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# New insights into the technological management of the Neolithic cowrie beads in the Levant: An experimental and traceological approach.

Hala Alarashi

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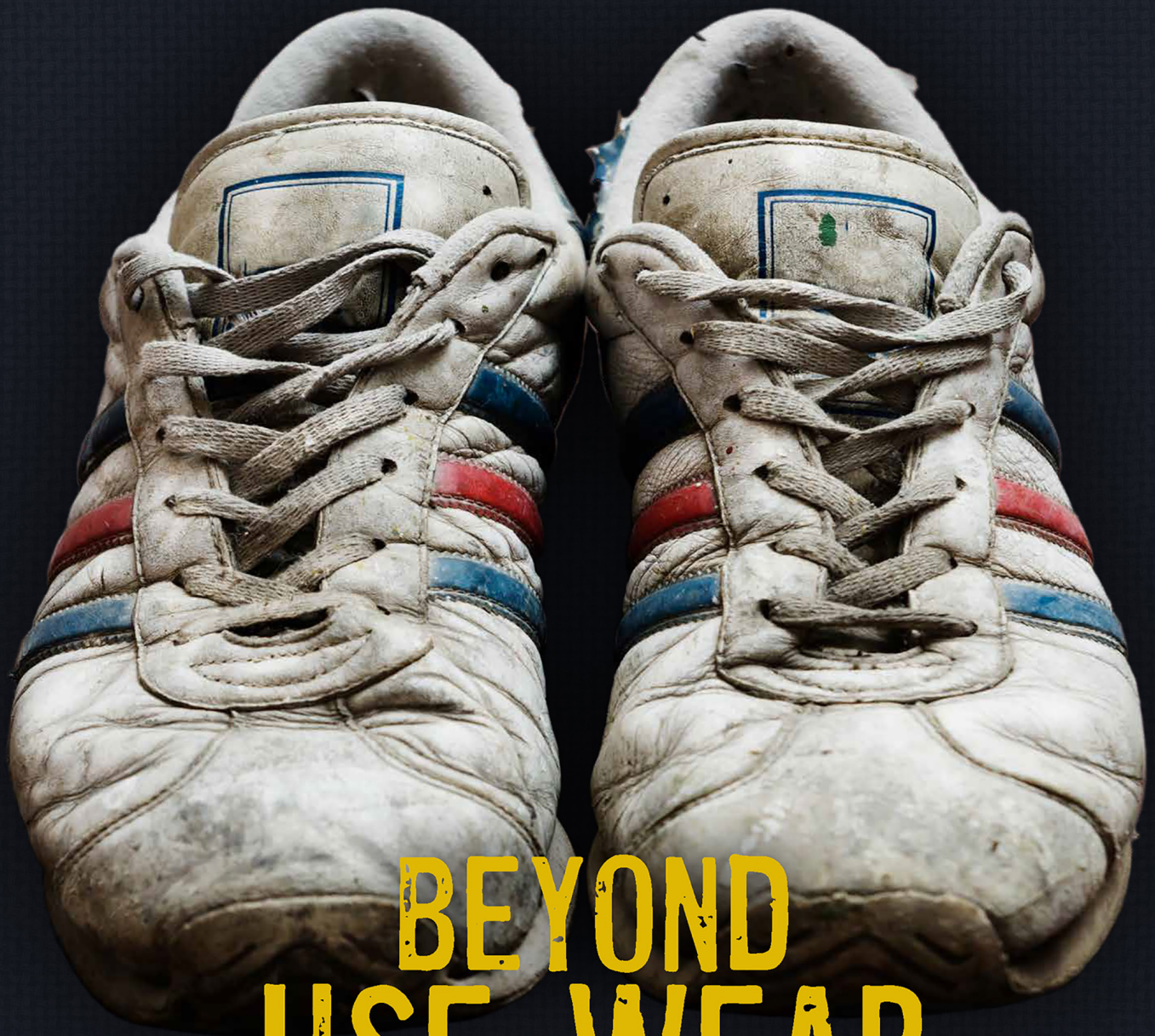
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# BEYOND USE-WEAR TRACES

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

SYLVIE BEYRIES, CAROLINE HAMON  
& YOLAINE MAIGROT (EDS)



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### **AWRANA IN PICTURES**





# New insights into the technological management of the Neolithic cowrie beads in the Levant

An experimental and traceological approach

Hala Alarashi

## Abstract

The Pre-Pottery Neolithic B (PPNB) village of Tell Halula (Northern Syria) has yielded an important assemblage of cowrie beads that were employed in the composition of belts and diadem-like ornaments. Cowrie shells were perforated through the complete removal of the dorsal part. The techno-traceological analyses and comparisons with the created experimental references indicate that the perforations were first made by percussion, then leveled by grinding. In addition to the technical traces of perforation recorded on the dorsum, ambiguous large facets full of striations cover the ventral side of the cowries. Were these intentionally abraded in order to fit the shells into garments or supports? Were they formed accidentally during the manufacture process, or produced during the use of the ornament? Based on the experimental results, it was hypothesized that the finishing stage of the perforation was carried out using a device to seize a batch of shells during the grinding. The batch processing is argued by the regularity and homogeneity of the finishing quality, and by the highly standardized thickness of the shells. The technological management of cowries through batch processing is also discussed taking into consideration the PPNB chrono-cultural context during which body ornaments pass an important quantitative and qualitative threshold along with the consolidation of the farming life-style in Mesopotamia and the Levant.

