



HAL
open science

AN EARLY 3D-MAP OF A TERRITORY? THE BRONZE AGE CARVED SLAB FROM SAINT-BÉLEC, LEUHAN (BRITTANY, FRANCE)

Clément Nicolas, Yvan Pailler, Pierre Stéphane, Julie Pierson, Laurent Aubry,
Bernard Le Gall, Vincent Lacombe, Joël Rolet

► **To cite this version:**

Clément Nicolas, Yvan Pailler, Pierre Stéphane, Julie Pierson, Laurent Aubry, et al.. AN EARLY 3D-MAP OF A TERRITORY? THE BRONZE AGE CARVED SLAB FROM SAINT-BÉLEC, LEUHAN (BRITTANY, FRANCE). *Oxford Journal of Archaeology*, 2021, 40 (4), pp.367-390. 10.1111/ojoa.12230 . hal-04101998v1

HAL Id: hal-04101998

<https://hal.science/hal-04101998v1>

Submitted on 3 Jan 2022 (v1), last revised 22 May 2023 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

AN EARLY 3D-MAP OF A TERRITORY? THE BRONZE AGE CARVED SLAB FROM SAINT-BÉLEC, LEUHAN (BRITTANY, FRANCE)

Nicolas, C., Pailler Y., **Stéphan P.**, Aubry L., Le Gall B., Lacombe V., Rollet J.

Summary. *While early maps are known from all over the world, the key questions always involve: what exactly do they show? And what spatial extent do they cover? In this context, we recently used 3D-modelling to re-examine a carved stone slab datable to the Early Bronze Age (c.2150–1600 BC) that was found at Saint-Bélec in Brittany. We show that the surface of the slab had been shaped in three dimensions to represent the relief of the surrounding landscape in which it was found, while several engraved motifs on it evoke contemporary structures known archaeologically. We argue that the Saint-Bélec slab represents an area of c.545 km² corresponding to the extent of a prehistoric political entity. The carving and subsequent burying of the slab can be linked to the postulated rise and fall of hierarchical societies and raises many wider questions about socio-economic structures in temperate Europe at that time.*

INTRODUCTION

‘Describing this curious monument with its cup-marks, circles and various engraved figures, in which some see a shapeless human representation and that of a beast, is difficult. ... Let us not be misled by fantasy, leaving it to a Champollion, who may one day find himself, to read it to us’ (Chatellier 1901a, 199).

More than a century ago, du Chatellier synthesized in these few words key issues about the engravings on the Saint-Bélec slab, which he had just unearthed in an Early Bronze Age barrow. Although it is the most intricately carved representation brought to light in a Bronze Age grave in Brittany (Pailler and Nicolas 2016), it has more or less fallen into oblivion; only a photograph of the slab by Paul du Chatellier was used in a later publication (Bénard 1929). Much later, Briard mentioned it once in a paper on cup-marked stones and suggested, through comparison with Alpine rock art (e.g. Valcamonica, Vallée des Merveilles), that it might be seen as a topographical figuration, which appeared to show a complex figuration of field-systems associated with cup-marks (Briard *et al.* 1994, 57 and 60). The rediscovery of the Saint-Bélec slab in 2014 gave us the opportunity to study this rock art in depth. 3D-scanning has enabled us to record the whole slab and the engravings in detail to study the techniques used, the motifs and their relative chronology. Subsequently, we tried to understand what these engravings represented, following Briard’s intuition: is it really a map? And if so, what does it represent?

THE SAINT-BÉLEC BARROW

The Saint-Bélec slab was recovered in June 1900 by du Chatellier (1900; 1901a; 1901b) during the excavation of a round barrow at Saint-Bélec in Leuhan parish, Finistère. The mound, which still survives, is located on the western edge of a hill, overlooking the Odet river valley (Fig. 1a–b). According to du Chatellier (1901a), the barrow measured 40 m in diameter and 2 m high, making it one of the larger barrows of the region. However, aerial photographs show a

circular soil mark about 30 m in diameter, suggesting that its size might have been exaggerated or enlarged by ploughing (Fig. 1c). When discovered, the slab formed the western end of one of the largest stone-cists in the region. It was orientated east-west and measured 3.86 m long, 2.1 m wide, and was 1.86 m high.

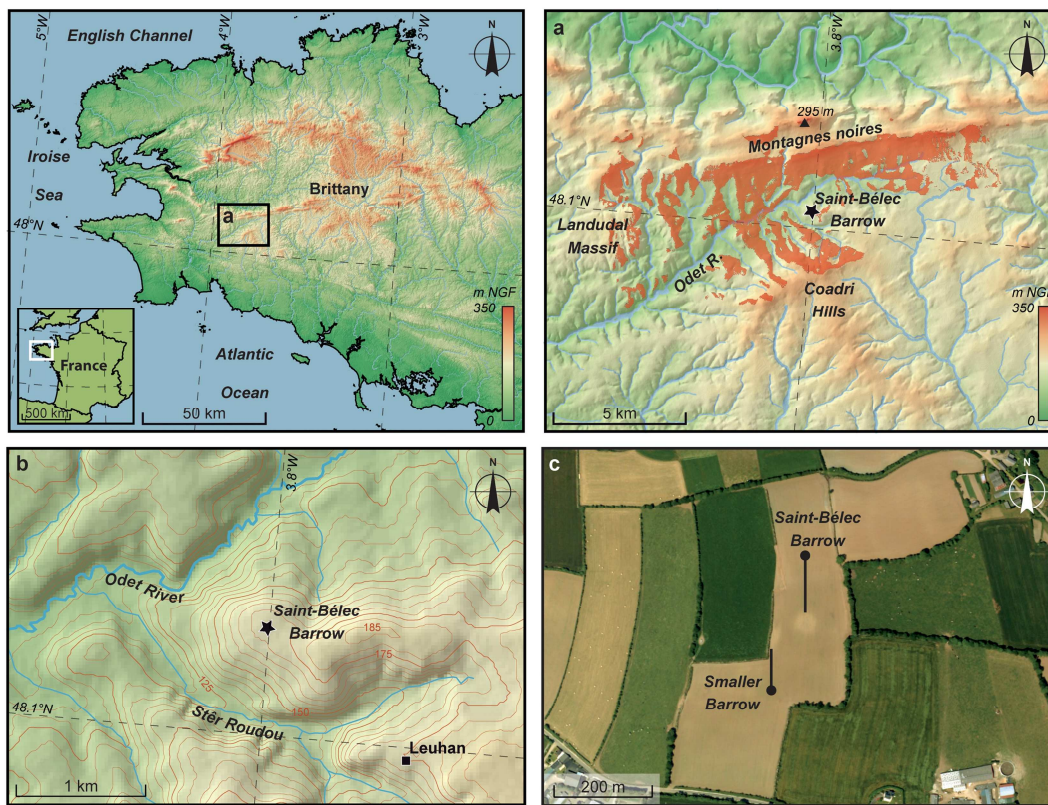


FIGURE 1. (a) Viewshed analysis, (b) location map and (c) aerial photograph of the Saint-Bélec Barrow (Institut Géographique National).

It was covered by a large capstone, $3.9 \times 2.7 \times 0.4$ m (Fig. 2a). The opposite eastern end consisted of a large quartz block, while the side walls were slightly inclined inwards and made from quartzite stones. Traces of wooden structures (floor, timbers) were found suggesting a complicated

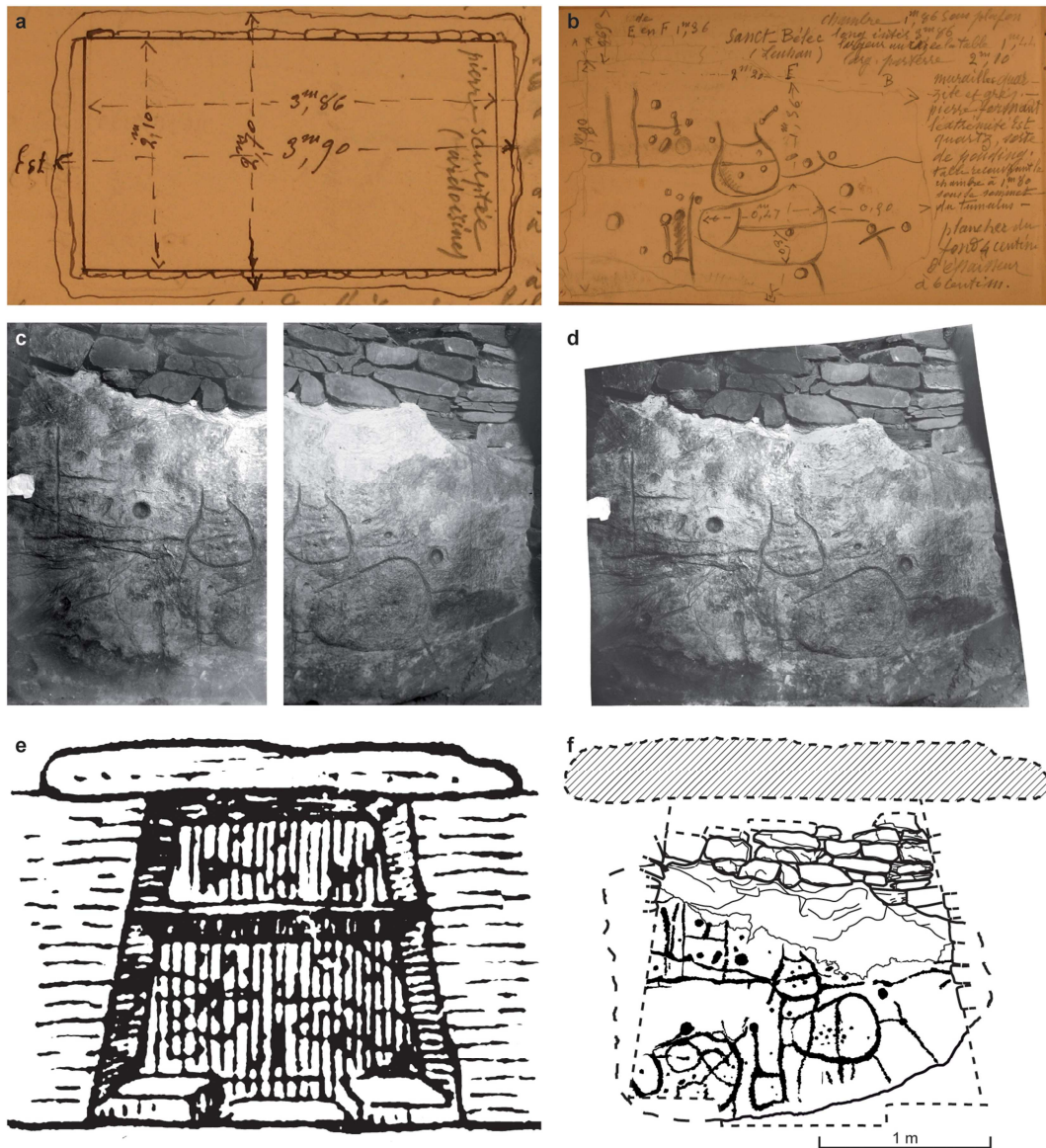


FIGURE 2. (a–b) Fieldwork sketches and (c–d) photographs of the Saint-Bélec excavation by Chatellier in 1900, and (e–f) reconstruction of the carved slab in the grave (e–f). (a–c: Archives Départementales du Finistère; d and f: assembly of fieldwork photographs and CAD C. Nicolas; e: after Chatellier 1901a).

