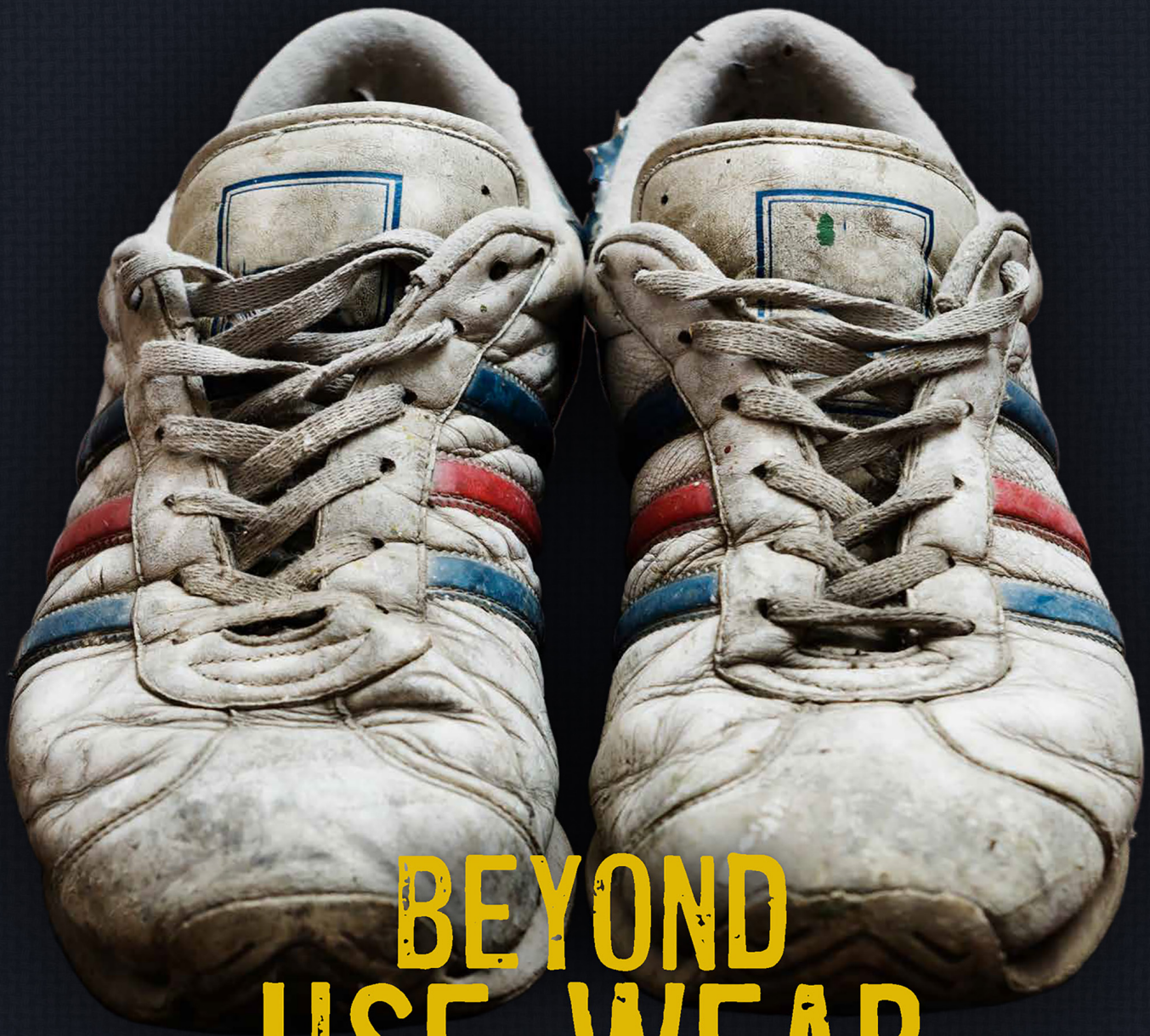
From the quarry to the village: usewear analysis of the manufacture of schist bracelets in the Early Neolithic of north-western Europe

Caroline Hamon, Nicolas Fromont, Eric Gaumé, Cécile Germain-Vallée



BEYOND USE-WEAR TRACES

GOING FROM TOOLS TO PEOPLE BY MEANS OF ARCHAEOLOGICAL WEAR AND RESIDUE ANALYSES

SYLVIE BEYRIES, CAROLINE HAMON
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Abstract

Schist bracelets are emblematic sign-objects of Early Neolithic contexts in Western Europe, where they are closely linked to the expansion of the Blicquy-Villeneuve-Saint-Germain culture (BVSG, 4950-4750 cal BC). This paper focuses on three specialized quarries and workshops and one settlement site located on the eastern margin of the Armorican Massif (Sarthe and Caen plain) where Pissot schist bracelets were produced. The integrated macroscopic and microscopic use-wear analysis of thousands of Pissot schist elements and hundreds of macrolithic tools found on these different sites has allowed us to precisely reconstruct the sequence of production and the technical processes involved in the manufacture of these bracelets. Together with large quantities of waste debris, objects reflecting the different stages of schist bracelets production were abandoned on the sites. In parallel, a large corpus of hammerstones and anvils, hand-held and grooved abraders, as well as edged tools, in different qualities of sandstones, have been recovered on these sites. Based on a first set of experimental tests, our analyses suggest the predominance of percussion and abrasion techniques in the production of bracelets in this area. Results are compared with other areas where schist bracelets were produced, especially southern Belgium, in order to investigate the technical choices adopted by the different communities and groups engaged in the production of schist bracelets throughout the BVSG area.

Keywords: Schist bracelets, macrolithic tools, Early Neolithic, use-wear analysis

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Introduction

Schist bracelets are emblematic sign-objects of Early Neolithic contexts in Western Europe; they are closely linked to the expansion of the Blicquy-Villeneuve-Saint-Germain culture (BVSG, 4950-4750 cal BC). This paper focuses on three specialized quarries and workshops BVSG culture that developed during the two centuries between 4950-4750 cal BC. This culture directly follows the expansion of the Linearbandkeramik (LBK) culture, and constitutes a second stage in Neolithic colonization and diffusion within the present territories of the Seine Basin (from Champagne to Normandy), southern Belgium (Hainaut, Hesbaye) and western France (as far as the Atlantic and Channel coastlines).