*Keywords: Cowrie beads, technology, traceology, experiments, batch processing, Pre-Pottery Neolithic B, Levant*

## Introduction

In the Near East, interest in cowrie shells (Cypraeidae) went in tandem with the establishment of large-sized farming communities (Hole 2000; Gebel 2004; Ferrio *et al.* 2012), the intensification of long-distance circulation networks (Watkins 2008; Borrell and Molist 2014), the emergence of specialized technologies (Quintero and Wilke 1995; Wright *et al.* 2008; Alarashi 2016), and with the increasing complexity of the social structures of the Neolithic groups (Kuijt 2000; Kuijt and Goring-Morris 2002; Verhoeven 2002; Benz *et al.* 2019). Popularity of cowrie beads has remarkably increased during the first half of the 8<sup>th</sup> millennium cal BC in the Levant and the Euphrates Valley. Their omnipresence in Middle and Late Pre-Pottery Neolithic B (PPNB) sites (Bar-Yosef Mayer 2005; Alarashi 2010; Ridout-Sharpe 2015; Alarashi *et al.* 2018) renders them characteristic of the ornamental traditions of the PPNB cultures in these regions.

Based on experiments, this paper presents the stigmata that have led to the recognition of a perforation method entailing a serial treatment of the Neolithic cowrie shells. The latter, also known as “batch processing” (Thomas 2011), “*en masse*” production (Wright *et al.* 2008) or “*Heishi technique*”<sup>1</sup>, consists in applying a technological treatment, generally polishing, on several objects at the same time. The aim of this study is to draw attention to this hitherto undocumented technological treatment on the cowrie shells, which has been developed in a period of multiple evidence of craft specializations, particularly in the domain of body ornaments.

## Material and Methods

Large amounts of cowrie beads were discovered in the village of Tell Halula (North Syria), a PPNB Site dated to the end of the 9th and the beginning of the 8th millennium cal BC, corresponding to the end of the Middle, and the beginning of the Late PPNB (Molist *et al.* 2013). The studied assemblage is composed of 358 cowrie beads, 250 complete and 108 broken halves (fig. 1a, b). All the cowries are perforated through the complete removal of the dorsum, which is the hemispherical solid dome of the shell (fig. 1c), and the internal whorl inside the columellar part (see preserved internal whorl on experimental specimens, fig. 2b, k).

The complete specimens were discovered exclusively in burials, adorning the skulls and the pelvic girdles of adults and children. As for the broken cowries, they were found in rejection outdoor areas of the village, in front of the habitats and in the pathways separating them. The



**Figure 1:** Cowrie shells from Tell Halula (drawing and photos: H. Alarashi), a- Set of cowrie beads (dorsal and ventral sides) composing an ornament discovered in a burial, b- Examples of broken halves of cowrie beads found in outdoor contexts, c- Used nomenclature.

<sup>1</sup> *Heishi* means shell bead in the language of the Santo Domingo Pueblo Indians of New Mexico. Peter Francis (1989, 31) used the term « *heishi technique* », to describe the method used to finish and polish disc beads by the native bead makers.

