20: Stone plaquette with head of an aurochs surrounded by radiating lines dated to c. 14,000 cal. BP (Naudinot et al. 2017: Fig. 7).

Perhaps the best comparisons to the LBB Anoa is a bas-relief of a bison from Isturitz (Graziosi 1960: Pl.59) which, like the LBB plaquette, appears to be a ‘work in progress’. On the Isturitz piece, the area around the bison’s head, and to a lesser extent, its underbelly, are more advanced in its creation (deeper lines, removal of material outside the body of the animal to create bas-relief, details of the face present) than the back end of the animal. While whether this particular Magdalenian artefact really was abandoned before completion, or if it was exactly as it was meant to be (met its intended use) is unknown, the commonalities between it and the LBB artwork is meaningful. A similar example of a bison is shown in Supplementary Figure 19 — this one from the Magdalenian contexts of La Garma (Canabria, Spain) (Ontañón and Arias 2012). The other item of particular interest is a stone plaquette recovered from the Early Azilian site of Le Rocher de l’Impératrice (northern France). Shown in Supplementary Figure 20 above, similarities to the LBB examples include the minimalist depiction of a key animal to their economy, the inclusion of rays, and the tracing of the engraved motif with pigment (in this case black) (Naudinot et al. 2017). This c. 14,000 BP image is the only example of rayed forms located at a similar time to the LBB artefact.

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