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LEVALLOIS POINTS PRODUCTION FROM EASTERN YEMEN AND SOME COMPARISONS WITH ASSEMBLAGES FROM EAST-AFRICA, EUROPE AND THE LEVANT

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Introduction

The recent discovery of evidence for the production of Levallois points in Hadramawt, in the east of Yemen, marks a milestone in the development of definitions of the Palaeolithic in the Arabian peninsula. These industries, still undated, but very likely from the Middle Palaeolithic, are currently almost exclusively documented by cores found on the surface of several sites at the top of the Hadramawt limestone plateaus.

The scope of this paper is to structure, in a preliminary approach, the Levallois production schemes observed in Yemen. This work is based on a still limited corpus of materials and might be somewhat arbitrary. Further investigations will show which of the production schemes present in fact reflect the prevailing southern Arabian mainstream. This study of the last phases of production on the cores allowed six production patterns to be identified, which show the making of two types of Levallois points; the so-called "classical" points and "constructed" points. These patterns reflect a variability of production within the limited geographical area in which this study has been conducted.

Through a comparative approach with other sites of production of Levallois points in neighbouring and more distant regions (East Africa, the Levant and Europe), we attempt to determine to what extent the production of Levallois points displays technical, and therefore cultural, similarities in the Hadramawt and around the world.

Palaeolithic of Arabia

In-depth studies on the Palaeolithic in the Arabian Peninsula are relatively recent, compared with those in Europe, Africa or the Levant. In recent years, the multiplication of excavations and survey operations on surface sites in southern Arabia (Amirkhanov 2006; Crassard 2009a; Delagnes *et al.* 2008; Rose 2006) implies many discussions and reflections on the role that this region could have played during prehistory (Amirkhanov 2008; Crassard 2008a, 2008b, 2009a, 2009b; Marks 2008; Rose & Bailey 2008; Petraglia & Rose 2009).

As regards more particularly the Middle Palaeolithic, the first studies on lithic materials indicate a relatively abundant presence of remains from this period in Arabia. These vestiges are mainly evidenced by lithic industries of the Levallois tradition. They come mainly from surface sites and, in this case, their high degree of patina confirms Pleistocene dating without much doubt, although this criterion should be considered with caution (Crassard 2009a). The problem remains to date this material radiometrically and to be able to find archaeological contexts that combine Levallois production with human and faunal remains. This would associate the industries with a chrono-cultural frame and would allow us to learn more about the Middle Palaeolithic knappers' environment, as well as the nature of the population and its dispersal: what origins and what species? While awaiting more details, which will be provided by the excavation of stratified sites, it is essential to provide a first comparative element, at intercontinental and micro-regional scales, from our sole source of information: lithic industries, and more particularly the Levallois points industries, which are relatively convenient to identify and therefore to compare.

The production of Levallois points: definition and geographical distribution

The Levallois concept

The Levallois concept consists in producing in a predetermined manner flakes, blades or points, thanks to the implementation of different methods of flaking (*débitage*) involving technical traditions that can be understood from the study of reduction patterns (Boëda 1994). This concept of debitage was used for nearly 500,000 years, from the African Acheulean until the end of the Middle Palaeolithic, and even in an isolated way during the Upper Palaeolithic and the Holocene. Levallois flake production appears with the Acheulean, at isotopic stages 10 and 9, but is generalised to the Middle Palaeolithic from stage 8 (Delagnes *et al.* 2007). The Levallois concept has been widely described and illustrated through the study of various assemblages (e.g. Bordes 1961; Boëda 1991, 1994; Delagnes 1992; Van Peer 1992). Levallois production schemes are evidenced on different continents; in Europe, the Middle East and northeast Africa (e.g. Crew 1975; Meignen & Bar-Yosef 1988, 1991, 1992,

2004; Van Peer 1992; Dibble & Bar-Yosef 1995; Meignen 1995; Delagnes & Meignen 2006; Delagnes *et al.* 2007).

In the Arabian Peninsula, the presence of Levallois debitage has been relatively recently identified in Yemen, first by Caton-Thompson (1938, 1953) and then by Van Beek (Van Beek *et al.* 1963), Inizan (Inizan & Ortlieb 1987) and Amirkhanov (1991, 1994). Since then, archaeological studies, including surveys of surface sites, have reported the presence of Levallois debitage in Saudi Arabia in the Jubbah basin (Petraglia & Alsharekh 2003: 675, 677), in the United Arab Emirates in the region of Fili close to Sharjah (Scott-Jackson *et al.* 2008; Wahida *et al.* 2008), in the centre of the Sultanate of Oman with the Sibakhan facies and its rare unipolar convergent Levallois cores (Rose 2006), and in Yemen in Wadi Wa'shah, Wadi Sana and the region of Hadramawt in general (eastern Yemen: Crassard 2008a, 2009a), as well as in the foothills of the Western Highlands at the interface of the Tihamah coastal plain with the sites of Shibat Dihya, including SD1 site in Wadi Surdud (Delagnes *et al.* 2008). This last site apart, which is dated by OSL method to around 60 ka BP, the Levallois presence in Arabia is not precisely dated.

Definition of the Levallois points production

Within the Levallois concept, a relatively important variability exists in the implementation of knapping operations. Production objectives can also be varied and getting oriented to the obtainment of points. In this case we have to speak of the production of Levallois points (*débitage Levallois à pointes*), recurrent or not, which aims at the making of triangular flakes, sometimes standardised.

It was in 1961 that Bordes described for the first time the flaking of a Levallois point, from the cores and points encountered in different industries from northern France (Seine Maritime and Somme) and Jordan (the site of Abu Sif). Later, Bordes (1980) described the production of Levallois points according to two modalities of preparation; preparation by unipolar convergent removals, flaked from the striking platform of the future point, or a unipolar divergent preparation by removals made from a striking platform opposite to that of the future point. Bordes also resumed schemes defined on the "Nubian" cores (Guichard & Guichard 1965), of which two types have been distinguished. The first type corresponds to "a Levallois point core characterised by a special technique", which Bordes brings closer to the Levallois point cores with a preparation by two unipolar divergent removals from an opposite striking platform to that of the point, and a second type with an elaborated centripetal preparation on a block of triangular morphology from which will be produced a Levallois point, but not in a "classical" way (Guichard & Guichard 1965:68-69). For Bordes, the objective of this second scheme is not the production of a Levallois point, but a triangular flake. A few years later, a third production scheme was proposed for obtaining a Levallois point, while pointing out the existence of many variants (Inizan *et al.* 1995:69). This scheme is the production of a Levallois point resulting from a strict bidirectional preparation. More recently, from the material found on the site of Umm el-Tlel (Syria), Boëda illustrated the diversity of the procedures implemented for the production of points (Boëda *et al.* 1998). After analysing the points and sub-products, Boëda defined two main groups: the so-called "three hits" (*trois coups*) points (that we qualify here as "classical" points), which are distinguished from the "constructed" points in which different schemes coexist depending on the direction of the preparation removals. Furthermore, Boëda had previously proposed around 30 theoretical patterns of Levallois "three hits" points production, from an experimental corpus (Boëda 1982), an approach previously developed by Crew (1975). It is important to emphasise the heuristic value of such a study, allowing us to consider the variability of the Levallois concept despite the existence of a single objective, that is, the production of "classical" points.