Experimentation							Macro and microwears			
Techniques	No.	Tool	Notes	Duration'	Dorsal side (DS)	Int. Whorl	Ventral side (VS)	Lateral sides (LS)		
Dir. Perc.	▼ E11	Flint hammerstone	VS placed on concrete floor without protection	-0:30	Removals, Cracks, Scratches, Random striae	-	Cracks, Scratches, Random striae	No		
Ind. Perc. (Pi.)	▼ E14a, b, c, d	Pointed flint tip & hammerstone	VS placed on concrete floor without protection	-1'	Impacts, Removals, Cracks, Scratches, Random striae	-	Scratches, Random striae	No		
Ind. Perc. (Pi.)	E31	Pointed flint tip & hammerstone	VS placed on concrete floor without protection	2:08	Small irregular piercing, impacts, shell removals	-	Scratches, Random striae	No		
Ind. Perc. (D. removal)	E16a, b*	Pointed flint tip & hammerstone	Piercing enlarged & edges leveled by ind. Perc. VS placed on concrete floor without protection	-0:30 (Pi) -1:30 (Enl)	Irregular edges, inner & outer shell removals	Damaged	Scratches, Random striae	No		
Ind. Perc. (D. removal)	E17	Pointed flint tip & hammerstone	Piercing enlarged & edges leveled by ind. Perc. VS placed on concrete floor, protected with leather	0:43 (Pi) 3:59 (Enl)	Irregular edges, inner shell removals	Damaged	No	No		
Ind. Perc. (D. removal)	E18	Pointed flint tip & hammerstone	Piercing by grinding, edges leveled by ind. Perc.	18:16 (Pi) 4:15 (Enl)	Irregular edges, deep inner & shallow outer shell removals	Damaged	Rough surface, Cracks, Scratches, Random striae	Scattered long striae		
Ind. Perc. (D. removal)	E32	Pointed flint tip & hammerstone	Piercing enlarged, edges leveled by ind. Perc. VS placed on concrete floor, above thin synthetic tissue	2:48 (Pi) 6:13 (Enl)	Irregular edges, deep inner & shallow outer shell removals	Damaged	Rough surface, Cracks, Scratches, Random striae	Scattered long striae		
Sawing	E15	Sharp edge flint blade	use of a leather for comfortable apprehension of tool. VS placed on concrete floor without protection	88:23	Flat edges, Groove, Organized long striae, inner shell removals	Sawn	Long multidirectional striae	Groove, Sideslip striae		
Single grinding	E30	Compacted coarse sandstone	Water added on the surface of the grinding tool	Stopped at 15:15	Regular facet full of long regular striae	-	No	No		
Single grinding	E13	Compacted coarse sandstone	Water added on the surface of the grinding tool	Stopped at 20:00	Regular facet full of long regular striae, no hole produced	Abraded	No	No		
Batch grinding	E12, E13	Compacted coarse sandstone	2 cowries placed on VS in shallow pits engraved in a wooden arm. DS ground through moving back and forth. Water added on the surface of the tool	Stopped at 21:00	Regular edge, Facet full of regular parallel striae	Abraded	Facets on the columellar and labial parts full of long parallel striae	Random striae		
1st: Ind. Perc.	E19	Pointed flint tip & hammerstone	Piercing enlarged, edges leveled by ind. Perc.	0:38 (Pi) 4:23 (Enl)	Irregular edge, inner shell removals	Damaged	Scratches, Random striae	No		
2d: Single grinding		Compacted coarse sandstone	Water added on the surface of the grinding tool	Stopped at 19:09	Regular facet full of long regular striae	Inaccessible	Idem. No additional traces	No		
1st: Ind. Perc.	E12	Pointed flint tip & hammerstone	Piercing enlarged, edges leveled by ind. Perc.	2:10 (Pi) 4:16 (Enl)	Irregular edge, inner shell removals	Damaged	Scratches, Random striae	No		
2d: Batch grinding		Compacted coarse sandstone	Two cowries placed on their VS in shallow pits engraved in a Wooden Arm (WA). DS ground by moving the WA back and forth. Water added on the surface of the tool	Stopped at 21:00	Regular edge, Facet full of regular parallel striae	Abraded	Facets on the columellar and labial parts full of long parallel striae	Random striae		

**Table 1:** Information on the conducted experiments. Dir. Perc.: Direct percussion; Ind. Perc.: Indirect percussion; D.: Dorsum, Int. Whorl: Internal whorl; Pi: Piercing; Enl: Enlargement of the obtained piercing. ▼ Failed experiment; \* Inadequate for experiment: thin and fragile shell structure; ° Cowrie initially pierced by indirect percussion. Time is given in minutes (').



**Figure 2:** Experimental cowries: a selection of *Cypraea annulus* (a-f) and *Cypraea caputserpentis* (g-l) employed, Indirect percussion (a, e, f, h, i), Sawing (b), Single grinding (g), Batch grinding (j, k), Combination of single grinding and indirect percussion (c), Combination of indirect percussion and single grinding (d), Combination of single grinding and batch grinding (k), Combination of indirect percussion and batch grinding (j), Direct percussion (l). (Photos: H. Alarashi). Numbers of experiments (E11, 12, etc.) are indicated in table 1.

focus of this paper is made on the technological aspects of Tell Halula's cowrie beads. A detailed description including the taxonomical diversity, the taphonomical alteration, the production qualities and the use-wear patterns along with a discussion about the functions of cowrie ornaments and their potential meanings for early farming communities, was recently published (Alarashi *et al.* 2018).

Material study was carried out in the field laboratory in Syria during the excavation seasons of Tell Halula. A stereoscope Motic Stereozoom CLASSMAG41 (10x – 40x), equipped with a digital Camera (2.0 MP) was used for the microscopic characterization. Shells were cleaned by picking the incrustated sediments and blowing, some were also gently washed with soapy tepid water. The surface of each cowrie was exhaustively examined, and the distribution of the traces was mapped. The shells were photographed and measured with a digital caliper. The nomenclature (fig. 1c) and the measurements convention are adapted from previous publications (Alarashi 2010; Alarashi *et al.* 2018).

Experiments on cowrie shells, all made by the author, were aimed to characterize 1) the technical traces produced by different perforation techniques on the dorsal side of the shells and; 2) the indirect or collateral stigmata on the ventral or lateral sides of the cowries. The experimental shells were observed under a microscope (Leica Z16 APO) at the CEPAM CNRS laboratory (Université Nice Côte d'Azur). Comparisons between the experimental traces and those observed on the Neolithic cowrie beads were expected to infer the manufacturing process of the latter.

Four perforation techniques were experimented: direct percussion (hammering), indirect percussion, sawing and grinding. Details on the tools used, the time, the conditions of the experiments and the produced macro and microwears are given in table 1.

A total of 14 actual cowries from the Red Sea, *Cypraea annulus* (around 25 mm length x 18 mm width) and *Cypraea caputserpentis* (around 30 mm length x 23 mm width) were used (fig. 2). The size of the latter is similar to the one of the archaeological species.