The BVSG culture is distinguished from the LBK by various traits, including the evolution of house plans, the evolution of ceramic decoration (typical "herringbone" motifs) and technology (generalization of bone temper), increasing importance of flake debitage in the lithic industry, a progressive shift in domestic animal species with an increase in the contribution of pig, etc. Among these significant innovations and evolutions, the production and diffusion of emblematic schist bracelets throughout the BVSG area is of particular importance and constitutes one of its most striking expressions of identity. Since LBK bracelets were made out of shell (*spondylus*) and limestones, supposed to be imported from the Mediterranean area, the production of schist bracelets appears a real innovation. Of particular interest is their frequent occurrence in tombs, where they are worn on the arms of the deceased (*e.g.* Bostyn *et al.* 2015).

Several sources and types of schist, green stone, limestone and sandstone were exploited to produce bracelets throughout the BVSG area, from the Ardennes to the Armorican Massif (Burnez-Lanotte *et al.* 2005; Fromont 2013; Praud *et al.* 2003; Pailler 2007). The fact that they were circulated over long distances from the workshops highlights the complex structuring of the BVSG territories, with producer and receiver sites, and suggests possible competing areas of diffusion (Fromont 2013). In parallel, bracelet typologies echo regionalization phenomena that have also been observed in other fields of BVSG material culture.

Combined technological and use-wear analysis of tools, waste material and products, in schist and other types of stone, have been conducted on a series of sites located close to outcrops of Pissot schist on the eastern margin of the Armorican Massif (Sarthe, Caen plain). These include quarrying sites (St-Germain-du-Corbéis; Fromont *et al.* 2006) and specialized workshops directly associated with the outcrops (Arçonnay, Champfleur; Giazzon *et al.* 2002; Marcigny *et al.* 2004; Gaumé 2007). In parallel, a producer settlement in Verson yielded a number of elements in Brioverian schist (Germain Vallée *et al.* 2014), as well as finished bracelets of different origins, as on most receiver sites (Fromont *et al.* 2013). This unique configuration provides an opportunity to reconstruct in detail the sequence of production and the technical processes involved in the *chaînes opératoires* of bracelet manufacture. Results are compared with other areas of production, especially in southern Belgium, in order to investigate the technical choices adopted by the various communities and groups engaged in schist bracelet production throughout the BVSG area.

A network of sites involved in the production of schist bracelets

In these regions, BVSG groups exploited schist outcrops on the interface zones between ancient crystalline massifs, such as the Armorican Massif and the Ardennes Massif, and the sedimentary Paris Basin. In these specific geological contexts, several types of sites dated to the BVSG have been discovered and excavated. Firstly, a number of acquisition and quarrying sites have been identified: these are specifically devoted to the extraction of schist raw materials, an activity that remains difficult to identify because of the scarcity of visible archaeological remains, and the specificities of schist outcrops that produce natural breakages and considerable fragmentation. Specialized workshops located either at the extraction sites or a distance away, are more easily recognizable due to the presence of large quantities of waste debris and numerous abandoned schist elements representing all stages of bracelet production. Next to the extraction sites, quite a significant number of settlement sites have yielded evidence for the bracelet producing workshops in certain houses. Within the BVSG area, these discoveries allow us to envisage a large network of sites involved either in the production, redistribution or consumption of the schist bracelets (Burnez-Lanotte *et al.* 2005; Fromont 2013).

In this paper, we will focus on the tools used in the manufacture of bracelets made out of one specific type of schist, so-called Pissot schist; the complete *chaîne opératoire* for the production of Pissot schist bracelets has been analysed, from the extraction of the raw material to the abandonment of used bracelets. Pissot schist outcrops were exploited on the eastern margins of the Armorican Massif. Within their area of distribution, two kinds of production sites have been recognized (fig. 1). On the acquisition site of "l'Ermitage" in Saint-Germain-du-Corbéis, BVSG people exploited a soft, slightly metamorphized schist, with good cohesion, which outcrops in the form of thick slabs (Fromont *et al.* 2006). Close to the quarries, a series of specialized production sites have been excavated in the Sées-Alençon Plain, at Champfleur "Le Bois de Barrée" and at Arçonnay "Parc Saint-Gilles". On these specialised workshop sites, the archaeological remains attest to all stages of bracelet production, from the