multi-material construction. Drawings and photographs made in the course of the excavation show that the engravings on the slab faced inwards (Fig. 2b–c). However, at the time of the excavation, the slab was found to be partly broken, presumably in antiquity, with the upper part missing. It was surmounted by several layers of rubble stone (Fig. 2d–f). Within the grave was a broken ceramic vessel. Although now lost, it was accurately described by du Chatellier: ‘*this ceramic, made of coarse fired clay, without the help of potter’s wheel, had an handle and was decorated with deep lines forming saw teeth, a pottery very characteristic of the Bronze age*’

(Chatellier 1901b, 6). Such handled pottery is well known in graves in Brittany with examples dated by associated radiocarbon determinations to the Early Bronze Age; domestic contexts point towards the period 1900–1640 cal BC (Briard 1984; Escats 2011; 2013; Blanchet 2016; Paillet and Nicolas 2019). The stone-cist architecture and its large size conforms well with this chronology (Briard 1984).

THE SAINT-BÉLEC SLAB

After the excavation, the slab was moved in August 1900 to Kernuz Castle (Pont-L'Abbé, Finistère), du Chatellier's home and private museum, whose collection was acquired in 1924 by the *Musée des Antiquités Nationales* held in the Saint-Germain-en-Laye castle (no. 90960; Giot 1997). However, the slab was not registered at that time and we had no assurance that it had followed the rest of the collection. Upon investigation, it turned out that the Saint-Bélec slab had been stored until the 1990s in a niche in the moat of Saint-Germain-en-Laye. It was then moved to one of the cellars of the castle, where we retrieved it.

At Kernuz, the slab was restored, six fragments being cemented in place by filling in some missing parts (Fig. 3a). Two are from the left-central part and probably result from the deterioration of the stone's surface, the larger one being found within the cist (Chatellier 1900). A further four fragments, corresponding to the missing upper part, were picked up from contexts now unknown (presumably from the grave or the barrow mound), but three of them are now lost again. According to du Chatellier (1901b), the slab weighs between 1.5 and 2 tons and it required no less than fifteen people using rollers and a ramp to move it.

The slab is a grey-blue coloured rock, c.2.2 m long by 1.53 m wide and 16 cm thick. Under polarized light, the groundmass of the rock is dominated by oval-shaped quartz porphyroclasts (< 1 mm), of possibly volcanic origin, aligned parallel to pervasive schistosity (flattening) surfaces outlined by tiny muscovite porphyroblasts (white micas; Fig. 4). These petrographic and structural attributes typically characterize a low-grade metamorphic rock showing close affinities with the Brioverian (pre-Paleozoic) sericite-schists of the Douarnenez Phyllade series that extensively occur south of the highly strained Paleozoic series of Montagnes Noires shear zone (Darboux and Le Gall 1988). From these correlations between the regional geology and the Saint-Bélec slab, it is thus assumed that the latter has a local origin and was not transported any great distance to its final resting place.

METHODOLOGY

The study was conducted using whole slab observations, general and detailed photographs with oblique lighting (Cassen and Robin 2010), and several 3D survey methods (photogrammetry, general and high definition 3D-scanning) to record the surface topography of the slab at different scales and to analyse the morphology, technology, and chronology of the engravings

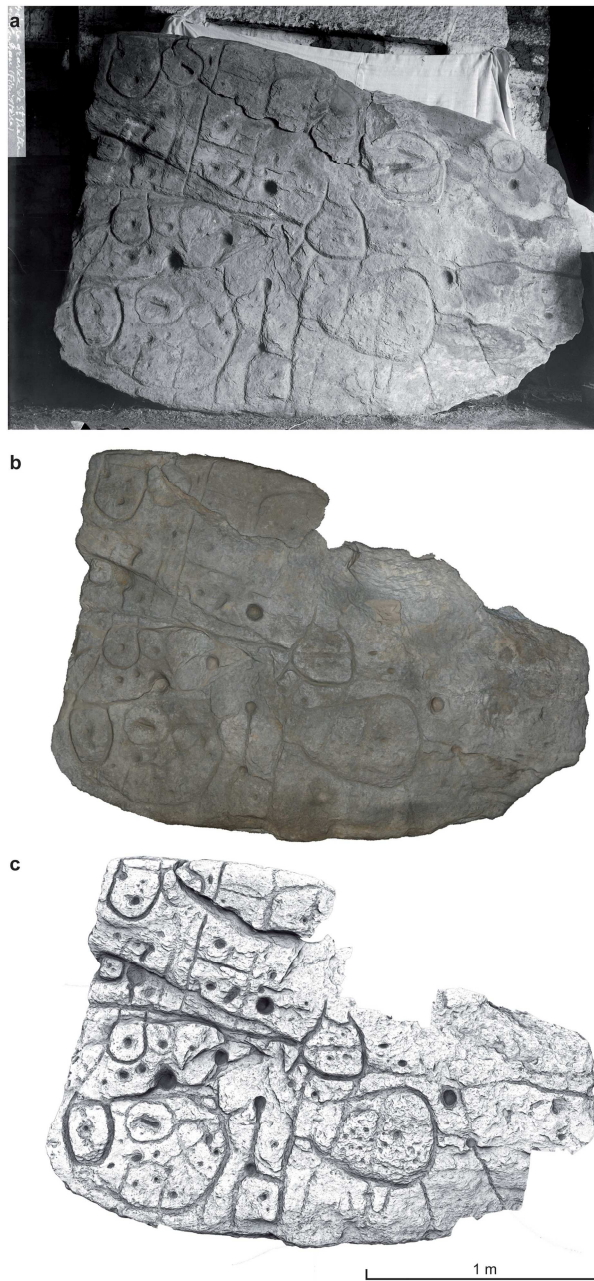


FIGURE 3. (a) The restored Saint-Bélec slab in 1900 by Chatellier (*Archives Départementales du Finistère*); (b) general 3D-model produced using ARTEC EVA (L. Aubry); (c) highdefinition3D-model produced using ATOSCompact Scan and processed with Ambient Occlusion (V. Lacombe).

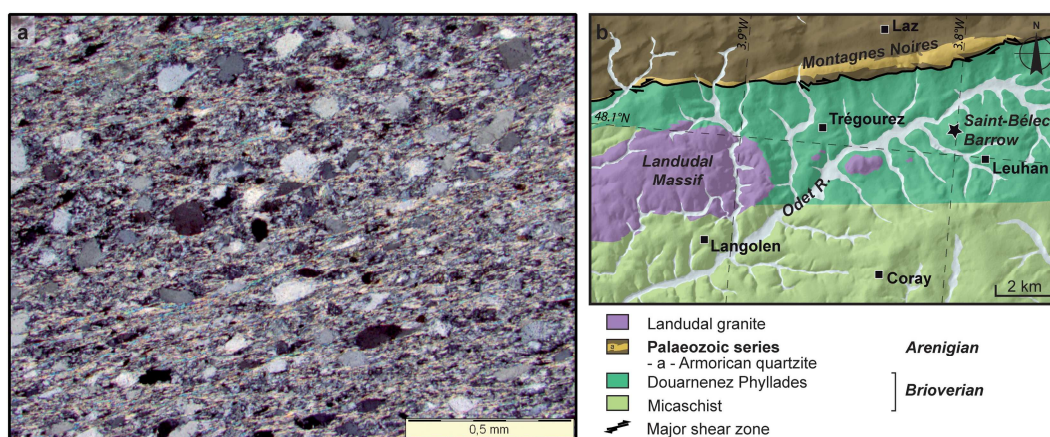


FIGURE 4. (a) Thin section of the fine-grained schist forming the Saint-Bélec slab (oriented orthogonally to the schistosity planar fabrics, crossed-nicol light-source; photograph B. Le Gall); (b) detail of the Gourin geological map (1:50 000) showing the location of the Saint-Bélec slab findspot in the Douarnenez Phyllades series that constitute the material of the carved slab (after Le Gall and Garreau 1988).

(see Supporting Information S11; Fig. S1–S2 and Fig. 3b–c). The generation of a 3D Digital Elevation Map (DEM) from high definition 3D-scanning was the basis for subsequent interpretation and analysis (cf. Cassen *et al.* 2014). Five software visualization techniques based on DEM manipulation methods were used, employing RVT Software to ensure the detection of all the engravings on the slab (Slope gradient image, Multi-Hillshading, Principal Components Analysis Hillshading, Anisotropic Sky-View Factor, and Simple Local Relief Model; Fig. S3). These relative relief processing procedures highlight the various features of the engravings (outlines, morphology, technological traces and overlapping; Fig. 5).

To facilitate the analysis of the engravings, their outlines were traced using vector drawing software (Adobe Illustrator). Due to the cleaved structure of the rock, directional flaking related to the engravings tended to create multiple outlines, especially in cases where they are shallow or intertwined. In such cases, we have retained the steepest delineations, created by repeated pecking or incising. This drawing process was controlled: cross-checking the results being conducted against the various relative relief depictions, as well as going back and forth to detailed photographs with oblique lighting, relief profiles generated from the DEM and direct observations. The early twentieth-century photographs have been manipulated as much as possible in order to fit with the elaborated DEM and to complete the now lost fragments.