## The experimental set

### Direct percussion

A thick shelled *C. caputserpentis* (fig. 2l) was hammered on the dorsum. After the forth strike, the cowrie broke in six fragments. Traces observed on the dorsal and ventral sides are given in table 1 (E11). Although the experiment has failed, this technique remains interesting as it requires one tool, it is quick and produces generally large openings (Francis 1982). With more practices the removal of the dorsum applying direct percussion is possible.

### Indirect percussion

Less risky than the previous one, this quick technique allows controlling the tool position and precision in the emplacement of the hole. Here, it was experimentally applied for two purposes: to pierce the dorsum (fig. 2h) and to enlarge the obtained holes (fig. 2a, c, i). Its application was successful on four cowries of *C. caputserpentis* (fig. 2h, i, j), and on five among nine *C. annulus* (fig. 2a, c, d, e). Piercing the top of the thick-shelled dorsum was possible after repeated strikes (12 to 40) in less than 3 minutes (tab. 1). The produced piercing is small, with irregular edges and surrounded by a rough, squamous surface marked with scratches and impact points (fig. 3a). Indirect percussion was very efficient to enlarge holes obtained either by the same technique, or by grinding. In the latter case (fig. 2c), the grinding traces have completely disappeared (fig. 3b). The edges of the enlarged holes remain jagged and irregular. Collateral traces (tab. 1) can be observed on the ventral (fig. 3c) and lateral sides of the shells, depending on whether they were protected or not during the percussion. The edge of the internal whorl (e.g. fig. 2a, c, j; fig. 3b, g) of four cowries was broken or damaged during the enlargement of the dorsum opening.

### Sawing

The removal of the dorsum by sawing has required more than an hour and twenty minutes (tab. 1, E15). Being thick, the sawing was made from all the sides and completed until the very last millimeter. To create the sawing groove as regular as possible, I followed the yellow "ring" ornamentation pattern of a *C. annulus* (fig. 2b). Although it took long time to remove the dorsum, this technique provides a regular opening with smooth flat facet surrounding it (fig. 3e) that could be mistaken with a grinding facet (cf. infra). Sawing technique can however be identified through the detection of remained parts of the sawing groove (fig. 3d) along with the sideslip sawing striations on the lateral sides (fig. 3d). A facet and sawing striations are also observed on the removed convex fragment of the dorsum (fig. 3b). The morphology and the preservation state of the internal whorl also help in identifying the sawing technique. The experiment shows that the tool has very little damaged this anatomical feature resulting in its partial piercing; the natural convexity of the internal whole was kept almost intact with a relatively regular edge (fig. 3e).

### Grinding

Grinding the upmost surface of a *C. caputserpentis* dorsum (fig. 2g) took 15.15 minutes of work (tab. 1, E30) after which the piercing was still not produced. The grinding area was marked by two overlapping facets full of parallel longitudinal striations (fig. 3f). The complete removal of the dorsum of a *C. caputserpentis* exclusively by grinding





**Figure 3:** Macro and microwears produced during experimentations, a- Small hole produced by indirect percussion, b- Enlargement of the initial piercing (similar to a.) by indirect percussion, c- Collateral random scratches and curved striations on the ventral side due to indirect percussion on the dorsum, d- Sawing groove and side slippery striations on the lateral side, e- Sawing producing regular facet and a small-sized piercing of the internal whorl. See also the remained sawing groove, f- Grinding facet full of parallel long striations, g- Grinding facet and striations on the remained edge of the internal whorl, h- Large facets on the ventral side, i- Detail of the ventral facet covered with regular long striations. (Photos: H. Alarashi).

(fig. 2k) resulted in a very regular opening surrounded by a large flat facet full of parallel regular striations. Here, the piercing of the internal whorl was produced quickly. On the contrary of sawing, grinding creates a large piercing on the internal whorl. Abrasion striations are observable on the edge of the internal whorl (fig. 3g).

Grinding was experimented on single cowries and on a group of shells at the same time. Single grinding was performed by holding the shell between the fingers and rubbing its dorsum on the grinding stone (fig. 6a). Batch grinding consisted in placing several shells<sup>2</sup> on their

<sup>2</sup> Here I used two cowries for which I have previously started the piercing of the dorsum: N° 12 (fig. 2j) was first pierced by indirect percussion, its initial state before grinding was similar to N32 (fig. 2i); N° E13 (fig. 2k) was ground manually for 20 minutes (tab. 1), and its initial state before the batch processing was identical to N° E30 (fig. 2g).

ventral sides inside shallow pits dug in a wooden plank<sup>3</sup> (fig. 6b). The latter was activated back and forth on the grinding stone. This way, the cowries were held the ventral side in contact with the wood while the dorsum with the tool. Both the single and batch grinding produce facets and striations on dorsal sides (fig. 2a, d, j, k; fig. 3g). However, only the second way have caused facets full of striations on the ventral side (fig. 3h, i; fig. 6b), and to a lesser extent on the lateral sides (tab. 1).

Manual grinding of single cowries is a long process that tapers the fingers because of the permanent tension. Thus, it requires several breaks. On the contrary, grinding using the wooden plank provides a very comfortable prehension with almost no pressure thanks to the weight of the wood

<sup>3</sup> Measurements of the wooden plank: around 50 cm length x 10 cm wide x 10 cm thick.

that helped in maintaining the stability of the shells during the action. Few breaks were needed mainly to control the progress of the work. In 19 minutes, instead of one, two cowries were ground according to the same gesture and efforts (fig. 2j, k).