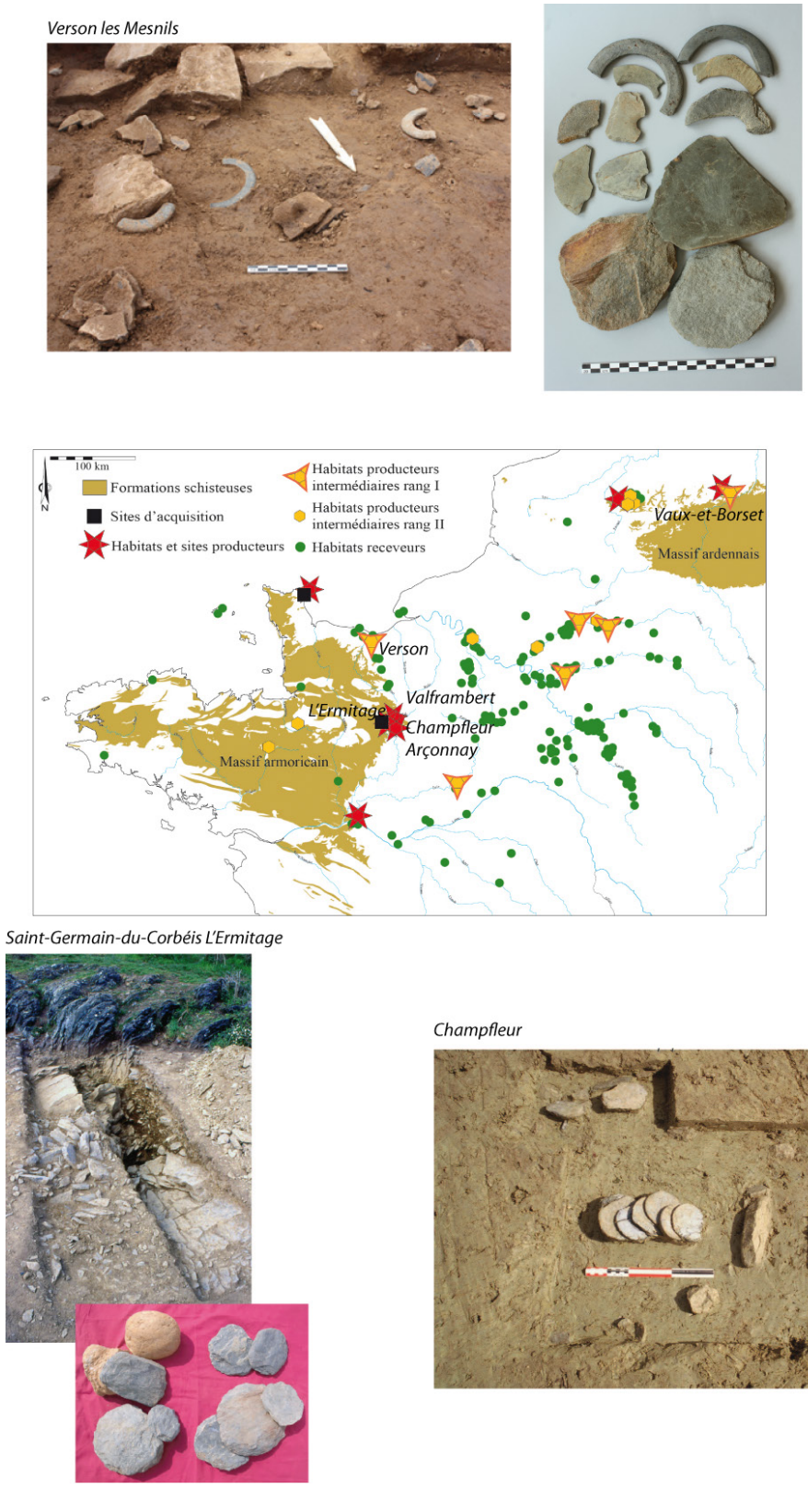
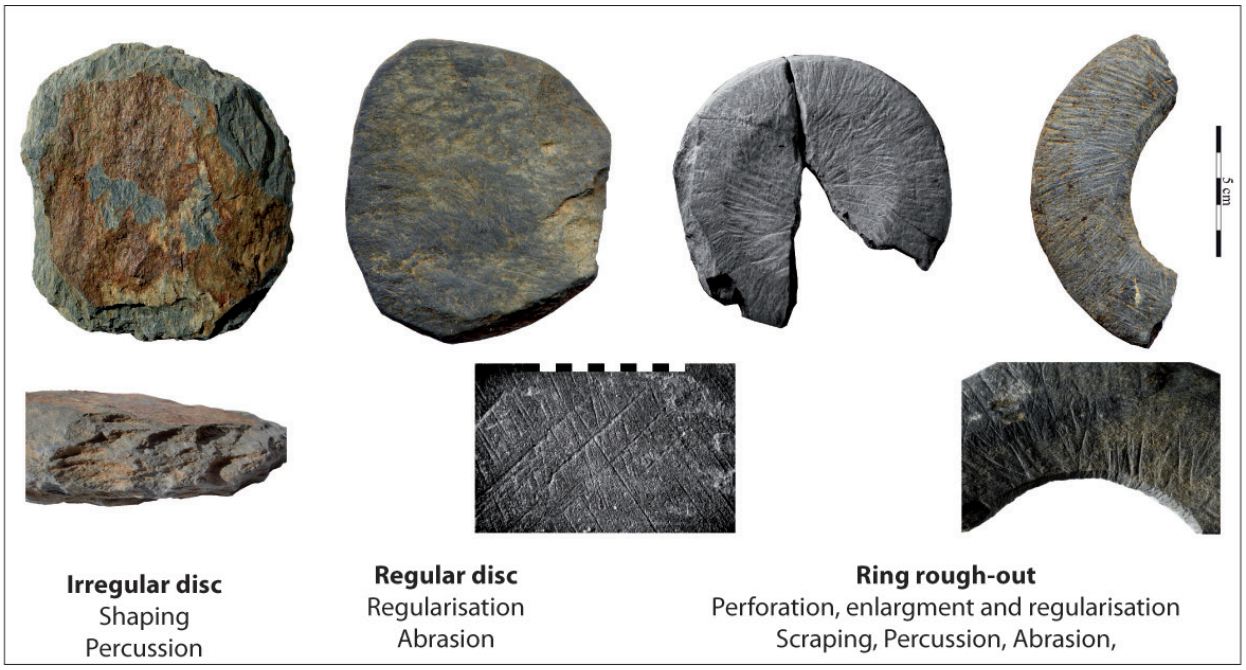


Figure 1: Locations of studied quarries, workshops and settlements with evidence for the production of Pissot schist bracelets, on the eastern margin of the Armorican Massif (map after Fromont 2013): Verson « les Mesnils » (photo: C. Germain-Vallée, CG Calvados), Saint-Germain-du-Corbéis L'Ermitage (photo: N. Fromont, Inrap – after Fromont *et al.* 2006), Champfleur (photo: C. Marcigny, Inrap – after Marcigny *et al.* 2004).