DESCRIPTION OF THE ENGRAVINGS

All the engravings are relatively fresh, dark grey in colour, and are associated with sharp and plain flaking of the schistoid fabric. In contrast the original surface is light grey and variously rough or smooth as a result of localized natural weathering (Fig. 5a–b). Together, these features

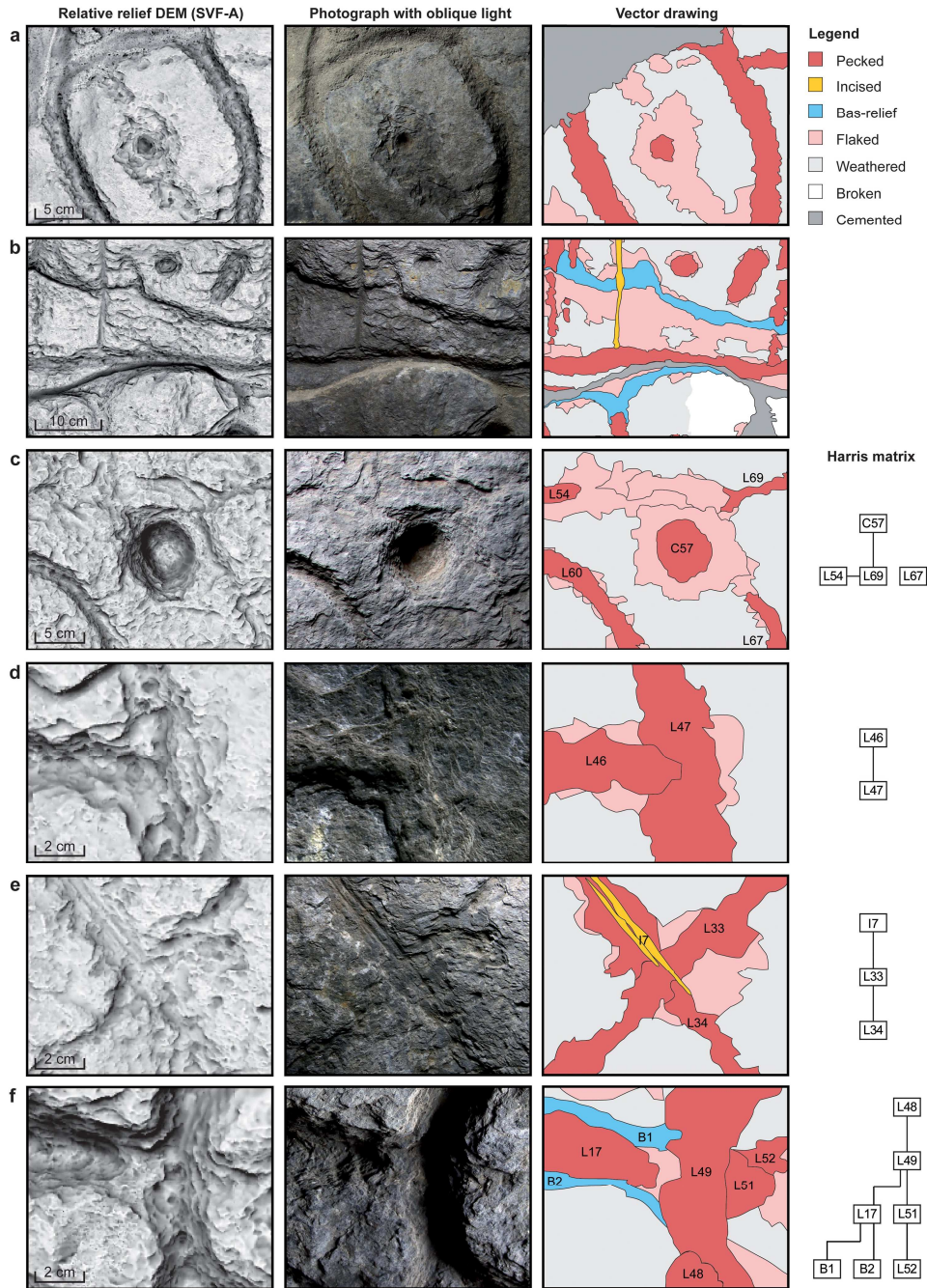


FIGURE 5. (a–b) Examples of surface conditions and (c–f) chronological relationships between engravings of the Saint-Bélec slab highlighted by relative relief processing (Anisotropic Sky-View Factor) of the Digital Elevation Model (DEM, V. Lacombe and P. Stéphan; Photographs and CAD, C. Nicolas).

AN EARLY 3D-MAP OF A TERRITORY?

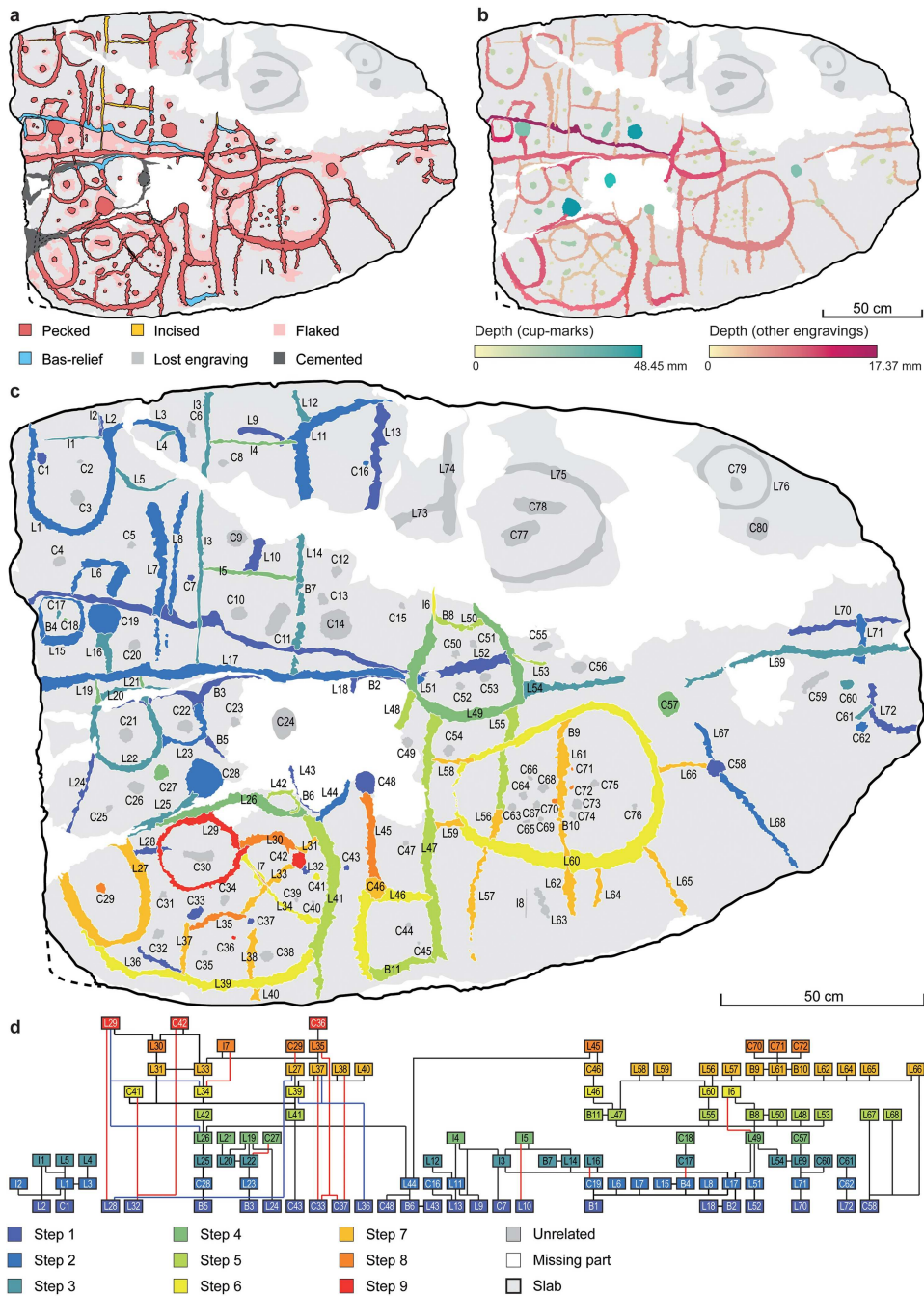


FIGURE 6. (a) Technology, (b) depth, (c) relative chronology and (d) Harris matrix of the engravings of the Saint-Bélec slab (C. Nicolas).

suggest that the carved slab was not exposed to the open air for long. The motifs cut into the surface are relatively uniform and show the repetition of simple geometric shapes: round and oval cupmarks; straight or curved lines; and squares, circles, ovals or other curved forms (Fig. 6).

Some associations between certain motifs appear to form recurrent patterns, for example one or more cup-marks included in a closed shape, and cup-marks at line ends or intersections.

Various techniques had been used by the makers of the slab as to how they carved the stone to different depths (Fig. 6a–b): pecked lines (1.5–14.7 mm deep); pecked cup-marks (C) (1.4–48.5 mm); pecked bas-reliefs (3.6–25.3 mm); and incised lines (0.6–6.6 mm). To facilitate the description of the engravings they have been numbered according to their manufacturing technique. As such, 76 pecked lines (L), 80 pecked cup-marks (C), 11 pecked bas-reliefs (B) and 8 incised lines (I) have been identified. Almost all the engravings and bas-reliefs are associated with more or less extensive, directional flaking, which results from the rock splitting while being pecked or incised. Additional flaking seems to have been carried out by pecking at the rock surfaces as is indicated by the resultant impact points, while some other flaking unrelated to the engraving process probably results from rock desquamation (Fig. 6a).

As most patterns are interrelated (114 out of 175), a key issue was to establish their detailed chronology. Some overlaps were obvious, while others required in-depth cross-checking. From this point of view, the schistoid fabric of the rock was advantageous, as it tends to create relatively abrupt terminations and directional flaking. We recorded all direct cross-cutting of any engraved elements (Fig. 5d–f) and the relationships between engravings, when not joined, as indicated by the flaking related to their creation (Fig. 5c). A nine-step sequence in preparing the slab has been recognized, taking into account such overlaps of engravings and related flaking (Fig. 6c). All the relationships between engravings have been summarized in the form of a Harris matrix (Cassen *et al.* 2014; Fig. 6d).

On the left-central part of the slab, a triangular hollow has been carved from the centre to the left end. Its upper and lower edges have been shaped by deep pecking. The upper edge (B1) is peculiarly steep and deep (8.4–25.3 mm). The lower edge (B2/B3) is less perceptible as it has been largely split and then cemented. In between, the surface could be either weathered or freshly flaked by pecking or later engravings (Fig. 5b and 6a). At the left end of the triangular hollow, a squared-shaped bas-relief (B4/L15) has been preserved by the upper edge. The pecked lines and most of cup-marks constitute the main steps of the engraving process. They have been pecked at different stages without any specific order. Nevertheless, some round, large and deep cup-marks located in the middle part appear as quite early features (Fig. 6c).

The main changes are argued to be connected to the two oval-shaped pecked lines. The first one (L39) was filled successively by linear, oval, square or circular sign and cup-marks. The second one (L60) was divided into three parts by two vertical lines and then filled by very small and shallow cup-marks. At some point, its left end seems to have been changed: flakes erased the previous line and in its place were made two short horizontal pecked lines (L58, L59) connecting the oval shape (L60) to a vertical line (L47). Lastly, incised lines were used for adding a cross-linked pattern (I3–I5), closing an open oval shape (I1) or emphasizing some small sections of previous pecked lines (I2, I6, I7).