Geographical distribution of Levallois points production

The production of Levallois points seems less geographically widespread than the production of Levallois flakes (fig. 1). It is especially attested in Eastern and Western Europe (OIS 7 and 6). At the Koulichivika site in Ukraine, and in the Bohunician in general (Meignen *et al.* 2004) the Levallois points show great morphological variation and are produced by the exploitation of the surface and then the thickness of the block, after a bidirectional or bipolar preparation. In the north of France, a few assemblages from open-air deposits have shown a production of Levallois points (Bordes 1954; Vallin 1988, 1992; Delagnes & Roppars 1996; Watté *et al.* 1999; Locht *et al.* 2000, 2001, 2002, 2003). Like the majority of the Levantine assemblages, the classical production scheme (unipolar convergent) is the more common; for instance, the lithic material from the site of Houppeville (Vallin 1988, 1992), the B assemblage from Le Pucheuil (Delagnes & Roppars 1996), the N2b layer at Bettencourt-Saint-Ouen (Locht *et al.* 2001; Locht 2002) or the sector 1 at Le Petit-Saule (Locht *et al.* 2003). Only the collection from Therdone site (189–167 kaBP, Locht *et al.* 2000) differs from this set of Levallois points from the north of France by the presence of a greater diversity of patterns of preparation of the convexities: preparation by unipolar convergent removals, sometimes reworked by distal removals; preparation by unipolar opposed and bidirectional removals; or preparation of the convexities by centripetal removals (Gadebois 2006). In the Rhone Valley, if some industries have points that are morphologically close to the Levallois point (at Mandrin, at Néron layer III: 43 ka BP and at Abri du Maras), their realisation seems to be far from the Levallois concept, according to Slimak (2004).

The production of Levallois points is relatively abundant and characteristic of some assemblages from the Levant (OIS 4 and 3), from the Lebanese sites of Ksar Akil (Meignen & Bar-Yosef 1998, 2004) and Bezez Cave (Copeland 1983), from the Israeli sites of Rosh Ein Mor (Marks & Crew 1972), Abu Sif (Neuville 1951; Copeland 1975), Tabun (Copeland 1975; Jelinek 1982; Meignen & Bar-Yosef 1988), Kebara (layers IX and X : 64–48 ka BP, Meignen 1995, Meignen & Bar-Yosef 1988, 1991, 2004; Meignen *et al.* 2006), Qafzeh XV (Hovers 1997) and Amud Cave (layer B1 : 58–53 ka BP, Watanabe 1968, Hovers 1998; Meignen 1995), or from Jordan at Tor Faraj/Tor Sahiba (69–44 ka BP, Henry 1995, 1998, 2003; Meignen 1995) and in Syria at Umm al-Tlel (65–50 ka BP for layer VI3b', Boëda *et al.* 1998). In most cases, concerning the production of elongated points or

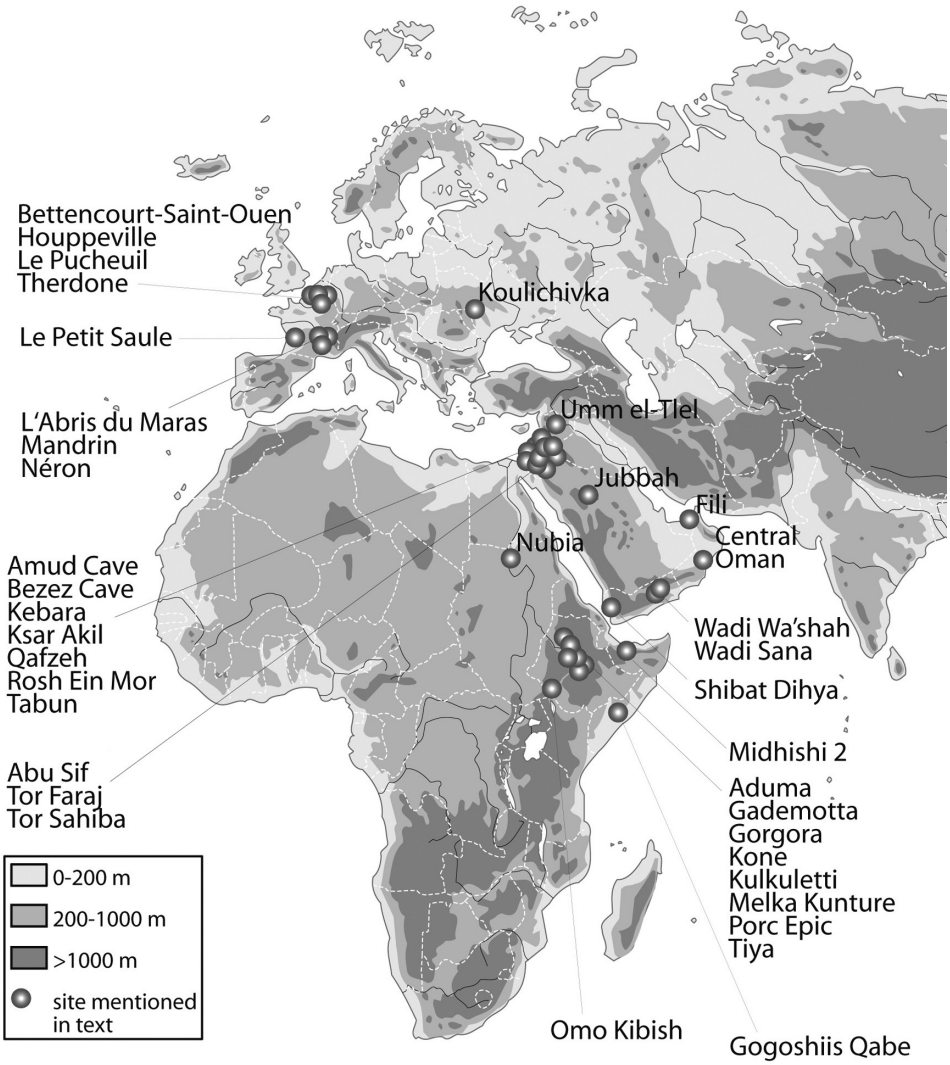

Figure 1 - sites mentioned in text, of the Levallois points productions.