transformation of the natural slabs to the final finishing of the bracelets. The evidence consists of thousands of schist elements (technical elements and wastes) together with a small number of flint artefacts and hundreds of macrolithic tools made from a variety of rock types (Giazzon *et al.* 2002; Marcigny *et al.* 2004; Gaumé 2007). Settlement sites with possible bracelet producing workshops, such as those that have been identified in Valframbert "La Grande Pièce" and Verson "les Mesnils", complete the network of sites involved in the production and diffusion of bracelets

fonction	mat prem	dimensions	position	action	état	geste	durée
anvil	fine quartzitic sandstone	45x23x8	lower	disc schaping	dry	throwing percussion	10
anvil	quartzitic sandstone	3,5x7,5x5,5	lower	perforation enlargement	dry	throwing percussion	30
anvil-hammerstone	micaceous quartzite	9x6,5x6,5	lower/active	perforation enlargement	dry	diverse	10
hammerstone	fine armorican quartzite	12x7X8	active	disc schaping		throwing percussion	10
hammerstone	quartzite	10x8,5x3	active	perforation enlargement	dry	70°	10
hammerstone	quartzitic sandstone	7,5x6X5	active	perforation enlargement	dry	throwing percussion	30
abrader	granodiorite	23x20x4,5	lower	abrasion faces / sides	with water	diverse	120
abrader	fine quartzitic sandstone	15,5x11x0,5	lower	abrasion faces / sides	with water	flat	40
abrader	fine quartzitic sandstone	15,5x11x0,5	lower/active	abrasion faces / sides	with water	flat	30
abrader	fine quartzitic sandstone	20x17x1	lower	abrasion faces / sides	with water	flat	35
abrader	"roussard" sandstone	25x21x5	lower	abrasion faces / sides	with water	longitudinal for groove	45
abrader	"roussard" sandstone	25x21x5	lower	abrasion faces / sides	with water	longitudinal for groove	10
abrader	"roussard" sandstone	25x21x5	lower	abrasion external side	with water	longitudinal for groove	10
abrader	"roussard" sandstone	25x21x5	lower	abrasion faces	with water	flat	15
abrader	"roussard" sandstone	9x5x4	-	regularisation of inner side	with water	longitudinal	45
abrader	microgranite	20,5x4x3	active	perforation enlargemen and inner side regularisation	with water		1800
abrader	"roussard" sandstone	9x8x4,5	active	regularisation of inner side	with water		10
flake		6,5x5,5x1,5	active	creation of central depression by scraping	with water	transversal 45°	50
flake	quartzitic sandstone, average size	8,5x5,2x10,2	active	creation of central depression by scraping	with water	transversal and longitudinal 90°	50
flake	fine quartzitic sandstone	8x5x2	active	creation of central depression by scraping	with water	transversal 45°	20
flake	fine quartzitic sandstone	6x4,5x10,5	active	creation of central depression by scraping	with water	transversal 45°	75
flake	fine quartzitic sandstone	9x5x2	active	creation of central depression by scraping	with water	transversal 45°	60
flake	fine quartzitic sandstone	8,5x4x1,5	active	creation of central depression by scraping	with water	transversal 45°	75
flake	quartzitic sandstone	6x3,5x2	active	regularisation of inner side	with water	70°	90
flake	quartzitic sandstone	3,5x3,5x1	active	finition of faces and sides by scraping	dry	diverse	70
flake	quartzitic sandstone	5x4x1	active	finition of faces and sides by scraping	dry	diverse	60
flake	quartzite	11x4,8x2	active	finition of faces and sides by scraping	with water	diverse	60
smoother	quartzite	4,8x3,5x1,5	active	final smoothing	with water	diverse	60
smoother	quartzitic sandstone	5x5x2	active	final smoothing	with water	diverse	120

Table 1: Experimental tools used at different steps of the *chaîne operatoire* of schist bracelets production, with indication of raw material, gesture and stage of the *chaîne operatoire*.



a

Initial shaping of the schist disc by percussion with massiv hammerstone and anvil

Regularization by abrasion of the disc face and sides on a flat abrader

Scraping of the disc face to create a perforation with the distal edge of a flake

Enlargement and regularization of the disc's inner side by abrasion/scraping with the distal edge of a small flake

b

Figure 2: Hypothetical production sequence of schist bracelets a. Different schist elements found on archaeological specialized workshop sites (photos: N. Fromont), b. Experimental tests with main steps of the production according to macroscale observations (experiments and photos: C. Hamon and N. Fromont).

made from Pissot schist (Germain Vallée *et al.* 2014). The area of diffusion for Pissot schist, especially in the form of finished bracelets, includes Normandy, the western Paris Basin and the center of France (Fromont 2008).

An integrated technological and use-wear analysis of schist products and stone tools

As a first step, macroscopic analysis was conducted on a representative sample of the thousands of schist elements found, including blanks from the quarries, intermediary products and roughouts, wastes and possible tools. Despite their abundance on BVSG settlements, flint artefacts have rarely been found on these sites, and use-wear analysis carried out on the few known examples did not associate their use with the treatment of soft mineral material or schist bracelet production (Charraud 2013). The virtual absence of evidence for the use of flint artefacts on the specialized workshop sites, as well as on settlements where bracelets were produced, constitutes a real technical and regional specificity of the area of Pissot schist exploitation. In contrast, the abundance and diversity of macrolithic tools on production sites suggests that they played an important role in the production of Pissot schist bracelets (Hamon 2006). The studied assemblage includes 12 macrotools from the acquisition site of Saint-Germain-du-Corbéis, 30 macrotools selected on site by the excavators of the workshop at Champfleur, 225 examples from the workshop site at Arçonnay, and finally a large part of the 227 macrotools found in the waste pits of the long houses at Verson.

The macroscopic and microscopic use-wear analysis of this material has allowed us to propose a detailed functional hypothesis for the role of each category of macrotool in each stage of the *chaîne opératoire* of bracelet production. On the basis of these observations, a series of experimental tests were carried out to explore different technical processes and the different tools used at each stage of bracelet production. Experiments were conducted in order to test the efficiency of different types of tools and active surfaces, raw materials and gestures, and also to record the marks that they leave behind, for several steps in the production of schist bracelets (tab. 1, fig. 2).

The tool raw materials and blanks were chosen to match, as closely as possible, the characteristics of the archaeological material found on the specialized workshops of Champfleur and Arçonnay (Gaumé 2007). Three quartzite anvils were used respectively for the shaping of the disc and the enlargement of the perforation. Four flat abraders of granite and quartzite were used for the abrasion of the faces / sides of several discs. Six flakes were used to hollow out the central part of schist discs, one for the regularisation of the inner side and 3 others for the regularisation of all sides and faces. Three hammerstones were used to enlarge the disc perforation. Seven abraders, made of low cohesive ferruginous sandstones ("roussard"), were used for the abrasion of the faces, and the outer and inner sides of bracelets. Two small cobbles were used to polish the surfaces as part of a final stage in the production. The above listed tools and raw materials constitute the basis of our experimental referential, both on schist elements and macrolithic tools. The experimental traces observed on the schist discs and macrolithic tools were then compared with the archaeological examples in order to estimate the extent to which they match.