While there are relatively few blank areas on the decorated surface, there is very little overlap within the motifs, except at their ends where most join other motifs. Therefore, it appears that the successive phases in creating the panel did not significantly change the overall composition but rather added to it in a planned and structured way.

MAPS IN PREHISTORIC AND PRE-INDUSTRIAL SOCIETIES

The most spectacular characteristic of the Saint-Bélec slab is its map-like pattern of repeated motifs, joined by a network of lines. The engravings appear rather homogeneous in technique and style, though a few patterns have been modified or added. Indeed, Delano Smith stated three conditions for recognizing prehistoric maps: *'that the artist's intent was indeed to portray the relationship of objects in space; that all the constituent images are contemporaneous in execution; and that they are cartographically appropriate'* (Delano Smith 1987, 61). The last requirement implies that the signs maintain some degree of correspondence between the motif and the object it is intended to represent or, at least, that there is a frequency of motifs comparable to those to be found on a modern map (Delano Smith 1987).

Among prehistoric maps, Delano Smith (1987) distinguishes the 'plan topographic maps', depicted as a bird's eye view, and the 'picture maps', combining elements of the landscape (mountains, rivers, dwellings, *etc.*) in plan, elevation or profile, but also incorporating anthropomorphic or zoomorphic signs. Picture maps appear more like scenarios, in which the landscape is secondary to the event being depicted (Delano Smith 1987, 62). They appear to be the oldest topographical representations. Thus, in Upper Palaeolithic portable art, some engravings are interpreted more or less convincingly as representations of campsites, or even elements of the landscape including rivers and mountains (e.g. García-Diez and Vaquero 2015). But, it is the plan topographic maps that share the most common features with the Saint-Bélec slab.

One early example of map is the well-known wall painting at Çatalhöyük, central Anatolia, Turkey (Fig. 7a). It was found in a building from the level VII of this Neolithic village, dated between 6790 and 6430-cal BC (Mellaart 1964; Schmitt *et al.* 2014). The lower register includes square-shaped patterns, interpreted as plan of a village similar to Çatalhöyük, while the upper register depicts a double-peaked motif that might have figured a volcanic eruption. Indeed 130 km away, the twin peaks of the Hasan Dağı volcano is known to have erupted broadly within this time period (6960±640 BC; Schmitt *et al.* 2014). According to Delano Smith (1987), this depiction should be considered as a picture map, as it mixes both plan topographic representation and a profile of the landscape.

In Europe, the most acknowledged plan topographic depictions are those found in the Alpine rock art, especially in Valcamonica, Italy, and the Vallée des Merveilles, France (Arcà 2016; Huet 2017). The earliest (style II), dated to the fourth millennium BC, show geometric, mainly quadrangular-shaped patterns that are sometimes dotted or cross-linked, and frequently set close to one another. They are considered to represent pastoral systems or cultivated fields, an interpretation supported by their association with ploughing scenes. Later panels (style IV) show more complex representations with dotted squares linked by a network of straight or more sinuous lines: these might represent more scattered settlements and, presumably, more extensive territories (Arcà 2016). In particular the Bedolina Map (Capo di Ponte, Lombardy) consists of c.40 squared motifs and some circular or oval shapes, mostly joined by straight, sinuous or zigzag lines, forming a 4.3×2.4 m panel on an outcrop overlooking the middle valley of the Valcamonica (Turconi 1997; Fig. 7b). E. Casti (2018) observed that the outcrop relief has been respected by the engravings: where the surface is plane, lines tend to be straight, while on sloping areas, lines are rather sinuous or zigzag, as paths that wind through mountainous terrain. This suggests that the Bedolina map is not only a planimetric representation but also a 3D-map and the outcrop might have been especially selected for its morphological features in order to represent the desired relief of the surrounding landscape. The latter is supposed to correspond broadly to a mountainous

environment or, more specifically, to a local territory, the scale of which remains to be defined (Casti 2018). Although these Bedolina-like maps have long been considered to be Bronze Age in date, recent chronologies for the engravings put them rather later, well into the Iron Age between the seventh and the fourth centuries BC (Arcà 2016). Comparisons with enclosures and field systems in Celtic Europe confirm both the revised dating and the interpretation of the motifs as being related to an agrarian landscape (Brocard 2005).

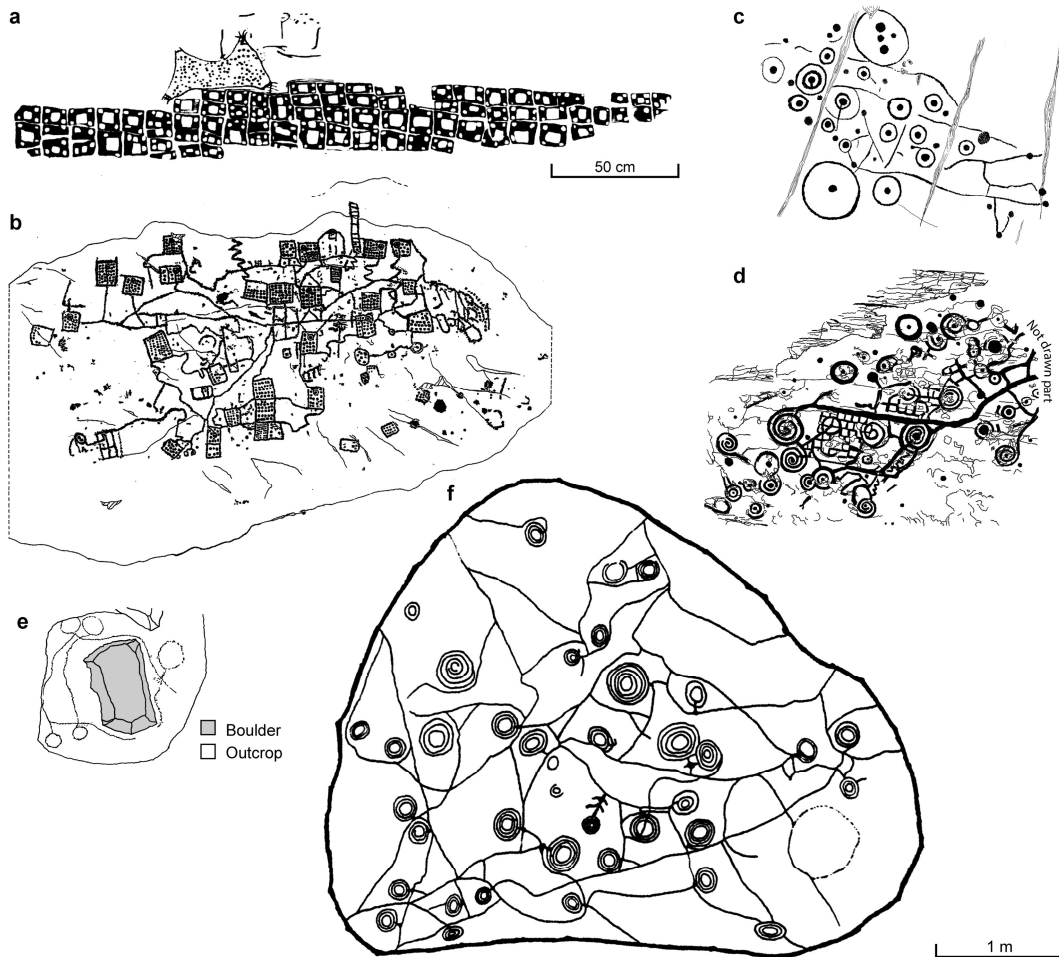


FIGURE 7. Examples of early cartographic representations: (a) Çatalhöyük, Konya, Turkey (after Mellaart 1964); (b) Bedolina 1, Capo di Ponte, Lombardy, Italy (after Turconi 1997); (c) Staigue Bridge, Kilcrohane, co. Kerry, Ireland (after Finlay and Harris 2018); (d) Fornos dos Mouros, Sever do Vouga, Aveiro, Portugal (after Alves 2003); (e) Harmonie, KwaZulu-Natal, South Africa (after Maggs 1998); (f) Lydenburg area, Mpumalanga, South Africa (after Maggs 1998).

Westwards, Atlantic rock art may similarly show topographic features, being broadly dated to the fifth to the first millennia BC (Bradley 1997; Bueno Ramírez *et al.* 2007; Cassen 2009).

Crossed-linked patterns are well known in megalithic and open-air art from Iberia to the Anglo-Celtic Isles (e.g. Shee Twohig 1981; Bradley 1997; Hidalgo Cuñarro *et al.* 2005; Cassen *et al.* 2018; Finlay and Harris 2018; Fig. 7c–d). They are repeatedly interpreted as field systems or, at least, as divided and defined areas of land (Cassen and Grimaud 2020). There are also numerous cup-and-ring motifs with one or more concentric rings that are organized in various ways, some of them being joined by a network of lines and/or associated with crossed-linked patterns (Fig. 7d). As early as the mid-nineteenth century, Graves (1873) as well as Greenwell (in Delano Smith 1987) regarded such representations as distribution maps of the ‘forts’ of the area (Fig. 7c). Ever since, various topographic interpretations of the cup-and-rings have been purposed, such as house or grave plans (Bradley 1997). At Fornos dos Mouros on Mount Arestal (Aveiro, Portugal), Alves (2003 and 2012) observed that the carved outcrop, which overlooks the area up to the Atlantic Ocean, seems to reflect the local relief. As with Mount Arestal, the outcrop is a mass of granite emerging from the schist bedrock and has a similar profile. The rock surface itself seems to have been remodelled, removing the outer crust, before being carved. Engravings were organized in three phases in a rather planned way, with the addition of new motifs that respected the previous executed ones (crossed-linked patterns, then circular motifs, and finally a network of lines; Fig. 7d).

Across the world, rock art shows some similarities with prehistoric topographic maps in Europe. In South Africa, Maggs (1995 and 1998) recorded several rock panels depicting simple or concentric rings or more complex circular motifs that might be linked by networks of lines (Fig. 7e–f). This art is thought to be related to agro-pastoralists, who reached the region in the first millennium BC. The engravings frequently exploit the relief of the outcrops, especially in the KwaZulu-Natal region, with zigzagging lines on slopes, similarly to the Bedolina Map, or with motifs set around a boulder (Fig. 7e). Local people consider that these engravings depict the settlements of their ancestors, an interpretation which is supported by close similarities with archaeological structures (Maggs 1995). In the United States, several depictions of sinuous or meandering lines, associated or not with geometric or zoomorphic patterns, are thought to represent river systems (Lewis 1998; Dockal and Smith 2005). The most convincing example is undoubtedly the Shoshoni stone (Idaho) which is interpreted as the representation of the middle and upper valley of the Snake river and the surrounding landscape stretching for over 600 km (Lewis 1998). Further parallels might eventually be found in the Aboriginal art of the Panaramitee tradition in Australia. This rock art style was produced from the Upper Palaeolithic to the twentieth century (Bednarik 2010) and includes repeated geometric motifs, straight or sinuous lines, as well as animal and human footprints (Franklin 2007). Aboriginal people who still practice similar art recognize in this rock art cosmogonic representations of the ‘Dreamtime’, figuring the journeys of the ancestors and the landscape they created; as such, they should be regarded as mapping and explaining the landscape (Flood 2004).

