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Zooarchaeology Volume 2

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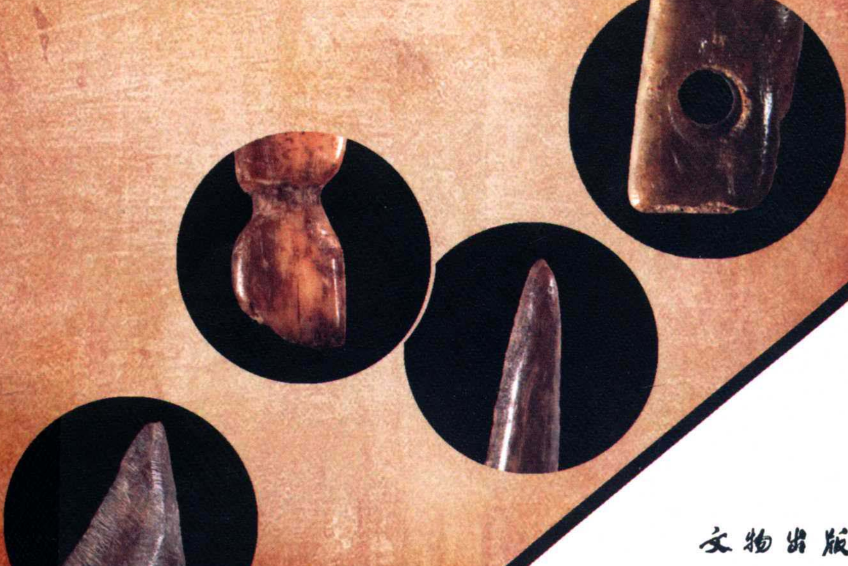

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Volume 2

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前　言

骨制品（包括角、牙、贝等）是考古遗址中比较常见的一类文化遗物，其承载着古代先民生产、生活方面的诸多信息，对深入研究古代经济、技术、社会状况具有重要的历史、科学和艺术价值。骨器研究的理念，在很大程度上受到人类学和考古学理论的影响。在西方考古中，人们很早就关注到骨器，但直到20世纪60年代，骨器还只是作为学者研究文化年代、时代特征、工艺技术的对象，大多数只是从定性的角度出发去描述、分类、图解骨器。自从新考古学兴起，特别是90年代以来，骨器研究的情况发生了很大变化。考古学家逐渐认识到，透过骨器制作技术能够加深对制造和使用骨器的人的理解。近年来，西方学者把分析石器的微痕技术用到了骨器研究中，从而能够获得更多的考古信息。然而，与石器和陶器研究相比，西方学者对骨器制作专业化的研究仍然很少，究其原因，可能在于不同文化的骨器变化小，没有引起人们的兴趣；更重要的是，西方很少发现与制骨作坊有关的丰富骨料，国际学术刊物很少见到这方面的研究文章也反映了这一点。

中国骨器研究始于20世纪30年代对北京周口店旧石器时代骨器的发现，但长期以来，由于受考古学科发展、骨器自身特性等因素的影响，骨器研究并没有引起学者的重视。简单的器物描述和形制分类几乎构成了骨器研究的主要内容，而骨器制作技术、生产专业化等深层次问题很少涉及。一些都邑性遗址出土的大量骨料，或被束之高阁，或不见了踪影。令人欣慰的是，近几年，动物考古学者逐渐重视不同时期考古遗址出土的骨料遗存，开始理性地思考中国骨器研究的相关问题，着手整理分析制骨作坊出土的骨料，甚至带着学术目的科学发掘制骨作坊遗址。