The production of bracelets on quarry sites and on workshop sites: tools and sequences

Analysis of schist elements

Some of the selected natural slabs acquired from the schist outcrop were initially shaped by coarse flaking in order to obtain irregular discs (fig. 2a). As evidenced by the distribution of fine impacts, smoothed areas and longitudinally and transversally orientated striations, the faces and sides of the discs were regularized in a second step; fine percussion and abrasion were used alternately in order to give the discs a more regular circular shape. The central portion of each disc was then thinned, either by scraping, as suggested by dense groups of fine crossing striations visible on the central area of both sides of the discs, and/or by fine percussion, as suggested by the concentrations of fine percussion impacts on both faces. The hollowing out and enlargement of the perforation was then carried out by fine percussion. Circular striations visible on the inner side of the bracelet roughouts suggest that the shape and dimensions of the perforation were adjusted and regularized using fine abrasion. In parallel, the smooth flat aspect of the faces and external sides of the bracelets attests to a final stage of fine abrasion, and in some cases, a final finishing by polishing.

Analysis of wear traces on macrolithic tools

The important corpus of macrolithic tools found on extraction sites and specialized workshop sites includes edged tools, hammerstones and anvils, and a large series of flat, hand-held and grooved abraders (fig. 3). Three criteria guided the selection of blanks from local mineral sources: the morphology of their surfaces, their overall dimensions/weight and the efficiency of the raw materials for the intended purpose.

Most of the anvils and hammerstones are made out of hard rocks such as Ordovician quartzitic sandstones. One example clearly illustrates how such anvils functioned: three of the active surfaces on its faces and distal ends bear traces of severe flaking and the detachment of coarse flakes; its edges bear dense micro-flaking, probably

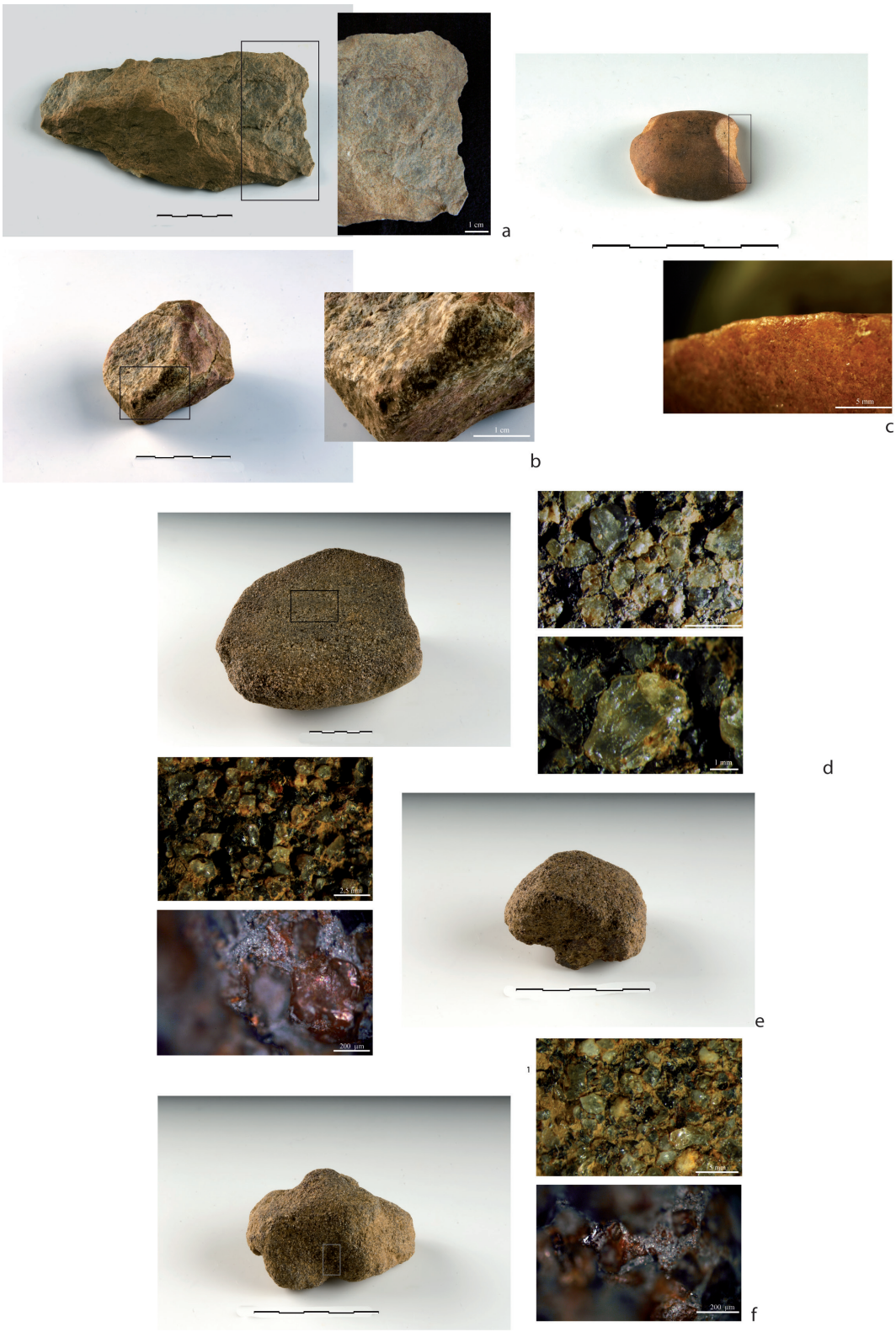


Figure 3: Sample of different categories of macrolithic tools and their use-wear traces from Arçonnay: a- Intermediate tool, B- Hammerstones, C- Scraping tool, D- Flat abrader, E- Hand abrader with convex active surface and shape, F- Grooved abrader (photos: H. Paitier, Inrap, microphotos: C. Hamon and N. Fromont).

created by the initial debitage of the irregular schist discs; a series of large percussion impacts on its face and back could be related to the fine shaping of disc sides. Hammerstones generally weigh between 200 and 400g, with average dimensions of 10x8x4cm. Their angles and edges bear alternate intense percussion impacts and microflaking, resulting from their use in shaping schist slabs. Other anvils and hammerstones (weighing 100 to 600g) were made out of coarse "roussard" sandstones of varied morphologies; they were probably chosen for their ability to cushion percussion impacts, thereby helping to avoid uncontrolled breakage of the schist slabs and discs during the shaping phase.