The cartographic interpretation of these prehistoric depictions is far from consensual, especially the Çatalhöyük wall painting, which has been criticized by Meece (2006). She considered that it was very unlikely that such a small-scale society without writing was able to produce bird’s eye view map, as *‘the process of actually making a map, including reducing a space, constructing analogies between two-dimensional and three-dimensional space, and representing distant features is a significant development of abstract thinking and symbolic representation’* (Meece 2006, 9). According to her, ‘proper’ topographic maps in plan view do not appear before the third millennium BC in Mesopotamia with the city-states, where several building, town and cadastral plans are known (Millard 1987).

However, this evolutionist view is contradicted by literature produced by early explorers and through ethnographic research. Early accounts of the North Amerindians testify that they used portable two-dimensional maps made of birch bark, skin or hard animal materials, depicting roads, river systems, landing places and mountains (Lewis 1998). In Africa, ground maps besought by explorers attest that indigenous peoples were able to draw precise maps covering more than 200 km through the thick tropical forest, while the Tuareg could map the main towns across the Sahara (Bassett 1998). In the 1960s and later in the 1990s, Bernus (1988 and 1995) asked several Tuareg from Niger and Mali to draw mental maps of their regions (Fig. 8a–b). The maps thus produced were more or less accurate, depending on social class, but all of them depicted the fossil river network and water sources over a distance of several tens of kilometres. Similarly in the 1990s, Wassmann (1993) conducted a mapping experiment among the Yupno in eastern Papua New Guinea. They had been reached by missionaries in 1928, leading to the merging of formerly scattered hamlets into villages for the sake of evangelisation. Although they were not accustomed to making maps, 28 people were asked to draw on the ground the territory where they lived. The elders, who never left the valley, in particular drew the world as enclosed by an oval of steep-sided mountains, in the middle a river and possibly its tributaries made of lines, and, on both sides, repeated patterns of ovals, punctual signs or lines representing palisaded villages (Fig. 8c).

These examples from around the world show, *contra* Meece’s views, that ‘small-scale societies’, although they are no longer cut off from the Western world, have no difficulties in representing their environment in two dimensions and mapping it over distances that go beyond the needs of everyday life – from a range of ten kilometres to the extreme case of the Tuareg who are able to map a large part of the Sahara. Among prehistoric and ethnographic maps, some common features can be highlighted: maps are frequently river-centred, depicted by a series of lines, while both manmade and natural landscapes are figured by repeated geometric patterns

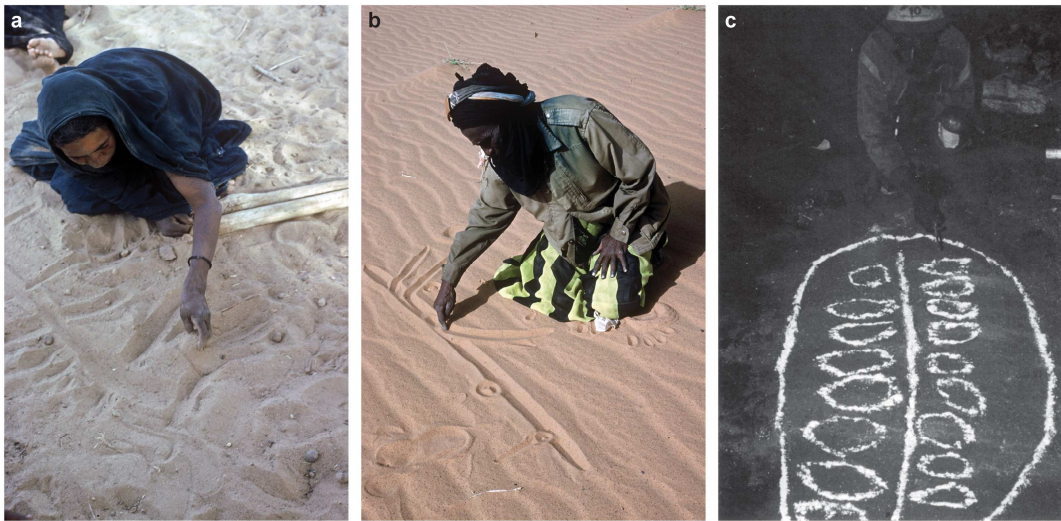


FIGURE 8. Examples of solicited ground maps in the 1990s among (a–b) the Touaregs in Mali (©IRD – Edmond Bernus, <http://www.indigo.ird.fra>) and (c) the Yupno in Papua New Guinea (after Wassmann, 1993).

(circles, squares, dots). Another feature of several prehistoric maps is that engravers use, even modify, the three-dimensional morphology of the rock ‘canvas’ to depict the topography of the surrounding landscape. All these characteristics appear on the Saint-Bélec slab.

AN EARLY BRONZE AGE 3D-MAP

The Saint-Bélec barrow overlooks the upper valley of the Odet river which is oriented approximately 70°N (Fig. 1a and 9b). This relatively steep-sided valley opens to the west at a fairly

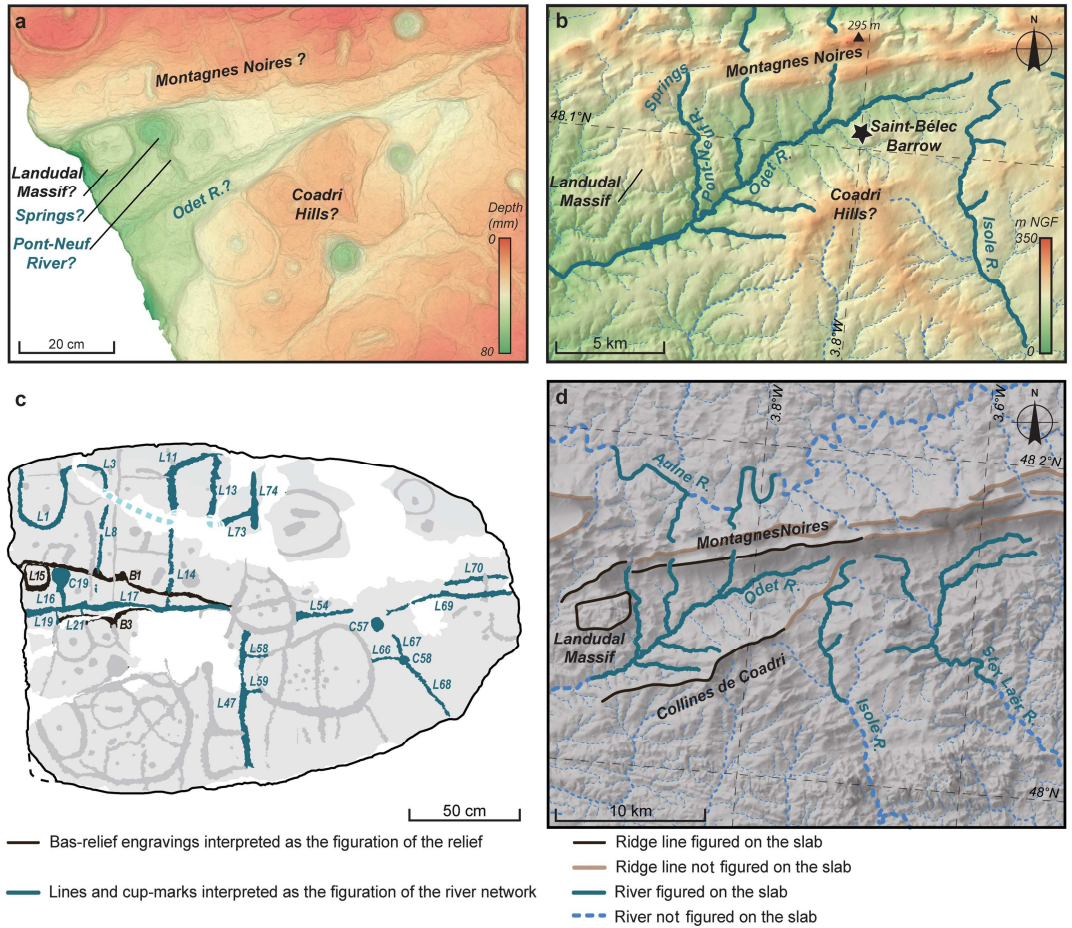


FIGURE 9. Comparison between the engravings of the Saint-Bélec slab and the topography of the *Montagnes noires* area: (a) zoomed DEM view of the carved triangular hollow on the left-central part of the Saint-Bélec slab to be compared with (b) the topography around the Saint-Bélec Barrow; (c) interpretation of some engravings as the figuration of the relief and the river network to be compared with (d) the relief and river shapes of the *Montagnes noires* area (background maps Institut Géographique National; a, V. Lacombe and P. Stéphan; c, CAD, C. Nicolas; d, map P. Stéphan).

acute angle (21°N); it abuts northwards and southwards against the linear and N80°-oriented relief of the *Montagnes Noires* and the Coadri Hills respectively. The Landudal granitic massif, a square tabular relief, slightly tilted towards the *Montagnes noires*, encloses the landscape to the west. The valley's shape nearly corresponds to the carved triangular hollow (B1–B3), which has roughly the same angle, the square bas-relief (B4/L15), and the horizontal central line (L17) that seemingly represents the course of the river (Fig. 9a). In addition, a large cup-mark (C19) and the related line (L16) joined to the horizontal central axis (L17) might represent the springs and the course of a tributary (Pont-Neuf river) of the Odet river. Further lines might represent the surrounding rivers: the Aulne river and its meanders (L1/L3, L11/L13 and L73/L74), the Isole river (L47) and the Stêr Laër river (L67-L70) and some of their respective tributaries; further, some cup-marks (C57 and C58) might correspond to confluences (Fig. 9c–d).

To assess the degree of similarity between these engravings and the river network and the relief, several network and shape analyses have been carried out (see Supporting Information S12). The results show a quite good statistical correspondence (up to 80%; Fig. S4), equivalent to those obtained for mind maps among the Tuareg and the Yupno (Fig S5 and Fig S6). Such striking correlations give the opportunity to at least approximately georeference the slab and define the scale of the space represented: an area *c.*30 km long and 21 km wide (Fig. S7 and Fig. 10c).