shorter wide-based points, the convexity is created by a unipolar dominant removal, or sometimes by two proximal unipolar convergent removals, even if some of the Negev series testify to the existence of a preparation from the distal part (Meignen & Bar-Yosef 1988). The site of Umm el-Tlel seems characterised by more varied preparation schemes (mainly unipolar convergent, sometimes recurrent, centripetal, bipolar, orthogonal) (Boëda *et al.* 1998).

The production of Levallois points is also attested in Nubia and Egypt during the Middle Stone Age (with very little chronometric data, these are dated between 300 and 50 ka BP), but the evidence is much less abundant than in the Levant. Preparation types are very different from those encountered in Levantine deposits: either centripetal (in reference to Nubian debitage type 2) or unipolar from the distal part of the core (Guichard & Guichard 1965; Hours *et al.* 1973; Van Peer 1992). In the Horn of Africa, several sites have delivered assemblages featuring Levallois points. This is particularly the case in Ethiopia at the Gorgora rockshelter (no dating, Moysey 1943; Leakey 1943), or at Pork-Epic Cave (70–60 ka BP, Clark *et al.* 1984, Pleurdeau 2001), where they are uncommon and come from a unipolar convergent management, more rarely bipolar (Pleurdeau 2003), or of a Nubian type as at Kone (no dating, Kurashina 1978). Industries that have shown a significant number of Levallois points are known in northern Somalia at Midhishi 2 (no dating, Brand & Gresham 1989). Some points have been found at Omo Kibish (site AHS 195±5 ky, Shea 2008). The lack of technological descriptions of these finds means it is not always possible to determine which method was used to obtain these points.

In the East African MSA tradition, tools are characterised by points with unifacial and bifacial retouch on blanks likely Levallois, as is the case at Gademotta (ETH-72-8B before 276±4 ka BP, Wendorf & Schild 1974; Nubian at ETH-72-6 after 183±10 ka BP, Morgan & Renne 2008) and at Kulkuletti (200–300 ka BP, Wendorf & Schild 1974) and Tiya (surface, Joussaume 1995), Aduma (100–80 ky, Brooks *et al.* 2005), Melka Kunture (Garba III, Hours 1976), Gorgora (Leakey 1943) and in Somalia at Gogoshiis Qabe (no dating, Brand & Gresham 1989; Clark 1988). The great difference between these and the Levantine Middle Paleolithic is a much less systematic production of Levallois points during the East African MSA.

The production of Levallois points in Hadramawt, in the east of Yemen, presents a relative diversity of reduction patterns. Care-

ful analysis of the material gathered during surveys allows us to complete the production models proposed by our predecessors and emphasises a greater diversity of the already known production modalities. Here, the proposed study details and refines the previously proposed nomenclature (Crassard 2009a), thanks to the contribution of new sites which were discovered during surveys in January 2008. In the future it will be interesting to confront the different reduction patterns in the production of Levallois points that are known in Hadramawt with a broader geographical context, in order to identify any technical similarities between these industries and those from East Africa, the Near East and Europe.

Production of Levallois points in Hadramawt region: context of discovery and presentation of the studied assemblage

Hadramawt, covering part of the centre and the east of Yemen, is a region of limestone plateaus formed during the Palaeocene and Eocene which can reach altitudes of more than 1000 m. Erosive activity over the millennia has formed an impressive network of canyons and steep valleys. Two main areas have been selected in this study; Wadî Wa'shah to the north and Wadî Sana to the south, two wadis located on either side of Wadî Hadramawt (or Wadî Masîlah), whose orientation follows a west–east axis.

The sites that have delivered cores for Levallois points are located at the top of the limestone plateaus. They were discovered during archaeological operations in two distinct projects; The Roots of Agriculture in Southern Arabia Project (RASA) in Wadî Sana and the French Archaeological Mission in Jawf-Hadramawt (HDOR) in Wadî Wa'shah. A total of 27 surface sites with artefacts reflecting the production of Levallois points have been studied (18 by HDOR and 9 by RASA fig. 2). They were mostly characterised by the discrete presence of lithic industries directly found on the surface. These Levallois debitage collections very rarely included typical Holocene pieces (arrowheads, less patinated lithic material). A few sites, however, delivered abundant material bringing together several lithic production phases (reduction flakes, Levallois flakes and points, etc.), but unfortunately in a context too uncertain to make an accurate study of all the vestiges. It has thus been decided to focus this study on some cores and points, and therefore on the very last visible phases of the Levallois production, visible through the removal scars on the abandoned cores. A total of 50 cores used for the production of Levallois points has been analysed, with the four Levallois points that have been collected. Well aware of the limits inherent in the almost exclusive analysis of cores in the general understanding of schemes of production, nevertheless it seemed interesting to deliver here our observations which, to our mind, participate in the recognition of a greater diversity of the schemes of production of Levallois points realised by prehistoric human groups.

Analysis of the cores for Levallois points from Hadramawt

In previous studies (Crassard 2007, 2008a, 2009a), the different procedures attested by the Levallois debitage in Hadramawt