Three categories of edged tools have been identified. (1) Several intermediate tools (9 to 14 cm long and 2 to 4 cm thick) bear important flaking on their shaped distal ends, associated with coarse percussion impacts on their opposite ends. They were most probably used for splitting schist slabs in order to obtain the appropriate thickness for manufacturing bracelets. (2) Several edged tools made from various opportunistic raw materials and blanks (less than 10 cm in length, with a maximum thickness of 5 cm) bear micro-flaking and/or smoothing on their ends, which suggests a scraping action. Their active surface, measuring 1 to 3 cm in width, bears smoothing which evokes the scraping of a soft mineral material together with water. Some of these tools may have been hafted for greater efficiency. They would have been employed to reduce the central part of the discs, using a scraping action, prior to their perforation. (3) A very small number of tools made from sandstone flakes (7x3x2cm) were shaped to create a pointed end; the pointed end bears slight distal micro-flaking, produced by the application of pressure or torsion.

- Abrading tools present a wide diversity of blanks, morphologies and sizes adapted to different stages of schist bracelet production. Most are made out of Cenomanian coarse ferruginous "roussard" sandstones, the cohesion of which varies from one bloc to another, thus allowing their better use in relation to the required processes during the various stages of manufacturing. (1) A couple of rare slab abraders: in one case, use-wear analysis identified a strong mechanical levelling, and fracturing of rock grains, suggesting that this was a former grinding tool reused as a flat abrader; (2) Hand abraders of "roussard" sandstones present different use facets, characterized by a pronounced levelling of the microtopography and slight microfracturation of the rock grains; they were probably used to regularize the different faces and sides of the bracelets. At least, five of these cylindrically shaped tools would have been used specifically to regularize the inner sides of the bracelets; (3) Numerous small grooved abraders (8 cm long by 6 cm wide maximum) in coarse sandstone show a deformation of their volume and pronounced mechanical levelling with light microfracturation of well-individualized grains; such traces are characteristic of the abrasion of mineral material. Two kinds of grooved abraders have been identified: (a) abraders with rectilinear to curvilinear grooves, with long and parallel sides and a u- shaped section, (b) abraders with semi-circular "notches" on the tool sides, created by circular motion. Both were used for the regularisation of the external and internal sides of bracelets, with complementary longitudinal and transverse motions.

- A few flat polishers were made out of slabs and blocs of harder raw materials, and display several used faces. They present uniformly levelled and smoothed concave surfaces, a morphology which suggests that they were used in conjunction with water. The most used surfaces display a combination of extensive smoothing, an irregular deposit on the grain surfaces, and fine parallel striations. These polishers were used for the final stages of regularisation of the faces of schist discs. A series of smoothers made from cobbles of hard, dense, raw material were also found (ranging in size from 7 cm x 2 cm to 6 cm x 2 cm). They display fine smoothing and a shiny aspect, compatible with their use for the final polishing of the bracelets.

As a matter of fact, some of the tools appear quite standardized in their use, such as the pointed tools used to perforate or calibrate the inner sides of bracelets, or the grooved abraders used to regularize their inner surface; these tools are dedicated to the most « risky » stage of bracelet production. On the other hand, other tools were more polyvalent, for example, medium-size hammerstones and rare anvils could be used either for the first stages of pre-forming of schist slabs or for the perforation stage.

Combined analysis of schist and macrolithic elements

Through combined use-wear analysis of schist and macrolithic elements, it has been possible to reconstruct the complete *chaîne opératoire* of bracelet production on specialized workshop sites, and to identify the tools employed, the technical process involved and the final schist product obtained from each stage of the production.

1. The blanks are brought from the quarries to the specialized workshops as blocs, natural slabs or irregular discs;
2. Slabs are transformed by debitage into irregular discs using percussion with hammerstones of different

Figure 4: Proposed reconstruction of the *chaîne opératoire* for the production of Pissot schist bracelets, with corresponding tools, mode of action and schist product (photos: H. Paitier, drawings: N. Fromont).

sizes, sometimes, but not always, in conjunction with an anvil;
3. The outer sides of the discs are then shaped by macroflaking or by percussion impacts using lighter hammerstones;
4. The faces, and sometimes the outer sides, of the discs are then shaped by abrasion using flat, hand-held or grooved abraders; these operations are carried out before and / or after the perforation stage;
5. The preparation of the perforation is carried out by scraping with an edged tool or by abrasion of the central part of the disc in order to reduce its thickness; in a second step, the disc is perforated by light knapping of the residual material using small hammerstones, and in some cases possibly anvils;
6. The enlargement and regularisation of the perforation is made by abrasion, especially using small pointed abraders;
7. In the finishing stage, the faces are regularized with flat abraders to obtain a surface with a more or less homogeneous aspect, while inner and outer sides are regularized with hand-held and grooved abraders.

A producer settlement: the production of bracelets in briovarian schist at Verson

At the scale of the BSVG area, very few settlements were engaged in the production of bracelets. This production took place at a number of different levels: (1) specialized settlements which produced bracelets intended for widespread diffusion; (2) settlements where only part of the production sequence was undertaken in situ- such sites; this suggest the existence of redistribution sites, and possibly of itinerant bracelet makers; (3) small-scale domestic production. To illustrate this last case, we will take the example of the BVSG settlement of Verson « les Mesnils », located close to the Channel coast in Normandy (Germain-Vallée *et al.* 2014). On this site 28 pits have been discovered, organized in rows within a group of at least six domestic units. Flint tools are abundant on the site and they correspond to a classic BVSG domestic assemblage. More surprisingly, schist debris and macrolithic tools present particular features that suggest the existence of specialized workshops for the production of schist bracelets within the actual domestic area.