The main matter surrounding the dating of the Saint-Bélec slab is its re-use. Stylistically, the motifs are quite different from those found in the regional traditions of 'megalithic' art (Pailler and Nicolas 2016) and therefore rule out the re-use of a Neolithic carved slab. This is also supported by the freshness of the engravings which implies a relatively short time-span between their creation and the subsequent burial of the slab.

Several motifs on the Saint-Bélec slab can be echoed in archaeological structures dated to the Early Bronze Age. The cup-marks of various sizes (1–10 mm in diameter) find correspondence with the distribution of Early Bronze Age barrows that are known to range in size from 5 to 60 m in diameter (Briard 1984; Fig. 10a–b). A significant number of them are located along the so-called 'Roman roads', some of which can be dated back to the Bronze Age (Leroux 2015). In the Saint-Bélec area, the Tronoën–Trégueux road (Éveillard 2016) is bordered by several barrows and might correlate with some pecked lines (L48, L52, L53? and L26?). Other alignments of round barrows in the area, perhaps secondary routes, could correspond to some pecked lines on the slab (e.g. L11/L14, L31/L33/L44).

Above all, the shape of the central pattern (L49) resembles a large curvilinear Early Bronze Age settlement enclosure excavated at Lannion (Brittany). Covering 3.7 ha, the boundary earthwork included a substantial ditch up to 3 m wide and 1.7 m deep. The enclosure opens out to the south-west towards a small barrow cemetery set in line with a 'Roman' road (Escats 2011; 14; Fig. 11a–b). Interestingly, the La Motta barrow situated in front of the entrance at a distance of 1 km contained a richly furnished grave typical of elite burials at the time (Butler and Waterbolk 1974). The enclosure was built *c.*1900 cal BC, contemporaneously with the related elite barrow (Escats 2011; Nicolas 2016). This settlement neatly matches the central motif on the Saint-Bélec slab, which lies amid a dense network of lines (roads?), and is surrounded by a series of cup-marks (barrows?). Squared and cross-linked motifs might represent field systems, some of which date back to *c.*2000 cal BC in north-west France (Marcigny 2012; Blanchet *et al.* 2019). Archaeologically they consist of relatively deep straight or sinuous ditches, orthogonally organized, and sometimes quite extensive (Fig. 11c–d).

To sum up, the carved surface of the Saint-Bélec slab is interpreted as representing the local topography while the superimposed motifs appear to show the recorded distribution of Early Bronze

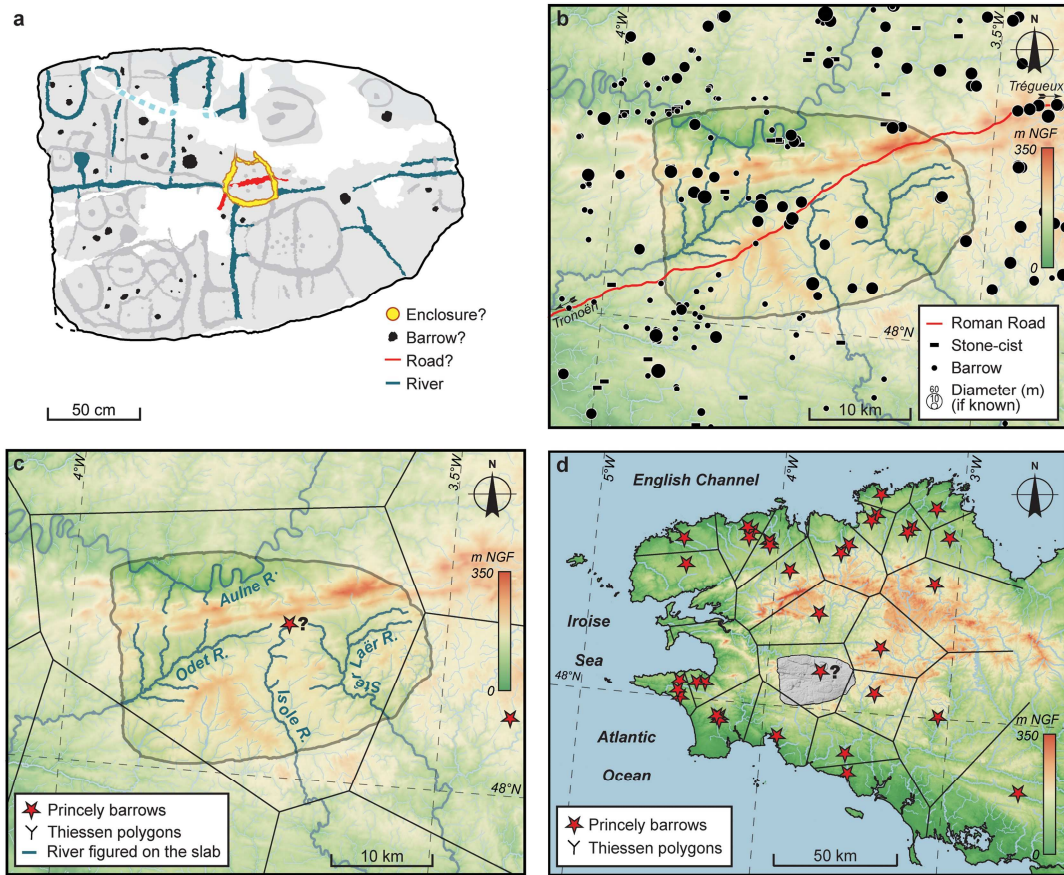


FIGURE 10 The Saint-Bélec slab as the map of an Early Bronze Age territory in Brittany: (a) interpretation of some engravings as the depiction of the river network and human landscape (enclosures, barrows) to be compared with (b) early Bronze Age structures known in the *Montagnes noires* area; (c) comparison between the georeferenced extent of the Saint-Bélec slab and the corresponding theoretical territory, drawn from a postulated princely centre in the middle of the springs of the Odet River, Isole River and Stér Laër River; (d) map of the princely barrows and their corresponding theoretical territories in Brittany (background maps Institut Géographique National; a, CAD C. Nicolas; b: barrows according to Fily 2008 with updates, 'Roman road', DRAC/SRA Bretagne; c–d, maps C. Nicolas).

Age settlements, barrows, field systems, and tracks. Some elements are more difficult to interpret, but might represent further components of the local landscape, for example springs, tributaries or folds in the landscape, or additional anthropogenic structures. Taken as a whole the carvings seem to show two scales of representation: one which is fairly realistic figuring the general topography; the other one, slightly magnified, shows pieces of the anthropogenic landscape. This is a trait of map-making also seen on large-scale medieval maps (Harvey 1987), and means that physical distances between the places depicted have been shortened because of the exaggerated scale of the symbols.

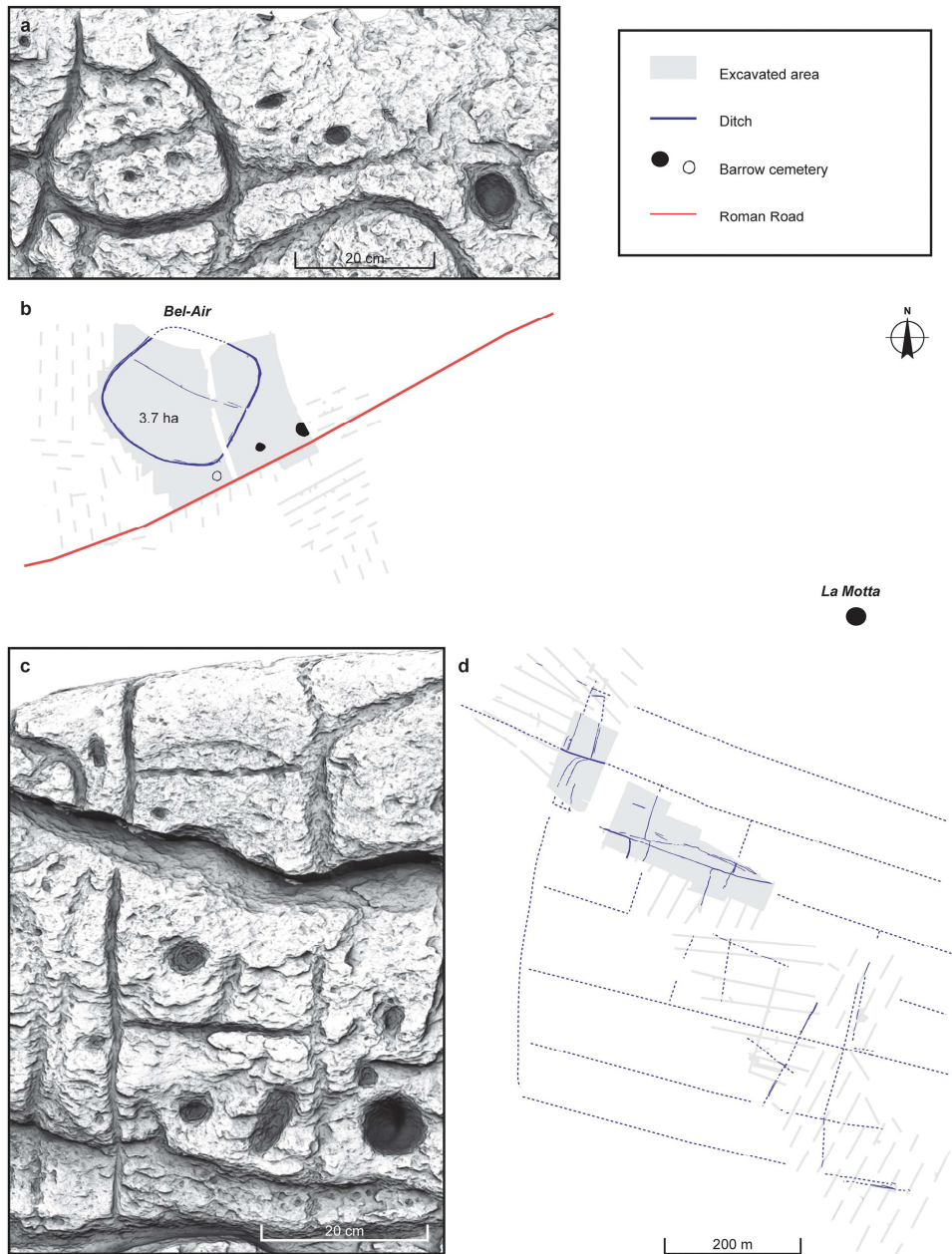


FIGURE 11 Comparison between some carved patterns of the Saint-Bélec slab with Early Bronze Age enclosure (above) and field-system (below) in north-west France: (a) central pattern and adjacent pecked lines and cup-marks of the Saint-Bélec slab (V. Lacombe); (b) Bel-Air enclosure, Lannion, Côtes-d'Armor (after Escats 2013); (c) cross-linked pattern of the Saint-Bélec slab (V. Lacombe); (d) Cairon field system, Calvados, excavations C.-C. Besnard-Vauterin and D. Giazzon, Inrap (after Marcigny 2019).