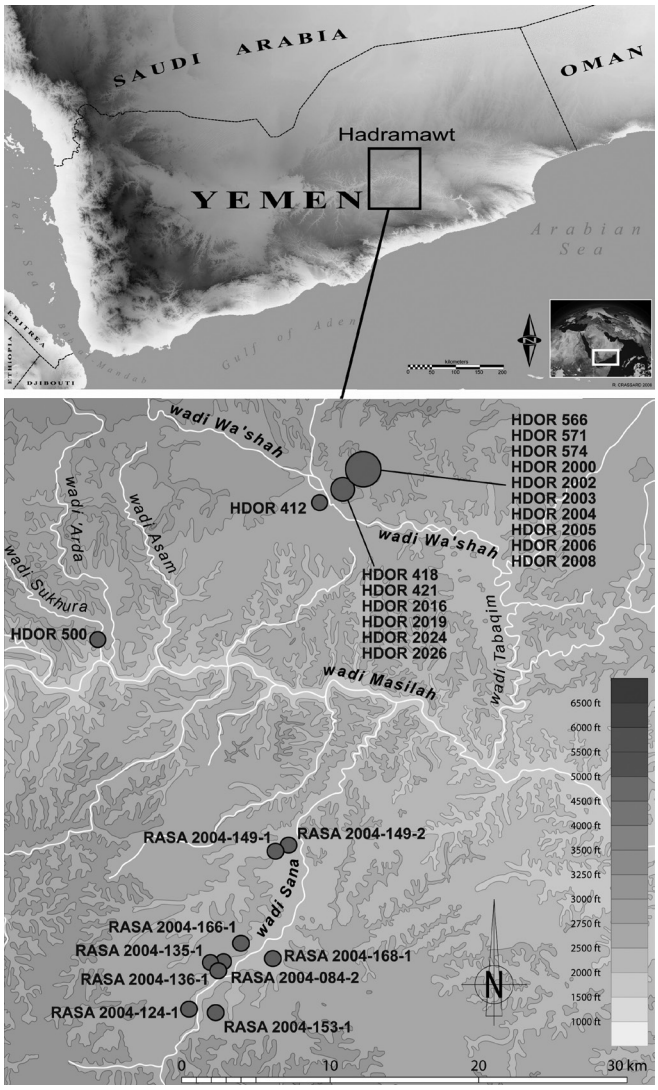

Figure 2 - Sites from Hadramawt, Yemen, where Levallois points production has been documented.

have been defined through three broad categories: Group A for the Levallois debitage with one (or two) preferential flakes, Group B for the Levallois debitage of points, and Group C for the centripetal recurrent Levallois debitage. Groups A and B include several modalities. We resume here Group B, which brings together the procedures for obtaining Levallois points. Thus, to the four previously identified schemes (B1, B2, B3 and B4, Crassard 2007), a fifth one has been added (B5), while group B2 has been associated with group B1.

The categories of points production have been established based on the direction of the preparation removals seen on the debitage surface of the cores. The categories are divided into subgroups based on the absence or presence of scars which accentuate the distal or lateral convexities by removals of more centripetal directions (fig. 3).

Thus, we find patterns corresponding to the "classical" points and to the so-called "constructed" points from Boëda's work. However, we preferred a first-level categorisation based on the direction of preparation removals because, regarding the material collected in Hadramawt, some production schemes of the

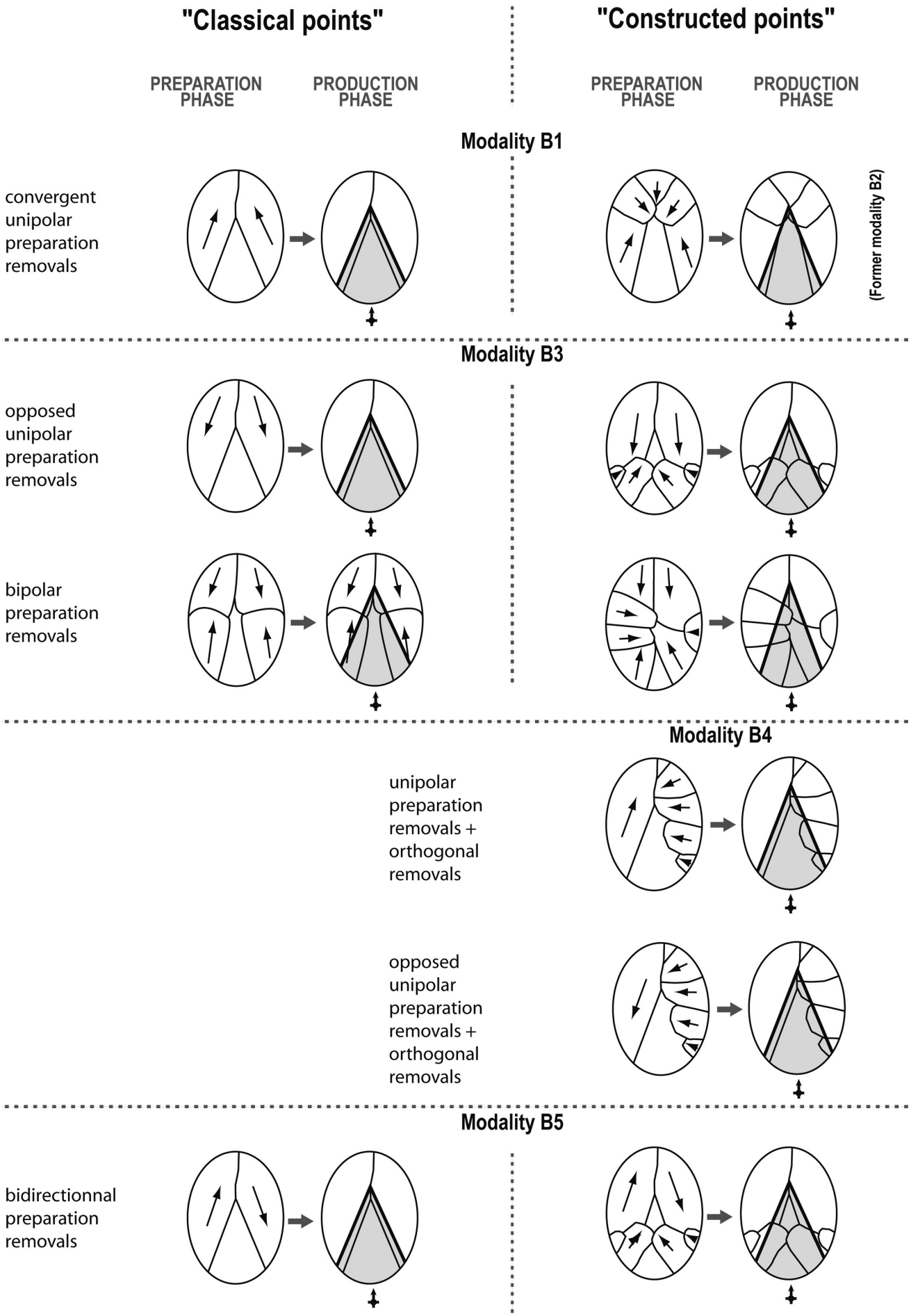

Figure 3 - Group B schemes.

so-called "constructed" points are more an improvement of the production of convexities prior to a truly independent conceptualisation of the production schemes of the "classical" points.