Schists elements

Among the normal domestic waste material, it has been possible to highlight concentrations of 214 schist elements, including 127 finished bracelets, 34 advanced roughouts and 53 technical elements. They are particularly abundant in domestic units 2 and 5. These wastes and products correspond to at least 6 or 7 sources of different schists and reflect two types of production: (1) a domestic production with low investment, (2) a production which was only partially carried out on site, suggesting that other stages of production were carried out on other settlements or specialised workshops. This second category of production is represented by technical elements in Brioverian and spotted schists, which together represent 25% of the assemblage: four slabs and six irregular discs which are barely and not systematically shaped by macroflaking and percussion impacts. Nine to eleven circular discs show groups of fine to large multidirectional and cutting striations, consecutive of scraping actions on their central part in order to reduce their thickness and prepare the discs for perforation. The faces and sides of circular discs bear covering smoothing and dense striations, resulting from their regularisation by abrasion. Fifteen roughouts correspond to different stages of perforation using bifacial fine percussion, scraping and abrading actions.

Stone tools

In amongst the classic domestic toolkit, a combination of the raw materials selected and use-wear analysis has allowed us to identify a number of polishers, hammerstones and pointed tools, tool types that are generally absent from BVSG domestic contexts (fig. 5). These atypical macrolithic tools appear to be concentrated in two domestic units (2 and 5) where quantities of schist wastes and bracelets were also found. Their technological characteristics make them very similar to those found on specialized workshops, and their use-wear analysis suggests that they were used for the transformation of soft mineral materials.

Among the 95 percussion tools identified, three anvils on massive blocs of coarse sandstone would have functioned in a vertical position, probably for the debitage of schist slabs. Several cobbles of Brioverian sandstones show bifacial macroflaking on areas of differing morphologies located on their sides and faces; these could also have been used in the early debitage stage of schist bracelet production. Several massive hammerstones on quartzitic sandstone cobbles were used on their angles, probably to shape schist slabs. Two intermediate tools with macroflaking on their distal edge could have been involved in the scraping of the faces of schist discs. A dozen small ovoid hammerstones (weighing less then 100g), with small facets of percussion and covering smoothing, were used for precise percussion, and could have been used to shape the external sides of schist discs or during the first stage of face hollowing.

Twenty flat, hand-held and grooved abraders were made out of different qualities of fine to coarse sandstones. They show multiple concave or grooved surfaces of use, on their faces and sides. Their active surfaces combine intense smoothing of the microtopography and an irregular deposit on the rock grains faces, characteristic of the abrasion of hard animal material and soft mineral

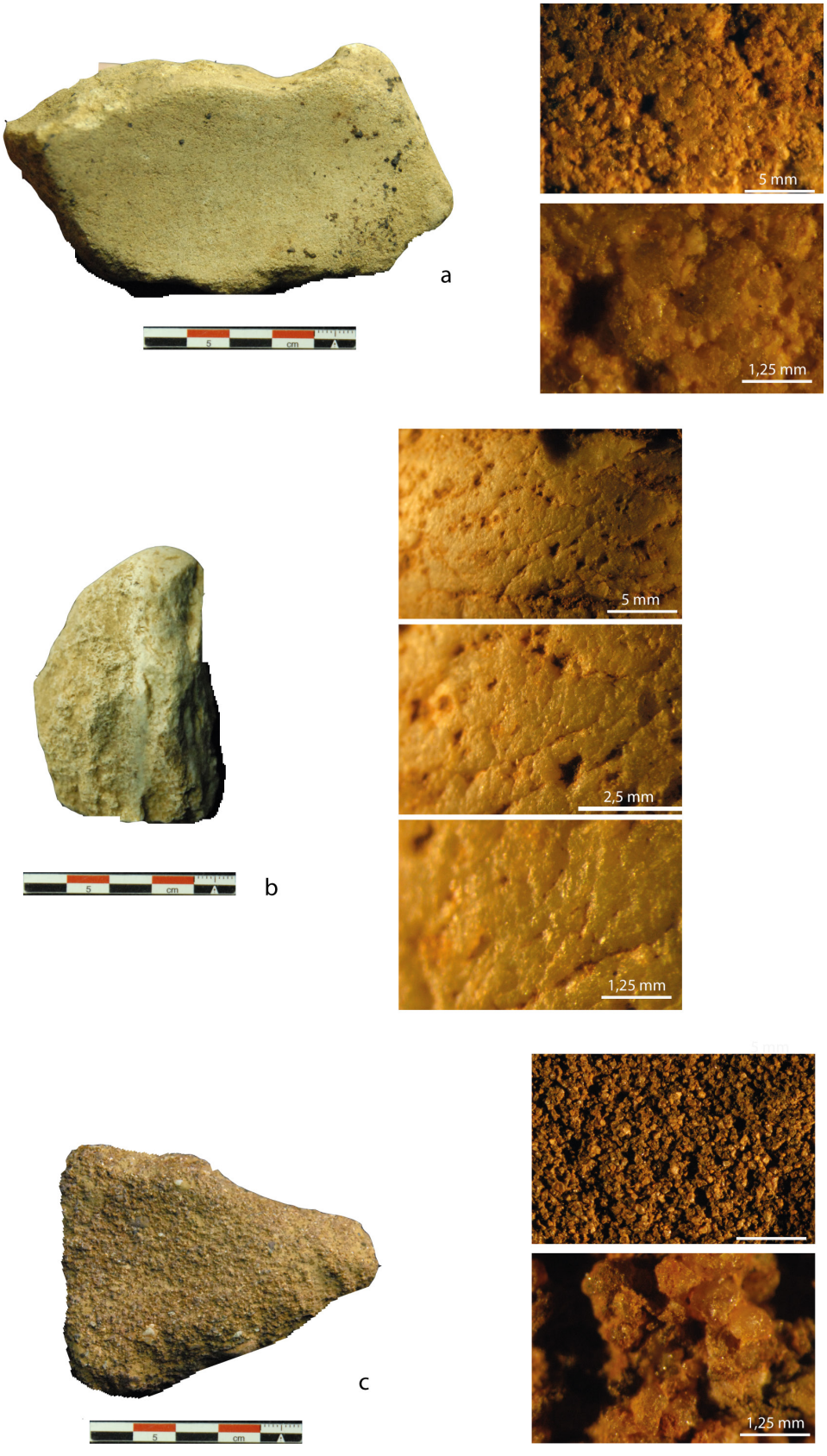


Figure 5: Representative examples of macrolithic stone tools with use-wear traces from Verson a- Slab polisher, b- Pointed tool, c- Pointed abrader (photos and microphotos: C. Hamon).