**Combination of techniques**

Indirect percussion was first applied followed by grinding technique on two specimens, E12 (fig. 2j) and E19 (fig. 2d) (tab. 1). For both, grinding has created large flat facets around the perforation and erased completely the percussion stigmata except on the internal whorl. The percussion has partially destroyed the internal whorl while grinding has abraded its remained edge (fig. 3g). In terms of efficiency, this combination of techniques allowed obtaining regular perforations in less than 28 minutes (tab. 1). Application of batch grinding provided, however, a larger perforation as the motion was less tiring than the one requiring manual seizing of the shell. Indeed, the use of this holder has allowed a very comfortable seizing, thus prolonged the motion and created very regular flat perforations.

**The Neolithic cowries**

Cowries of Tell Halula are large-sized shells typologically identified as flat cowrie beads (Alarashi 2014). Among the main dimensions of the shell, the thickness is the one affected by the manufacturing process. For 250 measured cowries, the thickness values show little variations (fig. 4) that can be explained by the variations in the global size. In other terms, the larger is the shell, the thicker it is. However, the shells sharing similar global sizes have standardized thickness values.

The same types and patterns of distribution of technical traces are observed on the complete and broken cowries.

*Traces on the dorsal side*

Macro and microscopic traces are observed on the perforations, which are large openings; the diameter

occupies more than 92% of the cowrie length. The facet, observed on 99% of the shells, is the most commune feature (fig. 1a red arrow). This delimited flat area surrounds the edges of the perforation and exhibits, in a cross-section, the organization of the shell layers (fig. 5a). In most cases, the width of the facet corresponds to the thickness of the shell layers that reaches sometimes 2.9 mm. The regularity and the flatness of these facets as well as the large perforations suggest that the cowries were intensively abraded. Similar facets were produced experimentally (fig.2d, j, k; fig.3g).

The internal whorl is missing (fig. 1a, b) except in one case (fig. 5b). The whorl's edge adjacent to the columellar teeth is damaged for 12.56% of the shells. Very thin and fragile, it rarely shows grinding facets.

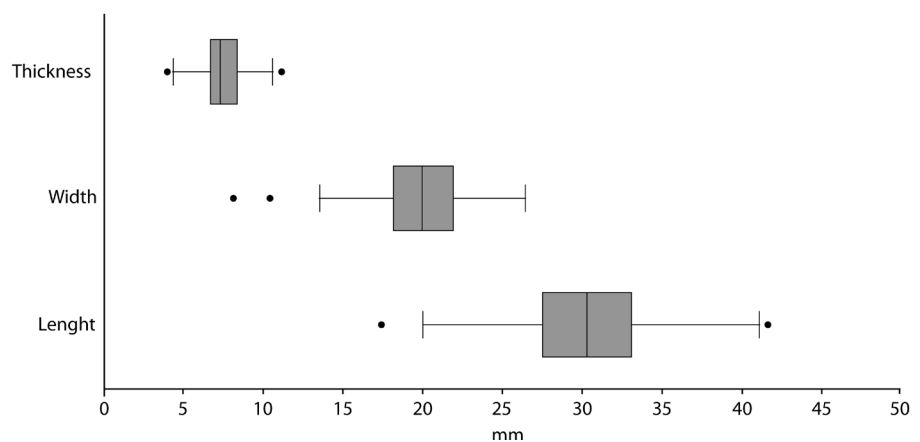
Other stigmata observed on the edges of the perforation are the squamous irregular areas that sometimes interrupt the continuity of the facets (fig. 5c & b). These correspond to the negatives of removal of the shell layers. Such negatives were produced experimentally when applying direct or indirect percussion on the dorsum (e.g. fig. 2c, i; fig. 3b). More than 56% specimens reveal the presence of these removals on the perforation edges, especially on the inner face of the shell. The edges of the internal whorls, much thinner than the perforation edges, present also irregularities and removals.

Striations were detected on 7.5% of the assemblage. These are long and deep parallel or oblique to the shell layers, and fine, interrupted and perpendicular to the shell layers (fig. 5a). Both types were recorded inside the facets, on the edges of the internal whorls, and on the negatives of shell removals.

In sum, cowries' perforations are regular and characterized by the presence of flat and large facets. In addition to these, more than half of the cowries have negatives of removals around the perforation.