Scheme B1

This is the production scheme of the "classical" points and the one most commonly encountered. It is characterised by the prior production of two convergent unipolar removals from the proximal part of the core. These scars will prepare the lateral and distal convexities (HDOR 2000 No. 1 and 2003 No. 1). This is scheme B1 for "classical" points (fig. 4). In a few rare cases, the two convergent unipolar removals may be accompanied by a few removals that accentuate the distal convexity (RASA 2004-166-1, former scheme B2). They correspond to scheme B1 for "constructed" points (fig. 5).

Scheme B3

Two sub-schemes have been distinguished: B3 opposed unipolar and B3 bipolar.

Scheme B3 opposed unipolar

This first sub-scheme includes unipolar preparation removals from the distal part of the core. They are therefore opposed to the striking platform that will be used for extraction of the point. These two removals contribute to the creation of the distal and lateral convexities, and no other preparation is present. This is thus a production of "classical" points. However, the plunging negative of the point still present on one of the cores shows that the distal convexity is sometimes insufficient (HDOR 2000 No. 2). The cores can then benefit from a new preparation of convexities by some distal and/or lateral removals (HDOR 2005 No. 5). There is then a production of "constructed" points (fig. 6). Around the core HDOR 2005 No. 5, the two unipolar removals from the distal part are still visible, but the right lateral part has undergone a reorganisation of its convexity by the production of shorter flakes of a centripetal direction, which have here hinged. Two removals in the left proximo-lateral part probably allow accentuation of the convexity obtained by the first removal. In this case, the presence of secondary removals seems thus more related to a lack of convexity than to an independent scheme.

Scheme B3 bipolar

This second sub-scheme differs from the first by the presence of negatives of bipolar removals. It is somehow a mixture of schemes B1 and B3 unipolar described above. The convexity may thus be made by a series of multiple bipolar removals from the distal and proximal parts of the core (HDOR 2003 No. 8 and HDOR 2004 No. 1), thereby producing "classical" points (fig. 7). As with previous schemes, when lateral or distal convexities are not quite pronounced, a new phase of preparation is implemented and lateral or distal removals of a centripetal direction can thus overlap the first negatives of removals, thereby causing the knapper to consider the production of "constructed" points. In two of the cores belonging to this category, the lateral centripetal removals overlap bipolar scars, and two others

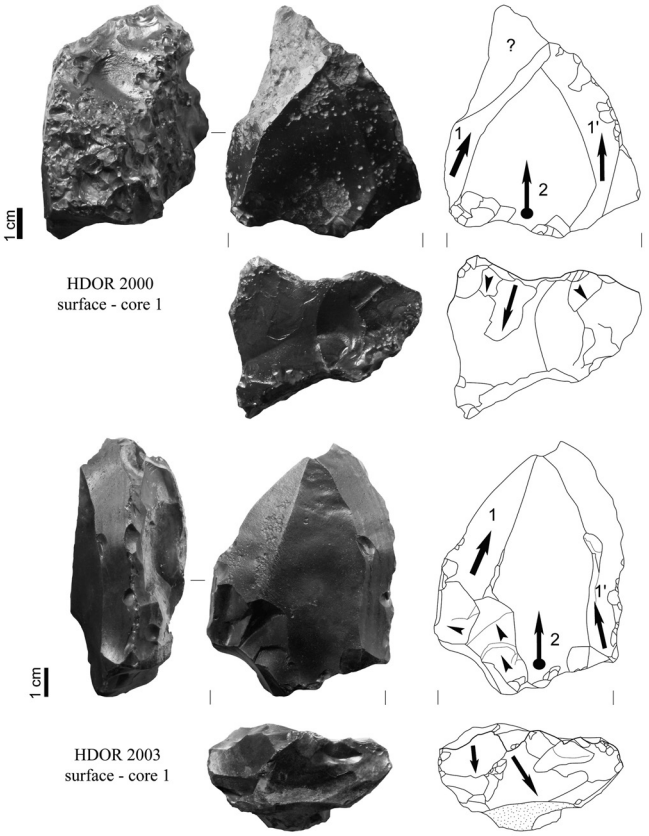

Figure 4 - Scheme B1, "classical" points.

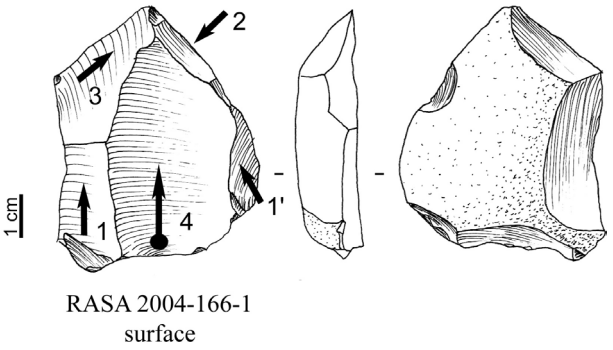

Figure 5 - Scheme B1, "constructed" points.

feature lateral centripetal removals overlapped by unipolar or bipolar removals (HDOR 566 No. 1, fig. 8).

Scheme B4

By its characteristics, scheme B4 exclusively includes the modalities of production of "constructed" points. It is subdivided into two sub-schemes: B4 proximal and B4 distal (fig. 9).

Scheme B4 proximal

This scheme includes the preparation of a lateral convexity by a major invasive removal from the proximal part (HDOR 2003 No. 5) while the convexity of the opposite side is prepared by shorter removals of centripetal direction. The strict independence of this method from previous schemes is not obvious. The

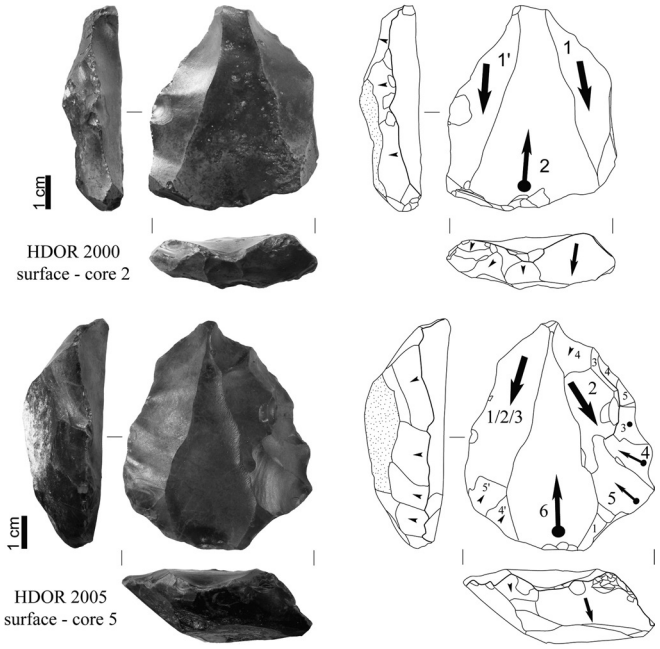

Figure 6 - Scheme B3 opposed unipolar: top, "classical" points; bottom "constructed" points.