material. Most of them may have been used for the final abrasion and regularisation of bracelet surfaces. Two polishers in hard Cambrian arkose are of cylindrical shape, resulting from the abrasion of their periphery. One of them displays a combination of concave surfaces of abrasion on its faces, areas of lateral abrasion and pointed ends. The upper surface presents significant levelling together with microfractured rock grains typical of wear resulting from the abrasion of soft mineral material. These tools were most probably used for the calibration and regularisation of the internal side of bracelets. Their low cohesion limits their functional analysis, but, in the case of at least two examples, the use-wear signature corresponds to the abrasion of soft mineral materials. One of the three grooved abraders presents a pronounced levelling of the microtopography, a strong shine and well-individualized rock grains; such traces are generally related to the transformation of hard mineral materials. A large number of these polishers were used for the regularisation, by abrasion, of the faces and sides of schist bracelets.

Four other quadrangular, oblong tools, 10 cm in length, display use wear mainly on their ends; these are sometimes shaped by a series of flakes. The ends bear rounded circular areas with covering smoothing and fine distal percussion. The use-wear analysis shows an association of fine percussion impacts, a uniform smoothing and a particularly well-developed shine, associated with well-individualized but intensively microfractured grains; such traces are consistent with these tools being employed to create hollows in soft mineral materials, probably schist discs.

Synthesis

The shared spatial distribution of roughouts, irregular discs and schist manufacturing wastes along with specific macrolithic tools, including hammerstones, polishers and pointed tools, suggests the existence of specialized workshops in at least two of the domestic units discovered in Verson. It has been possible to identify and isolate specialized tools involved in the production of schist bracelets and characterized either by their raw material, their morphology or their use-wear signature, which links them to the processing of soft mineral material. These observations could suggest the circulation of specialized craftspeople, with different levels of know-how, within the BVSG territory. As a matter of fact, the craftspeople involved in the production of bracelets in Verson did not share the same community of practice as the one present in the specialized workshops which exploited Pissot schist. The schist transformed in Verson appears to be of lower mechanical quality than that used in the Pissot schist workshops, and the transformation processes show several differences that suggest a better mastering of schist working in the specialized workshops than on the Verson settlement. This suggests the existence of two different groups of producers, with little exchange of know-how between Verson and the Pissot schist workshops. However, one cannot exclude the possibility that the Pissot schist producers, who were particularly skilled in the techniques of bracelet production, circulated between the settlement sites; such a scenario is suggested by the presence of technical elements and final bracelets from these productions in the domestic pits at Verson.

Different traditions of production and diffusion at the scale of the BVSG area

By the combined association of technological and use-wear analysis of schist and macrolithic elements on different kind of sites (quarries, specialized workshops, settlements), it has been possible to accurately reconstruct the different steps and technical processes involved in the production of Pissot schist bracelets in a particular area of the BVSG culture. We have also been able to highlight the specialized toolkits associated with the production of these emblematic personal ornaments of the BVSG culture. Our study led isolate within the whole macrolithic tools assemblage involved in other food and craft activities within the domestic areas (flint, bone and ceramic production), specific tools related to schist bracelets production. The recognition of this toolkit may, in the future, contribute to identifying production sites in the absence of finished schist bracelets, and to identify more accurately the spatial segmentation of the production as well as the degree of specialization on these different sites.

This systemic study also allows us to identify different technical traditions of schist bracelets producers within the BVSG area (Fromont 2013). This statement is perfectly illustrated by one particular example: the comparison of the Pissot (Marcigny *et al.* 1999; Gaumé *et al.* 2009; Fromont 2012) and Ardennes productions, especially on the sites of Vaux-et-Borset and Irchonwelz (Burnez *et al.* 2005; Fromont *et al.* 2008).

First of all, the types of sites involved in bracelet production are not the same for both areas. While quarries, specialized workshops and settlements are complementary in the Pissot system of production, redistribution, and export of bracelets, the production in Ardennes schist seems to be more concentrated in settlements in Hesbaye. Secondly, the processes of production show many differences between the two areas. In the Pissot schist area, the sequences of production appear quite standardized and mostly involve macrolithic tools rather than flint tools. In contrast, in Hesbaye, the sequences of production are more varied, and involve the use of a much wider range of flint tools, macrolithic tools being mostly used for the abrading operations carried out to regularize the faces and sides of bracelets.

SARTH	ARDENNES
Marcigny et al. 1999, Gaumé et al. 2009, Fromont 2013	*Burnez et al. 2001, Caspar et al. 1993*
Context / type of sites	
Quarries	Specialised settlements
Specialised workshops	
Settlements : domestic production, redistribution,	
production for export	
Processes	
Few or no flint tools	Diversity of processes
Macrolithic tools diversified : scrapers,	Flint tools : scrapers, hammerstones
hammerstones, anvils, abraders, polishers	Macrolithic tools : polishers
Final products	
Diversity of schist bracelets types	No evolution of schist bracelets types

Table 2: Schematic and comparative synthesis of the characteristics of schist bracelet production in the Sarthe and Ardennes.

The perforation stage, in particular, involves mechanical perforation, a procedure that is virtually absent from the Pissot schist production. This observation stresses the important capacity of bracelet producers to adapt and develop strategies suited to locally available raw materials and means of production. Finally, the absence of evolution in the types of bracelets produced in the Ardennes contrasts strongly with the diversity of types manufactured in Pissot schist. Underlying the differences in the treatment of the two different raw materials, these statements highlight two different technical traditions and spheres of production with important regional anchoring. These regional groups of production echo regionalization phenomena that have also been observed in other fields of material culture within the BVSG area (Bostyn and Denis 2016; Meunier 2012).

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