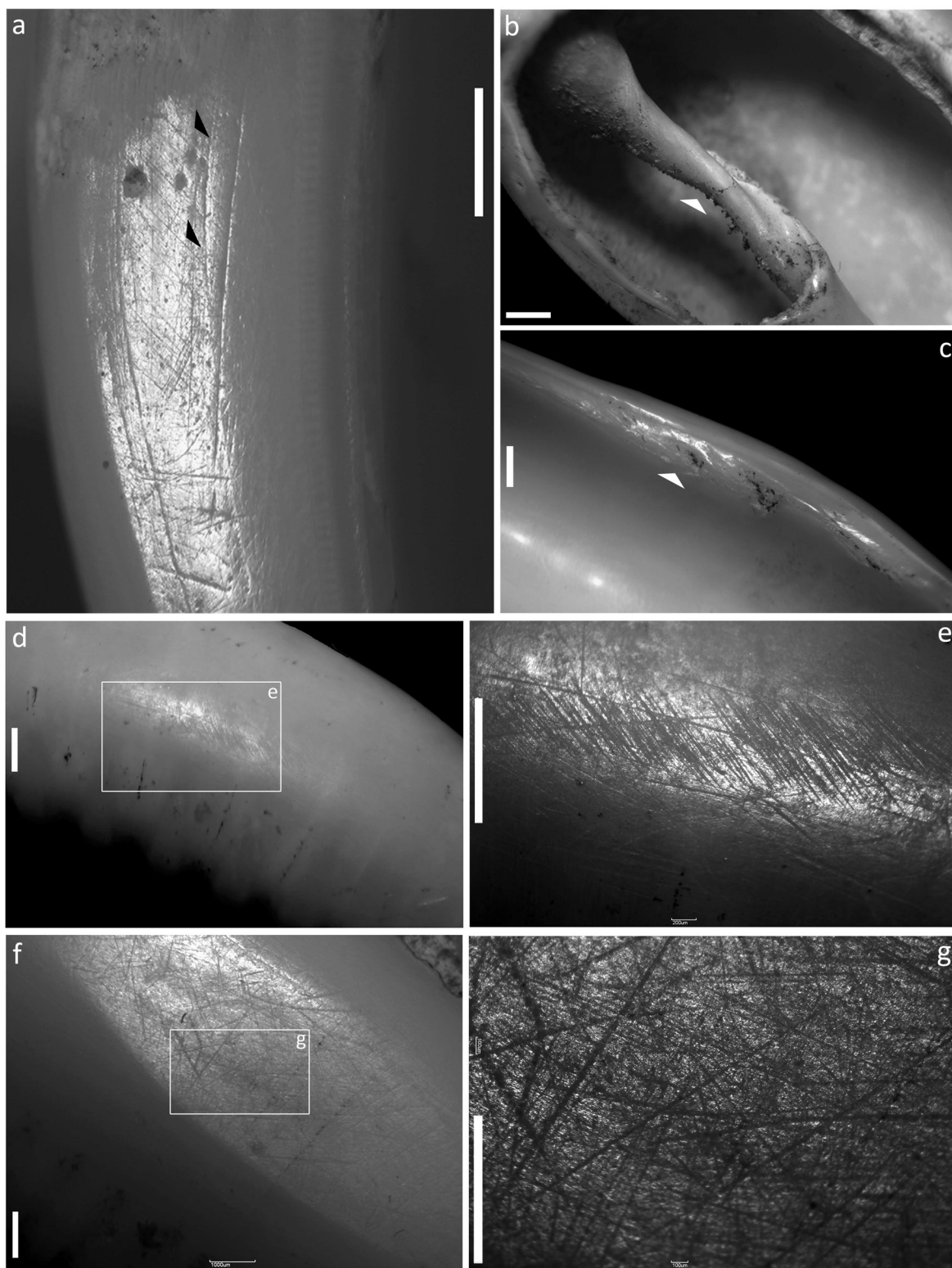
*Intriguing traces on the ventral side*

The ventral side of the cowries also show large facets (fig. 1a, b red halos) along the outer (fig.5e) and the



**Figure 4:** Box plots of the main metric values of the Neolithic cowrie shells of Tell Halula. N=250 shells.





**Figure 5:** Macro and microscopic wears observed on the Neolithic cowries, a- Large facet around the perforation with long deep and fine parallel striations (black arrows), b- Unique example of a cowrie preserving the internal whorl after the dorsum removal, c- Negatives of shell removal on the inner face, d- A facet on an outer lip on the ventral side, e- Long parallel striations covering the facet, f- A facet on a columellar lip, g- Straight multidirectional striations covering the facet. Scales = 1 mm. (Photos: H. Alarashi).

columellar lips (fig. 5f), and occasionally along the lateral sides. These naturally convex surfaces have been clearly flattened. The surfaces of the facets are all covered with groups of straight multidirectional and parallel striations (fig. 5e-g). Well preserved, deep and long, they were easier to detect at a microscopic scale than those on the perforation edges. Negatives of removals are absent.