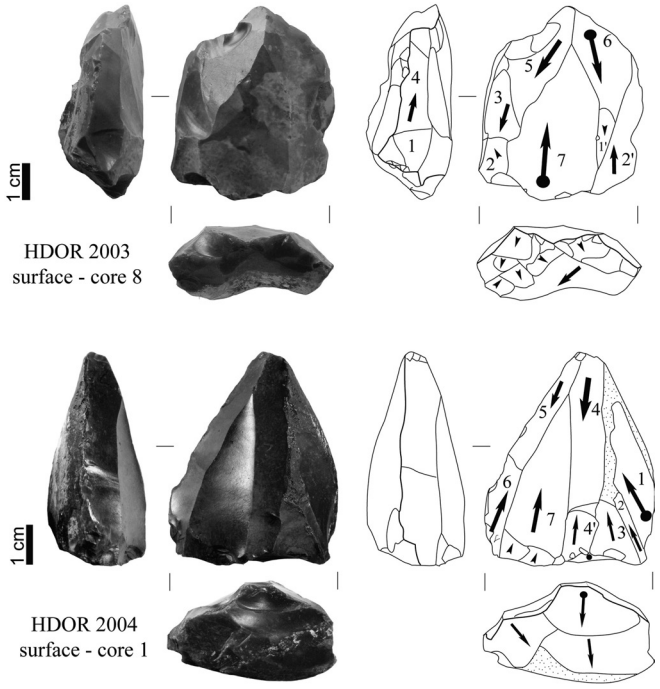

Figure 7 - Scheme B3 obipolar, "classical" points.

centripetal negatives may hide previous, more invasive, unipolar or bipolar removals.

Scheme B4 distal

These show the same preparation of convexities, but this time from the distal part of the core (HDOR 2004 No. 4).

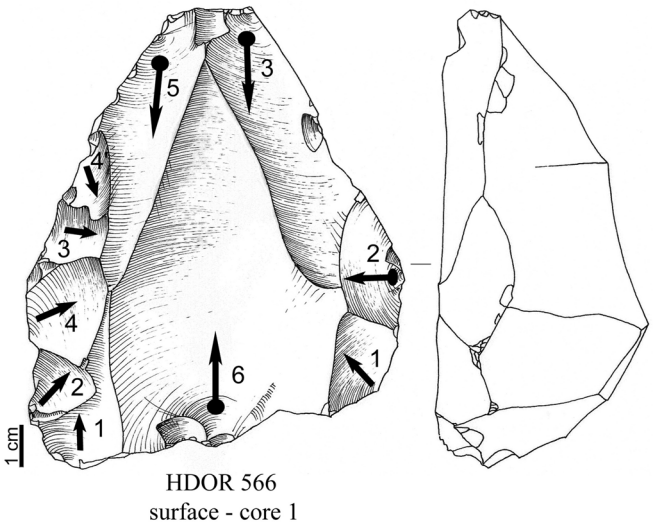

Figure 8 - Scheme B3 bipolar, "constructed" points.

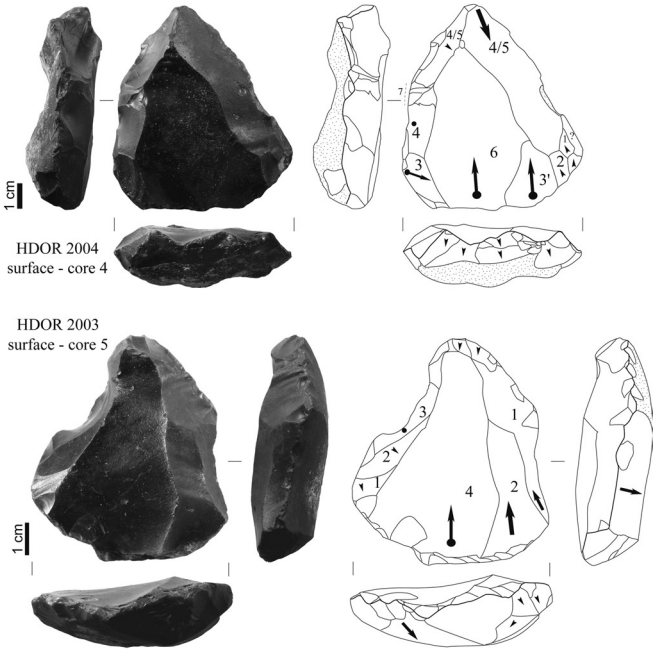

Figure 9 - Scheme B4.

Scheme B5

Its originality from previous schemes is in the preparation of a striking surface by two lateral bidirectional removals (production of "classical" points). One of the cores classified in this scheme could also testify to a recurrent production of bipolar points (HDOR 2003 No. 4).

This schema is fairly widespread (fig. 10) and may be supplemented by lateral removals, emphasising lateral convexities ("constructed" points production). Three cores pertaining to this scheme feature one or two more centripetal lateral removals (HDOR 2016 No. 2 and HDOR 2004 No. 5).