A MAP OF A POLITICAL ENTITY?

The fact that the Saint-Bélec slab was engraved on its whole surface while modifying it to reflect the local topography suggests that the carver(s) intended to represent a well-defined

portion of land. Yet, the Early Bronze Age in Brittany is well known for its large number of barrows and stone-cists (over 3000), and its elite burials showing a strong social and spatial hierarchy (Nicolas 2016; see Supporting Information SI3). These elite burials are regularly distributed in western Brittany, and are assumed to reflect the centres of established territories (c.160–1600 km²) that can be modelled using Thiessen Polygons (Brun 1998; Nicolas 2016; Fig. S8). Such assumptions find additional support from the association between the well-furnished La Motta barrow and the Lannion enclosure that could have acted as a central place. The location of the elite barrows along roads or overlooking estuaries suggests that controlling long-distance movements and the flow of trade and exchange was important (Needham 2009).

Unfortunately, few archaeological excavations have so far been carried out in the Saint-Bélec countryside. Nevertheless, the interpretation of the central motif (L49) as a central place associated with a high-status burial under a large round barrow is supported by analogy with the recorded evidence at Lannion. Thus, taking the centre of the territory figured on the Saint-Bélec slab and drawing a Thiessen polygon around it produces an interesting result (Fig. 10d). The outlines of both the territory depicted on the slab and the theoretical territory predicted by the Thiessen polygon match roughly at several hundred square kilometres in size (respectively 843 and 545 km²). As a result, we can reasonably infer that the map on the Saint-Bélec slab refers to an established territory or polity of some kind.

DISCUSSION

The Saint-Bélec slab is not particularly unusual among prehistoric maps. What is so is the opportunity it affords to provide an idea of the scale of such representations. While early depictions of the topography and the social uses of the landscape have been recognized in Alpine rock art, further map-like engravings, particularly in Atlantic Europe, would undoubtedly deserve a closer examination of their relationship with their rock surface and their surrounding environment. In north-west Europe, the Saint-Bélec slab appears to be contemporary with the Nebra skydisc found in central Germany (Meller 2010), although its chronology has been controversially challenged (Gebhard and Krause 2020; Pernicka *et al.* 2020). Buried about 1600 BC and attributed to the Únětice culture, the bronze disc (c.30 cm in diameter) appears to show a map of the heavens with celestial bodies picked out in gold. The disc and its wider context suggest a hierarchical social organization and an economy based on land and the control of trade, much like that in Brittany (Bartelheim 2009; Meller 2019). In both regions, Early Bronze Age social organizations collapsed or drastically changed around 1600 BC (Risch and Meller 2015). At almost the same time, at either end of western Europe, two communities symbolically buried images of the natural world (land and sky). Both suggest the end of attempts by elite groups to harness power through controlling elements of the natural world in which they lived.

One outstanding question about the Saint-Bélec slab is why it was made. It is conceivable that there was a mythological, cosmogonic or religious discourse attached to it, but such dimensions have been irretrievably lost. One possibility, following Arcà (2004) and Casti (2018) in relation to Alpine rock art, is that such a territorial depiction was a material and symbolic act enforcing ownership. Set alongside the contemporary development of field systems in Brittany, the making of the slab perhaps suggests the appearance of a new form of land tenure (Brun and Marcigny 2012), while the distribution of elite graves is closely linked to soil fertility (Nicolas 2016). Against this background we can hypothesize that the Saint-Bélec slab was used as either a medium asserting authority over the territory or as a tool for managing the territory and

controlling land, like a cadastre. Something similar was happening in the Near East during the third and second millennia BC where early cadastral plans on clay tablets seemingly gave the land owners' names (Millard 1987). Despite the different postulated socio-economic contexts — emergent states in the Near East (Scott 2017) as against chiefdom-based systems in temperate Europe (Brun 1998; Earle 2002) — similar concerns clearly came to the fore. This all leads to the obvious conclusion that closer attention needs to be paid to the meaning and reading of rock-art panels elsewhere in north-west Europe and the relationship they bear to social organization.

ACKNOWLEDGEMENTS

This study would not have been possible without the support of many people, all of whom we would like to thank here. Special thanks go to: Rolande Simon-Millot, Catherine Louboutin, Alain Villes and Vital Drille from the *Musée d'Archéologie Nationale* (France) for allowing us to find and study the Saint-Bélec slab. The UMR 8215 Trajectoires (dir. O. Weller, CNRS), the UMR 6554 LETG (dir. F. Gourmelon, CNRS), the Marie Skłodowska-Curie Actions (MSCA-IF-2018, project no. 841128 'WATCH') and the Collective Research Program '*Éléments pour une nouvelle approche de l'âge du Bronze en Bretagne*' (dir. S. Blanchet, Inrap/DRAC Bretagne) have funded various research costs, including the lifting of the slab, while Bournemouth University funded Open Access to the paper. We are grateful to Lara Bacelar Alves, Stéphane Blanchet, Agnès Caraglio, Gilles Chazot, Muriel Fily, Finola Finlay, Pierre Gouletquer, Robert Harris, Grégoire Le Campion, Cyril Marcigny, Tim Maggs, Yolaine Maigrot, Camille Netter and Laurence Manolakakis for their help and advice. Timothy Darvill kindly improved and polished our drafts of the manuscript.

(CN)Marie Skłodowska-Curie fellow, Department of Archaeology & Anthropology, UMR 8215 Trajectoires Bournemouth University, Christchurch House CG17, Talbot Campus, Fern Barrow, Poole BH12 5BB, UK (Corresponding author) E-mail: cnicolas@bournemouth.ac.uk

(YP)Chaire ArMeRIE, UMR 6554 LETG, INRAP, UBO, IUEM, Rue Dumont d'Urville - Technopôle Brest Iroise, Plouzané 29280, France

(PS, JP)UMR 6554 LETG, CNRS, IUEM, Rue Dumont d'Urville - Technopôle Brest Iroise, Plouzané 29280 FRANCE

(LA)UMR 8215 Trajectoires, CNRS | Centre Malher, 9 rue Malher, Paris 75004, FRANCE

(BL-G)UMR 6538 Laboratoire Géosciences Océan, CNRS, IUEM, Rue Dumont d'Urville - Technopôle Brest Iroise, Plouzané 29280, France

(VL)DIGISCAN3D, ZA de Viais, 4 rue des Tuiliers, Pont-Saint-Martin 44860, FRANCE

(JR)UBO, UMR 6538 Laboratoire Géosciences Océan, Institut Universitaire Européen de la Mer, Rue Dumont d'Urville, Technopôle Brest Iroise, Plouzané 29280, France

REFERENCES

ALVES, L.B. 2003: The Movements of Signs. Post-glacial Rock Art in North-western Iberia (PhD thesis, University of Reading).

- ALVES, L.B. 2012: The circle, the cross and the limits of abstraction and figuration in north-western Iberian rock art. In COCHRANE, A. and MEIRION JONES, A. (eds.), *Visualising the Neolithic: Abstraction, Figuration, Performance, Representation* (Oxford, *Neolithic Studies Group seminar papers* 13), 198–213.
- ARCA, A. 2004: The topographic engravings of Alpine rock-art: fields, settlements and agricultural landscapes. In CHIPPIINDALE, C. and NASH, G. (eds.), *The Figured Landscape of Rock-Art: Looking at Pictures in Place* (Cambridge), 318–49.
- ARCA, A. 2016: Maps in alpine rock-art: cultivations and cultures, land plots and societies from Neolithic to Iron Age. *Bollettino del Centro Camuno di Studi Preistorici* 41, 7–32.
- BARTELHEIM, M. 2009: Elites and metals in the Central European Early Bronze Age. In KIENLIN, T.L. and ROBERTS, B.W. (eds.), *Metals and Societies, Studies in Honour of Barbara S. Ottaway* (Bonn), 34–46.
- BASSETT, T.J. 1998: Indigenous mapmaking in intertropical Africa. In WOODWARD, D. and LEWIS, G.M. (eds.), *The History of Cartography, volume 2, book 3, Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Chicago), 24–48.
- BEDNARIK, R.G. 2010: Australian rock art of the Pleistocene. *Rock Art Research* 27(1), 89–113.
- BÉNARD, C. 1929: *Le Finistère préhistorique* (Paris, *Publications de l'Institut international d'Anthropologie* 3).
- BERNUS, E. 1988: La représentation de l'espace chez les Touaregs du Sahel. *Mappemonde* 88(3), 1–5.
- BERNUS, E. 1995: Perception du temps et de l'espace par les touaregs nomades sahéliens. In CLAVAL SINGARAVELOU, P. (ed.), *Ethnogéographies* (Paris), 41–50.
- BLANCHET, S., ed. 2016: *Côtes-d'Armor, Lannion, Penn an Alé: Occupations rurales de l'âge du Bronze et antiques*. Unpublished report, Inrap Grand Ouest (Cesson-Sévigné).
- BLANCHET, S., FAVREL, Q., FILY, M., NICOLAS, C., NICOLAS, T., PAILLER, Y. and RIPOCHE, J. 2019: Le Campaniforme et la genèse de l'âge du Bronze ancien en Bretagne: vers une nouvelle donne. In MONTROYA, C., FAGNART, J.-P. and LOCHT J.-L. (eds.), *Préhistoire de l'Europe du Nord-Ouest : mobilité, climats et identités culturelles, volume 3, Néolithique – âge du Bronze* (Paris), 269–88.
- BRADLEY, R. 1997: *Rock Art and the Prehistory of Atlantic Europe: Signing the Land* (London).
- BRIARD, J. 1984: *Les Tumulus d'Armorique* (Paris, *L'âge du Bronze en France* 3).
- BRIARD, J., LE GOFFIC, M. and ONNÉE, Y. 1994: *Les Tumulus de l'âge du Bronze des Monts d'Arrée* (Rennes).
- BROCARD, M. 2005: Les gravures rupestres à parcellaire. *Études Rurales* 175-176, 9–28.
- BRUN, P. 1998: Le complexe culturel atlantique: entre le cristal et la fumée. In JORGE, S. (ed.), *Existe uma idade do Bronze atlântico?* (Lisbon, *Trabalhos de Arqueologia* 10), 40–51.
- BRUN, P. and MARCIGNY, C. 2012: Une connaissance de l'âge du Bronze transfigurée par l'archéologie préventive. *Archéopages* HS3, 132–9.
- BUENO RAMÍREZ, P., DE BALBÍN BEHRMANN, R. and BARROSO BERMEJO, R. 2007: Chronologie de l'art mégalithique ibérique: C¹⁴ et contextes archéologiques. *L'Anthropologie* 111, 590–654.
- BUTLER, J.J. and WATERBOLK, H. 1974: La fouille de A.-E. Van Giffen à la Motta, un tumulus de l'âge du Bronze ancien à Lannion (Bretagne). *Palaeohistoria* 16, 107–67.
- CASSEN, S., ed. 2009: *Autour de la Table : explorations archéologiques et discours savants sur des architectures néolithiques à Locmariaquer, Morbihan (Table des Marchands et Grand Menhir)* (Nantes).
- CASSEN, S. and GRIMAUD, V. 2020: *La clef de la mer: une étude des représentations gravées sur la Pierre de Saint-Samson (Côtes-d'Armor)* (Nantes, *Lithogénies* 1).
- CASSEN, S., GRIMAUD, V. and PAITIER, H. 2018: Les monolithes gravés dans la tombe à couloir néolithique du Maner ér Groez à Kercado (Carnac, Morbihan). *Gallia Préhistoire* 58, 87–138.
- CASSEN, S., LESCOP, L., GRIMAUD, V. and ROBIN, G. 2014: Complementarity of acquisition techniques for the documentation of Neolithic engravings: lasergrammetric and photographic recording in Gavrinis passage tomb (Brittany, France). *Journal of Archaeological Science* 45, 126–40.
- CASSEN, S. and ROBIN, G. 2010: Recording art on Neolithic stelae and passage tombs from digital photographs. *Journal of Archaeological Method and Theory* 17, 1–14.