为了加强中外动物考古学家的相互交流与合作，推动中国骨器研究更好更快发展，2013年4月14～19日，由河南省文物局主办，河南省文物考古研究院承办，在郑州成功举行了“国际动物考古协会第九届骨器研究学术研讨会”。国际动物考古协会（International Council for Archaeozoology）是由国际动物考古学家组成的非营利性学术组织，旨在提高动物考古研究的科学化水平，促进国际动物考古学家之间的学术交流。该组织成立于1971年，从1974年起，每四年举行一次国际会员大会，现有会员550多名，来自六大洲的57个国家和地区。随着学科的发展，国际动物考古协会先后成立了14个专题研究组，其中包括骨器研究组（Worked Bone Research Group）。骨器研究组首次会议于1997年在伦敦大英博物馆举行，此后大约每两年举办一次国际学术研讨会。

本届骨器研究学术研讨会是骨器研究组首次在欧洲以外的国家召开，来自美国、法国、西班牙、英国、新西兰、丹麦、匈牙利、捷克、罗马尼亚和中国的41名专家学者，举行了20场学术报告和13次海报展讲。会上中外专家学者从不同的研究视角出发，对骨制品的生产技术、使用方式及其蕴含的古代人类认知过程等诸多信息进行了深入剖析，交流和分享了骨器研究领域最新的研究方法和成果。

这本文集收录的11篇论文是从会后提交的论文中挑选出来的，其中英文7篇、中文4篇，是继2010年出版的《动物考古·第1辑》之后的又一本动物考古专辑。文集采用中文和英文两种语言文字，没有对原文进行中英文互译。中文撰写的论文附有较长的英文摘要，呈现了主要研究内容和研究结果。下面对所收录的11篇论文作扼要介绍。

Éva David 提交的《如何使用科技手段从骨料上提取古代人类的技术行为信息?》一文，首先回顾了来源于民族学中的“操作链”（*chaîne opératoire*）概念，以及这一概念在20世纪90年代后期引入骨器研究的情况；然后使用操作链概念，分析了挪威西南部出土的中石器时代中期的骨器，尝试重构当时人们的技术行为。文章基于产品类型和生产模式研究了骨器制作技术特征，并通过对一批前所未见器物的描述，为研究史前人类活动提供了新的阐释。

Yolaine Maigrot & Noëlle Provenzano 的《骨器横断面微痕分析》指出，横向断裂的骨制品在世界不同地区不同考古学文化中都广泛存在；通过大量碎片上保留的骨骺，可判断它们来自大型野生哺乳动物的长骨（野马、野牛、鹿或美洲驼的股骨、胫骨、桡骨和肱骨）；所有的横向折断基本上都呈现出同样的形态。为了解这类骨制品，作者对其制作过程和用途进行了实验。文章提供了实验的主要结果，以及对横向断裂骨器上使用痕迹的民族学和考古学分析。

Katherine Brunson 等作者的《对安阳出土骨簪钻孔的复制实验》一文，对河南安阳铁三路遗址商代晚期制骨作坊出土的大量骨簪半成品上遗留的钻孔进行了观察，并用实验考古的方法，采用不同类型的钻头和研磨剂（粗细不等的砂粒）复制了钻孔。实验发现，不同材质（木质、石质或金属）的钻头对钻孔效率影响不大，但遗留痕迹不同（主要是孔的形状不同）；粗细不等的砂粒影响钻孔的效率，其中细砂粒钻得较快且更适合钻较深的孔。通过对不同实验方法所获得的钻孔与出土半成品上遗留的钻孔进行比较分析，作者认为铁三路遗址晚商时期制骨作坊使用了不同材质的钻头和钻孔方法。

Manuel Altamirano García 的《西班牙格拉纳达莫纳奇尔 Argaric 遗址青铜时代的骨质和贝壳装饰品研究》一文，从制造技术和功能方面对 Argaric 遗址出土的30个骨质和贝壳装饰品进行了研究。痕迹分析揭示了这些器物是如何被制作和使用的，而其形态和使用磨损痕迹的位置显示大部分饰品用作垂饰。有些器物可能使用了很长时间，因

此具备了超出制作它们所用原料本身的价值，由此也引出一系列关于财富展示和遗物继承的研究问题。

George Nutu & Simina Margareta Stanc 的《罗马尼亚东南部的 Niculitel 罗马时期别墅出土的雕刻骨器研究》一文，对 Niculitel 罗马时期别墅出土的 50 多件骨簪、骨针和餐具等雕刻骨器进行了研究，器形具有一定规律，为判断考古学相对年代提供了依据。