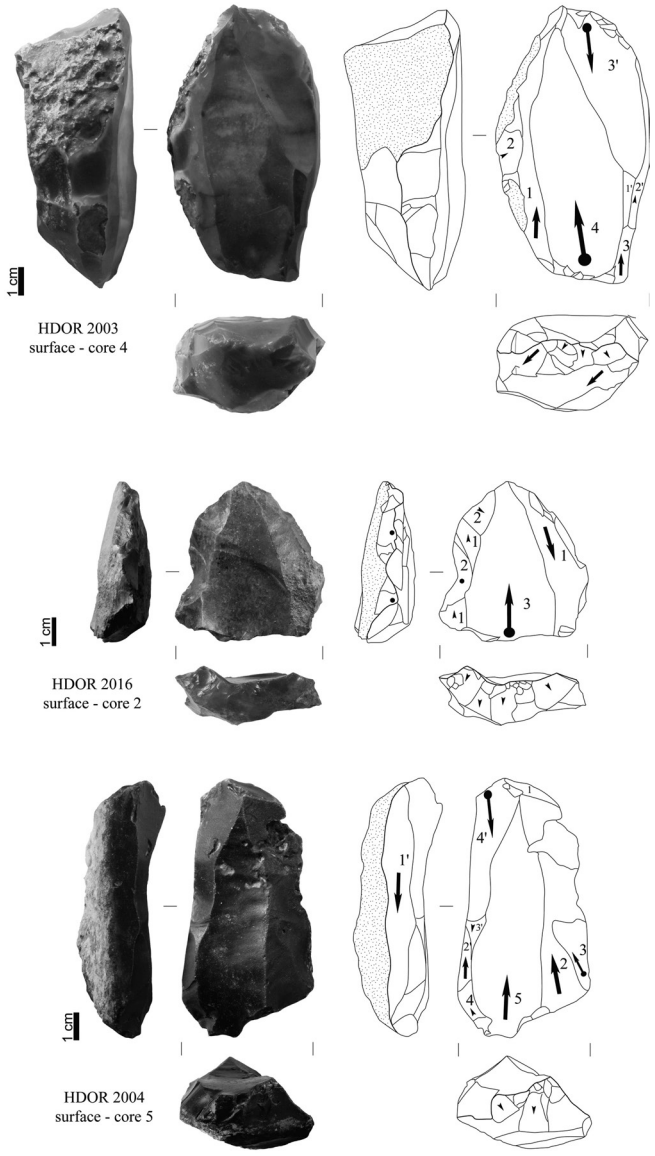

Figure 10 - Scheme B5.

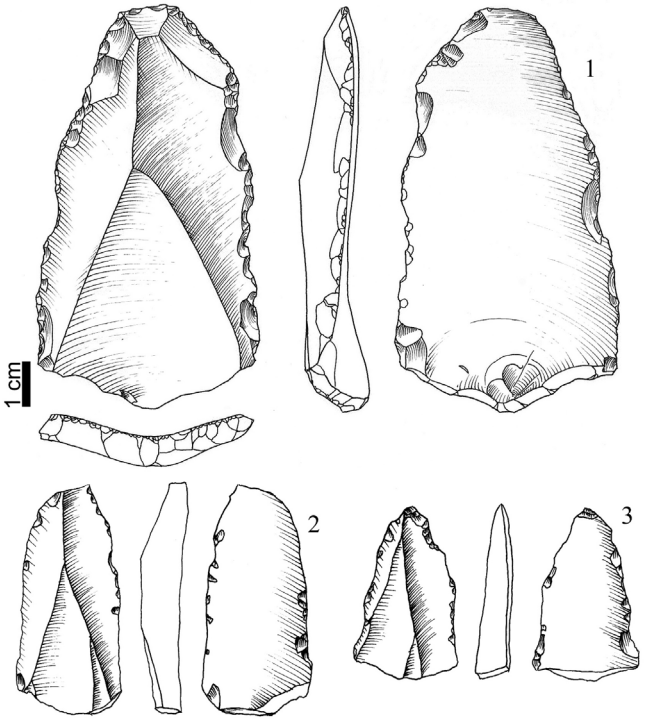

Figure 11 - Levallois points from Hadramawt, Yemen (2 and 3 are proximal fragments).

Production modality	"classical" points	"constructed" points	Total
B1	13	3	16
B3 unipolar	7	2	9
B3 bipolar	6	4	10
B4 proximal	-	1	1
B4 distal	-	4	4
B5	7	3	10
Total	33	17	50

Table 1.

Analysis of Levallois points

The points collected are very rare, just four. Their small number is due to the near absence of these pieces from the surveyed sites. They feature scars of unipolar convergent removals, linking them to the B1 group. One of them contains negatives of removals on the distal part which suggest a more sustained preparation of the distal convexity (potentially linked to the former scheme B2, i.e., scheme B1 for "constructed" points) (fig. 11).

Since the reference corpus of the Levallois points is extremely limited for Hadramawt, it seemed relevant to investigate the morphological and dimensional characteristics of the negatives of points, from the cores themselves. With regard to the morphological characteristics, the negatives of points observed on the cores are rather heterogeneous (fig. 12). A relatively large variation exists in the final shape of the resulting point, being long and thin, wide and short, wide and long, or short and thin. Analysis of the dimensional data (lengths and widths) for each method of production group does not particularly distinguish particular morphometric groups which could indicate a type of product for a particular method of production (fig. 13).

Thus, diversity of preparation schemes seems not to relate to any particular type of point. Accordingly, it is questionable if this diversity is due rather to the shape of the blocks of raw material, to some special technical knowledge, or to the final state of the debitage which does not allow us to identify the possible existence of the different stages of the schemes on a block due to the possibilities or the accidents of knapping that occurred.

Conclusions

Despite a limited number of cores, it was possible finally to identify many procedures for obtaining Levallois points. Such variation in the methods implemented for the production of Levallois points could, however, be typical to the Hadramawt region. At a regional scale, the presence of Levallois debitage