- CASTI, E. 2018: Bedolina: map or tridimensional model? *Cartographica: the International Journal for Geographic Information and Geovisualization* 53(1), 15–35.
- DARBOUX, J.-R. and LE GALL, B. 1988: The Montagnes Noires southern bordering shear zone of the Carboniferous Chateaulin basin (Britanny, France). *Geodinamica Acta* 2, 121–33.
- DELANO SMITH, C. 1987: Cartography in the prehistoric period in the Old World: Europe, the Middle East, and North Africa. In HARLEY, J.B. and WOODWARD, D. (eds.), *The History of Cartography, volume 1, Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean* (Chicago), 54–101.
- DOCKAL, J.A. and SMITH, M.S. 2005: Evidence for a prehistoric petroglyph map in central Arizona. *Kiva* 70(4), 413–21.
- DU CHATELLIER, P. 1900: Letter to Émile Cartailhac, 30th June 1900 (Archives municipales de Toulouse).
- DU CHATELLIER, P. 1901a: Exploration des tumulus des Montagnes noires (Finistère). *Bulletin Archéologique du Comité des Travaux Historiques et Scientifiques*, 185–203.
- DU CHATELLIER, P. 1901b: Les pierres gravées de Penhoat en Saint-Coulitz et de Sanct-Bélec en Leuhan. *Bulletin de la Société Archéologique du Finistère* 28, 1–7.
- EARLE, T. 2002: *Bronze Age Economics: the Beginnings of Political Economies* (Boulder).
- ESCATS, Y. 2011: Une enceinte et une nécropole de l'âge du Bronze à Lannion. *Archéopages* 33, 26–7.
- ESCATS, Y. ed. 2013: *Une vaste enceinte et deux tumulus de l'âge du Bronze, Z.A. de Bel Air, Lannion, (Côtes d'Armor)*. Unpublished report, Inrap Grand Ouest (Cesson-Sévigné).
- ÉVEILLARD, J.-Y. 2016: *Les voies romaines en Bretagne* (Morlaix).
- FILY, M., 2008: Les monuments funéraires et les dépôts métalliques dans le paysage rituel de l'âge du Bronze: l'exemple du centre-ouest de la Bretagne et du Finistère littoral (France) (PhD thesis, Université de Rennes 2 Haute-Bretagne).
- FINLAY, F. and HARRIS, R. 2018: Unusual rock art near Bantry, West Cork: the Ballybane group. *Journal of the Bantry Historical and Archaeological Society* 3, 68–83.
- FLOOD, J. 2004: Linkage between rock-art and landscape in Aboriginal Australia. In CHIPPINDALE, C. and NASH G. (eds.), *The Figured Landscape of Rock-Art: Looking at Pictures in Place* (Cambridge), 182–200.
- FRANKLIN, N.R. 2007: Discontinuous dreaming networks: analyses of variability in Australian pre-historic petroglyphs. *Rock Art Research* 24(1), 79–103.
- GARCÍA-DIEZ, M. and VAQUERO, M. 2015: Looking at the camp: Paleolithic depiction of a hunter-gatherer campsite. *PLoS ONE* 10(12), e0143002.
- GEBHARD, R. and KRAUSE R. 2020. Critical comments on the find complex of the so-called Nebra Sky Disk. *Archäologische Informationen* 43, 1–22.
- GIOT, P.-R. 1997: Paul du Chatellier, sa famille, sa vie, son œuvre, sa collection. *Antiquités Nationales* 29, 35–44.
- GRAVES, C. 1873: On a previously undescribed class of monuments. *The Transactions of the Royal Irish Academy* 24, 421–31.
- HARVEY, P.D.A. 1987: Local and regional cartography in medieval Europe. In HARLEY, J.B. and WOODWARD, D. (eds.), *The History of Cartography, volume 1, Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean* (Chicago), 464–501.
- HIDALGO CUÑARRO, J.M., COSTAS GOBERNA, F.J., ALVES, L.B., DE LA PEÑA SANTOS, A. and SILVA, A.M.S.P. 2005: *Arte Rupestre Prehistórica do Eixo Atlântico* (Vigo).
- HUET, T. 2017: *Les gravures piquetées du mont Bego (Alpes-Maritimes): organisation spatiale et sériation (VI^e-II^e millénaire av. J.-C.)* (Paris, *Mémoires de la Société Préhistorique Française* 63).
- LEGALL, B. and GARREAU, J. 1988. *Carte géologique de la France (1/50 000), feuille Gourin (311)* (Orleans).
- LEROUX, G., ed. 2015: *Piré-sur-Seiche, Ille-et-Vilaine, ZAC de Bellevue, secteur est. Un itinéraire routier de l'âge du Bronze au Moyen Âge* (Unpublished report, Inrap Grand Ouest (Cesson-Sévigné)).

- LEWIS, G.M. 1998: Maps, mapmaking, and map use by native North Americans. In WOODWARD, D. and LEWIS, G.M. (eds.), *The History of Cartography, volume 2, book 3, Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Chicago), 51–182.
- MAGGS, T. 1995: Neglected rock art: the rock engravings of agriculturalist communities in South Africa. *The South African Archaeological Bulletin* 50(162), 132–42.
- MAGGS, T. 1998: Cartographic content of rock art in Southern Africa. In WOODWARD, D. and LEWIS, G.M. (eds.), *The History of Cartography, volume 2, book 3, Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies* (Chicago), 13–23.
- MARCIGNY, C. 2012: Les paysages ruraux de l'âge du Bronze (2300-800 avant notre ère): structures agraires et organisations sociales dans l'Ouest de la France. In CARPENTIER, V. and MARCIGNY, C. (eds.), *Des hommes aux champs: pour une archéologie des espaces ruraux du Néolithique au Moyen Âge* (Rennes), 71–80.
- MEECE, S. 2006: A bird's eye view – of a leopard's spots: the Çatalhöyük 'map' and the development of cartographic representation in Prehistory. *Anatolian Studies* 56, 1–16.
- MELLAART, J. 1964: Excavations at Çatal Hüyük, 1963, third preliminary report. *Anatolian Studies* 14, 39–193.
- MELLER, H. 2010: Nebra: vom Logos zum Mythos – Biographie eines Himmelsbildes. In MELLER, H. and BERTEMES, F. (eds.), *Der Griff nach den Sternen (Halle, Tagungen des Landesmuseums für Vorgeschichte 5)*, 23–73.
- MELLER, H. 2019: Princes, armies, sanctuaries: the emergence of complex authority in the central German Únětice culture. *Acta Archaeologica* 90(1), 39–79.
- MILLARD, A.R. 1987: Cartography in the ancient Near East. In HARLEY, J.B. and WOODWARD, D. (eds.), *The History of Cartography, volume 1, Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean* (Chicago), 107–16.
- NEEDHAM, S. 2009: Encompassing the sea: 'maritories' and Bronze Age maritime interactions. In CLARK, P. (ed.), *Bronze Age Connections: Cultural Contact in Prehistoric Europe* (Oxford), 12–37.
- NICOLAS, C. 2016: *Flèches depouvoir à l'aube de la métallurgie de la Bretagne au Danemark (2500-1700 av. n. è.)* (Leiden).
- PAILLER, Y. and NICOLAS, C. 2016: Des dalles ornées durant le Campaniforme et l'âge du Bronze ancien en Bretagne. Mythe ou réalité? *Bulletin de la Société Préhistorique Française* 113(2), 333–71.
- PAILLER, Y. and NICOLAS, C., eds. 2019: *Une maison sous les dunes: Beg ar Loued, Île Molène, Finistère. Identité et adaptation des groupes humains en mer d'Iroise entre les IIIe et IIe millénaires avant notre ère* (Leiden).
- PERNICKA, E., ADAM, J., BORG, G., BRÜGMANN, G., BUNNEFELD, J.-H., KAINZ, W., KLAMM, M., KOIKI, T., MELLER, H., SCHWARZ, R., STÖLLNER, T., WUNDERLICH, C.-H. and REICHENBERGER, A. 2020: Why the Nebra sky disc dates to the Early Bronze Age. An overview of the interdisciplinary results. *Archaeologia Austriaca* 104, 89–122.
- RISCH, R., and MELLER, H. 2015: Change and continuity in Europe and the Mediterranean around 1600 BC. *Proceedings of the Prehistoric Society* 81, 239–64.
- SCHMITT, A.K., DANIŠÍK, M., AYDAR, E., ŞEN, E., ULUSOY, İ. and LOVERA, O.M. 2014: Identifying the volcanic eruption depicted in a Neolithic painting at Çatalhöyük, Central Anatolia, Turkey. *PLoS ONE* 9(1), e84711.
- SCOTT, J.S. 2017: *Against the Grain: A Deep History of the Earliest States* (New Haven).
- SHEE TWOHIG, E. 1981. *The Megalithic Art of Western Europe* (Oxford).
- TURCONI, C. 1997: La mappa di Bedolina nel quadro dell'arte rupestre della Valcamonica. *Notizie archeologiche Bergomensi* 5, 85–113.
- WASSMANN, J. 1993: Worlds in mind: the experience of an outside world in a community of the Finisterre Range of Papua New Guinea. *Oceania* 64(2), 117–45.