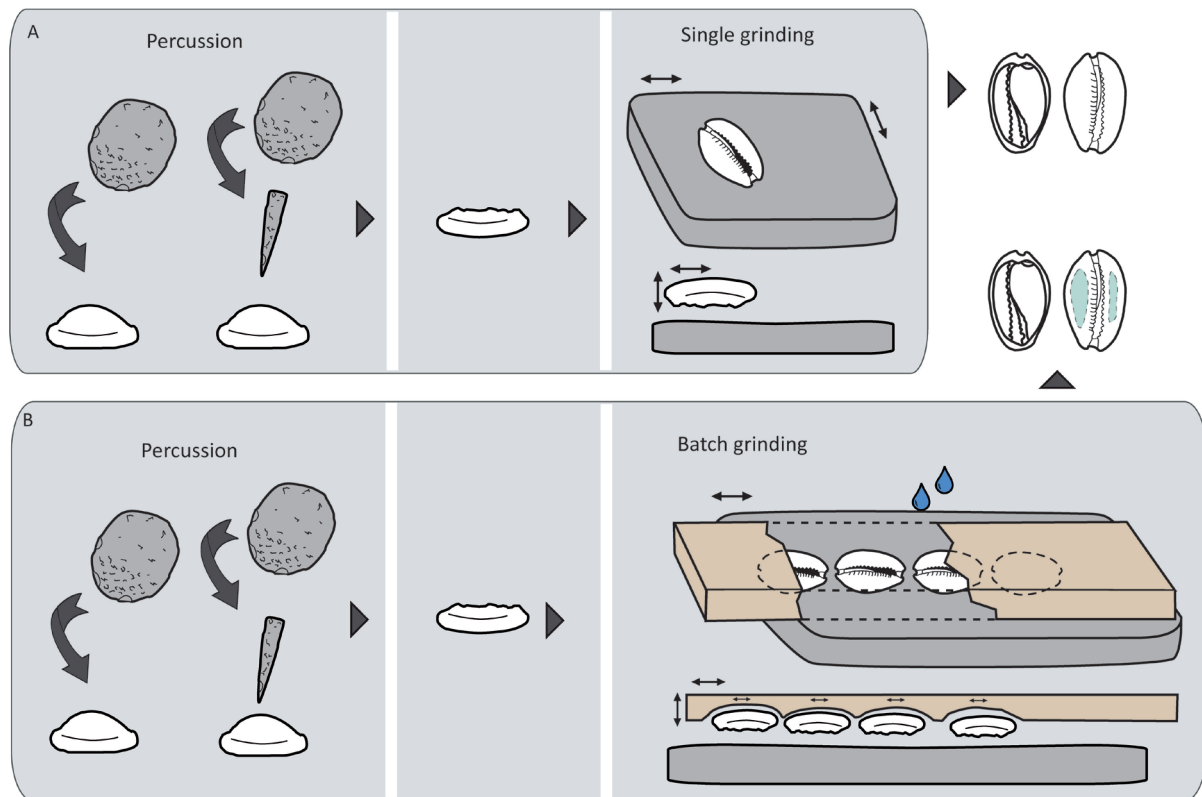
**From the shell to the ornament: an efficient manufacturing method**

Based on the experiments, percussion and grinding are inferred as the techniques applied to obtain the large regular perforations on the Neolithic cowries. Both techniques were deliberately performed. Shored cowries with missing dorsum could have been gathered by the Neolithic groups. However, such shells present generalized natural wear and alteration of the motifs and colors (Taborin 1993; Dupont 2006), which is not the case of the cowries at Tell Halula (Alarashi *et al.* 2018).

For 44% of the assemblage, the percussion traces were not observed. They were eliminated during the grinding that followed, presumably, the percussion. Grinding as the only technique applied for dorsum ablation allows

optimal results. Yet, it implies a considerable time investment. On the other hand, accumulation of both percussion and grinding traces on 56% of the cowries makes the hypothesis of an exclusive grinding of the dorsum unlikely. Similar dynamic of trace accumulation/elimination was produced during the experimental combination of techniques. Therefore, the perforation method of the Neolithic cowries has likely consisted in two stages (fig. 6): the removal of the hemispheric resistant dorsum by percussion, followed by the leveling of the edges of the perforation by grinding. Combining quick and precise techniques, this method presents an interesting compromise between efficiency and quality.

While microwear characterization of the dorsal side hints the employed techniques of perforation, the presence of grinding facets on the ventral sides of the shells remains unexplained. Were they formed because of the stinging system, for example, by a bead-on-bead wear? The position of the cowries on the human skeletons combined to the results of the use-wear study (Alarashi *et al.* 2018; Alarashi 2014) indicate that they formed a chain-like ornaments – none of the ventral, dorsal or lateral sides of the cowries were in contact – and that the ventral side was the one



**Figure 6:** Hypothetical reconstruction of the perforation method of the Neolithic cowrie beads, A- Single grinding, B- Batch grinding. Similar tools and devices were used for experimentations. (Drawing: H. Alarashi).

exhibited. The formation of the ventral facets is therefore not related to the display system nor to the use of the ornament.

Did the facets on the ventral side were formed during the manufacturing process? Identical traces were produced experimentally (fig. 3.h, i), and accidentally, on the cowries placed within a wooden device (fig. 6B). These collateral stigmata due to the dorsal abrasion suggest that those on the archaeological specimens were produced by repeated friction with a holding support or a device during the grinding.

Surely, a holding device can be used to abrade one single cowrie. However, several aspects argue in favor of processing a batch of shells. On the one hand, all the cowries of the corpus present a homogenous finishing quality with identical technical traces. On the other hand, the thickness values are strikingly standardized (fig. 4), which, in addition, strongly echo the exclusive occurrence of the flat type. The technical regularity combined to the size calibration are characteristics of batch processing (Ricou and Esnard 2000; Wright *et al.* 2008).

Tell Halula's cowrie belts and diadems were composed of 12 to 15 shells. Few comprised 16 or more, up to 36 cowries in one case. Notches of variable deepness developed by intense use-wear indicate that the cowries were aligned and attached together by their extremities (Alarashi *et al.* 2018). Obviously, composing cowrie ornaments demanded planning several aspects such as the number of shells and the amount of cords or strings needed for threading. Likewise, the perforation method presents several signs of adaptation in order to accomplish the final aim of the artisanal work, the creation of cowrie ornaments. First, the removal of the dorsum provides access to the natural aperture, thereby a comfortable fastening or threading of the shell extremities. Second, levelling and smoothing the edges of the perforation prevents the damage of the strings, thus, it insures a certain longevity of the ornament. Third, the batch grinding homogenizes the finishing aspect while reducing efforts and accelerating the production. Complying with rapidity and meticulousity, the identified perforation method of the Neolithic cowries can be considered as highly efficient and perfectly adapted to produce series of identical beads.