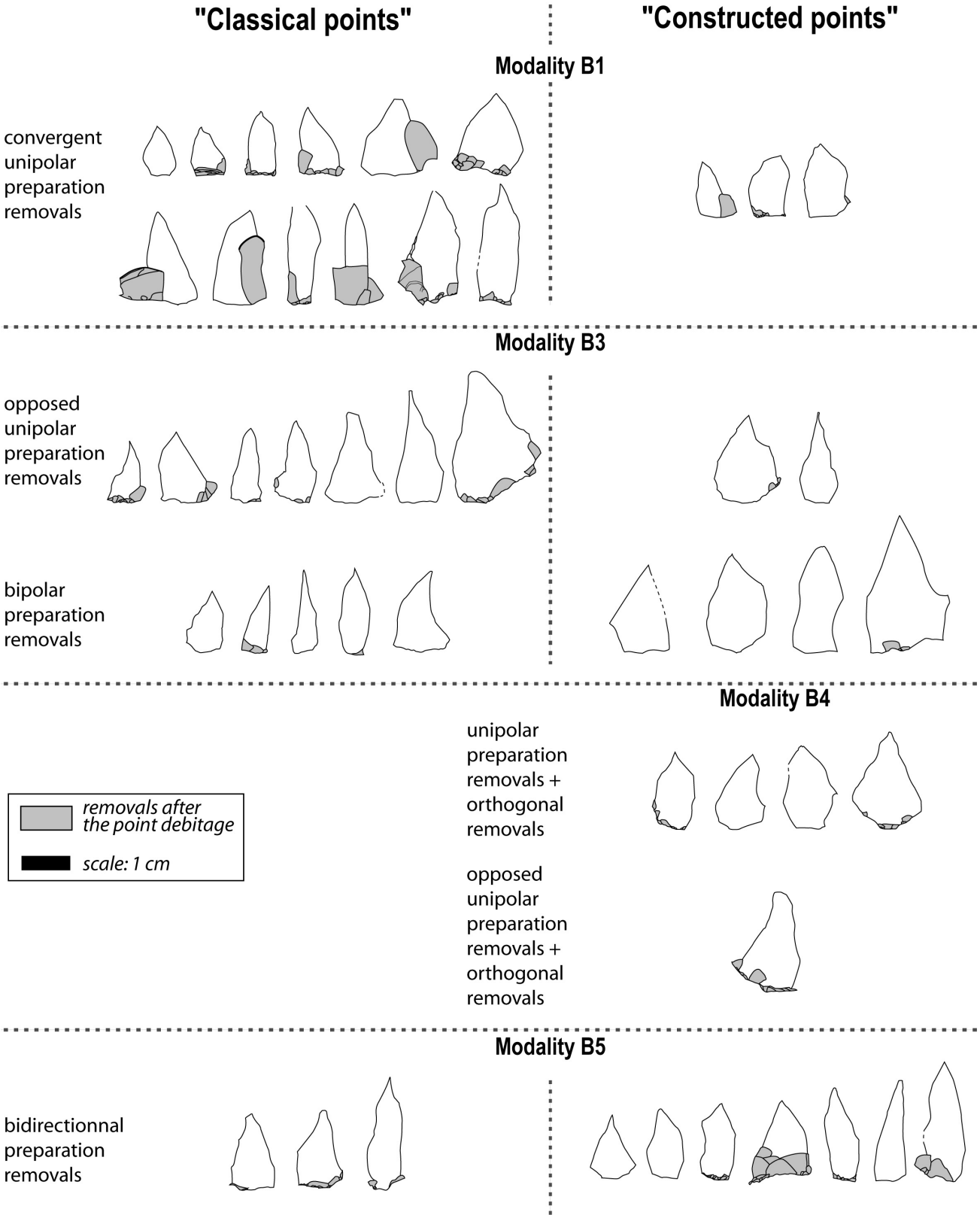

Figure 12 - Reconstructed shapes of Levallois points, from the analysis of the cores.

in general, for making points or not, can be explained by a diffusionist approach. Its presence in the plateaus in the east of Yemen could match the dispersal of the Levallois concept from the African coasts and/or from Levantine regions.
Furthermore, the possibility of an adaptive local development of the knapping modalities is quite likely. From an exogenous population base, future generations could very well have developed their own conceptual systems of preferential productions influenced by types of raw materials and technical or cultural traditions specific to those regions, which would explain the presence of a greater variation and even a greater diversity of knapping schemes in Hadramawt.

If the analysis of the scarce lithic material here cannot answer these questions, it does however offer a few elements of comparison with the assemblages from Africa and the Levant. The first dated archaeological data from Yemen and the first detailed comparisons thus tend to favour the hypothesis of the existence of an area of endemic development in southern Arabia, and this at different times of prehistory (Crassard 2008a, 2009a, 2009b).

Nevertheless it is fair to nuance the scope of this study on the material from Hadramawt region. Indeed, as the results of this analysis are based on a relatively small number of cores and just four points, it seems difficult to rule on the strictly independent character or not of the schemes described here. Do they attest to a real diversity of procedures in the production of Levallois points, or of a mere variation reflecting the adaptation by the knappers to the morphology of the blocks, to the stages of exhaustion of the exploited cores, and to the accidents of knapping? A common reflection with all researchers working on these issues may allow us to apprehend better the archaeological reality, at a micro and macro-regional scale, but also at a purely theoretical scale of the anthropology of techniques.

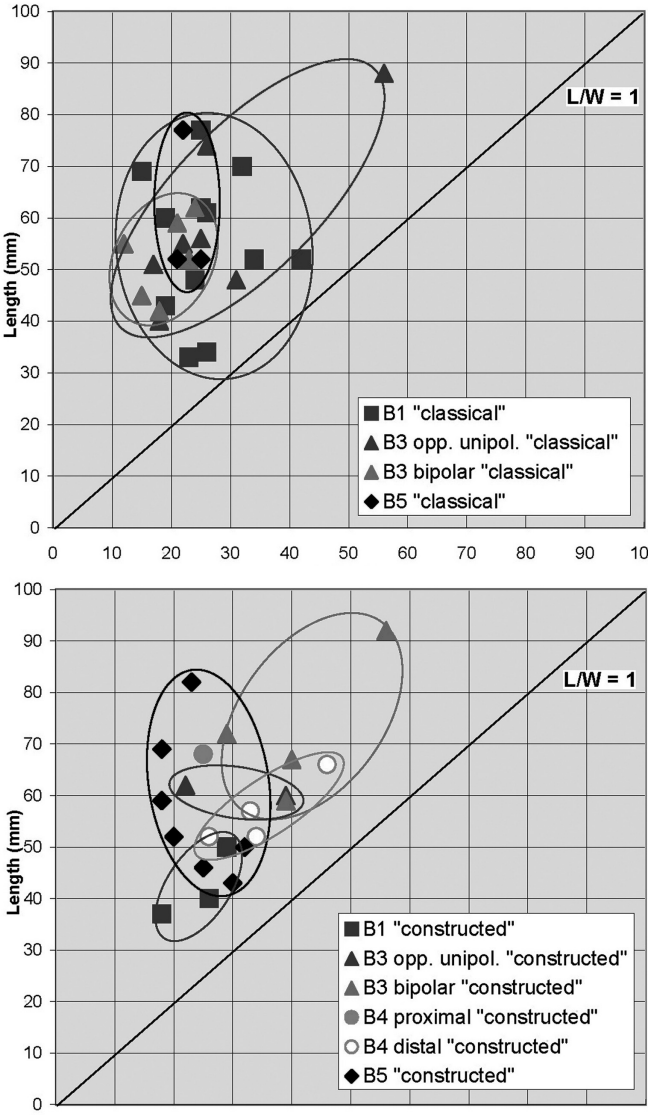

Figure 13 - Dimensions of the points by types (classical/constructed).

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