### **Batch processing and bead crafts**

Considering that many Prehistoric ornaments were composed from sets of elements generally identical makes it plausible to attach the first development of batch processing to the techno-symbolic domain of body ornamentation. In southern Levant, composite ornaments (necklaces, headdresses, leg and ram beaded bands) made of shells and bones occur as early as the Late Epipaleolithic, the Natufian culture (Bocquentin 2003; Wyllie and Hole 2012). Some have benefited from important technological

studies (Davin 2012; Le Dosseur and Maréchal 2013). However, none have questioned the eventuality of a batch treatment during the manufacturing process. On the other hand, batch processing is not appropriate for all bead types. It is also rather manageable for slow techniques that require precision and a repeated action according to the same gesture. For instance, it is applicable for the group of "surface abrasion techniques" (*Techniques d'usure en surface* in French) (Averbouh and Provenzano 1998) that include grinding, polishing and lustering. According to these conditions, batch processing is ideal for disc beads, which are the only known archaeological examples of this treatment. Perforated blanks mounted in groups around a string are ground together in a forth and back motion allowing the complete rotation of the blanks', resulting in identical shapes and standardized diameters.

In Northern Mesopotamia, batch treatment has accompanied the development of disc beads on stone supports since the 10<sup>th</sup> millennium cal BC. Examples are the groups of chlorite standardized disc beads found in the PPNA phases of Tell Mureybet (Maréchal and Alarashi, 2008), the stone disc beads composing ornaments in the early PPNA site of Körtik Tepe (Alarashi 2014), and those of the PPNB phases from Çayönü Tepesi (Ongoing study). Archaeological evidences of batch polishing of disc beads are also well attested for shell and ostrich eggshell in Africa and Europe (*e.g.* Cristiani 2015; Ricou and Esnard 2000; Thomas 2011).

In the wake of the Early Neolithic cultures (PPNA and Early PPNB) marked by the intensification of use of exotic stones, the end of the PPNB period can be considered as a threshold in the domain of body ornaments (Alarashi, accepted). From a symbolic point of view, the consolidation of the farming life style is reflected by a dramatic increase in prestige goods and ornaments. In all the late PPNB villages of Northern Mesopotamia and the Levantine corridor, exotic shells and stones are omnipresent with local materials used for ornaments. These goods have circulated in the region, although their possession by the PPNB contemporaneous groups appears differential (*e.g.* Delerue 2007; Borrell and Molist 2014). At Tell Halula, ornaments made from exotic materials constitute over 96% (Alarashi 2014). Those include important amounts of Red Sea cowrie shells procured over 500 years through regular and intense long-distance circulation networks<sup>4</sup>. During this period of consolidation of the farming life style, cowrie beads gained an unprecedented symbolic value.

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4 The orthodromic distance separating these two extremities is over 800 km, the middle Euphrates being the most septentrional distribution area of Red Sea cowries in the Near East known up to date.

The symbolic importance of cowries for the farming communities during the PPNB finds analogies with the importance of dentalium shells, the hallmark of the early Natufian sedentary groups in southern Levant (Garrod 1957; Bar-Yosef Mayer 2008). The difference between these two key components of the Prehistoric ornamental traditions in the region is that cowrie beads became very widespread all over the Levant and Mesopotamia, before gaining a universal interest persisting until today. Such a PPNB context had undoubtedly provided a fertile ground for the development of technological strategies and knacks to increase the productivity while maintaining a good quality of products. A perfect example of such adaptations is the batch processing. Interestingly, cowries with stigmata very similar to those of Tell Halula occur in contemporaneous sites however in distinct regions of the Near East: in the Middle Euphrates (Ridout-Sharpe 2015), Central (Alarashi 2010) and southern Levant (ongoing study of cowrie beads from Ba'ja).

Finally, considering the batch treatment within a Neolithic context of intensive circulation networks of prestigious goods raises the question of craft specialization (Perlès and Vitelli 1999; Spielmann 2002; Perlès 2007; Wright *et al.* 2008). While more data is required to argue the specialization in shell bead-making during the PPNB in the Levant, several studies point out already the development of extremely skilled technological abilities and high specialization in stone bead crafts (Wright *et al.* 2008; Groman-Yaroslavski and Bar-Yosef Mayer 2015; Alarashi 2016).

## Conclusion

The microscopic characterization of cowrie beads at the shell's scale, and the comprehension of the results at the ornament's scale allowed inferring the perforation method and the technological management that have entailed batch finishing. Development of such technological means within bead crafts raises several questions regarding the status of the ornaments, the social role of the craftsmen and of the individuals who displayed these products to adorn their bodies. In a late PPNB context with clear signs of specialization in bead crafts and intense circulation networks of prestigious products, batch processing of cowrie shells appears as one of the logical adaptations of the techno-symbolic development conducted by the early farming societies in the Levant.

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