Douglas V. Campana & Pam J. Crabtree 的《乌兹别克斯坦 Kyzyltepa 遗址铁器时代出土加工骨研究》一文，对乌兹别克斯坦 Kyzyltepa 遗址出土的少量骨器进行了讨论。这些骨器包括用牛的下颌骨制作的完整工具，还有一些由牛下颌骨、马和牛的牙齿制作的工具。作者认为这些工具可能是制作陶器的抛光工具。

Alexandra Legrand-Pineau & Isabelle Sidéra 的《探索研究骨、角、牙制作的新方法》是一篇简短的文章，作者尝试运用显微镜和图像分析技术，以研究骨器加工技术和功能的数据库为参照，来研究骨、角、牙器的制作工艺和主要功能。

陈文的《广西史前骨角器初探》一文，对广西地区史前骨角器的类型、分期、制作方法和功能进行了研究，并对如何命名骨器，如锥、镞、针、笄、刀、凿、斧等进行定义。虽然有些定义仍然存在争议，但此篇论文为科学命名骨器提供了重要参考。

吴晓桐、饶小艳、宋艳波的《新石器时代环境与社会多元互动下的骨器生产研究》，通过分析关中地区新石器时代考古遗址出土骨器的选料状况，认为制作骨器的原料主要是以鹿科和牛科动物为主的大中型食草动物；结合关中新石器时代骨器数量和哺乳动物数量的统计分析，认为影响骨器生产的主要因素是骨料资源的变化，生业经济、聚落形态、人口规模等也是影响骨器生产的重要因素。

余翀的《多重对应分析在动物考古学中的应用》一文，以甘肃秦安大地湾遗址出土的部分骨器为研究对象，采用统计学的多重对应分析方法，探讨骨器原料来源（动物种属、骨骼部位）与骨器种类间的相互关系。研究结果表明，制作骨器所用的动物种属、骨骼部位与骨器种类之间有较强的关联性。

侯彦峰、张继华、王娟等作者的《河南登封南洼遗址二里头时期出土骨器简析》一文，对南洼遗址二里头文化时期出土的 185 件骨（角、牙、贝）器，从器形类别、原料来源、器物用途和加工工艺等方面进行了分析。其中墓葬出土的一件较为完整的扇贝壳“覆面”，为研究该时期的丧葬文化提供了重要的考古资料。这批骨器绝大多数为实用器，涉及生活的诸多方面，为认识当时的编织水平、缝纫技术、宗教信仰和用餐方式等提供了重要的信息。

从这次骨器研究学术研讨会发表的报告及会后提交的论文可以看出，中国骨器研究尽管在近几年来才引起动物考古研究者的重视，但在研究理念和分析方法上，与国外同行研究水平的差距并不大。相对来说，我们所拥有的丰富实物资料，特别是制骨

作坊出土的各类骨料，令国外同行羡慕不已。我们相信，只要在考古发掘中认真采集各种骨料，并把对骨料的分析放在手工业生产的链条中去考虑，那么骨器制作过程所蕴含的经济、技术、社会、观念等方面的考古信息，就能够逐渐被挖掘出来。

马萧林

2014 年 12 月 7 日

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How Using Technology to Set Past Human Technical Behaviour Toward Osseous Material?

With a Special Emphasis on the Mesolithic Bone Industry from Norway(7900 – 6200BP)

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Abstract: Developed on the worked osseous remains by the French scholars since the end of the 90s, the technological approach is used as a scientific mean for characterizing past human behaviour towards transformation of raw material originated from animal species. It invites using the *chaîne opératoire* concept for reconstructing original technical actions and their ordering that have prevailed in the manufacturing of arms, tools, objects and implements used for subsistence by prehistoric groups. Taking advantage of a recently considered Middle Mesolithic bone industry from south-western Norway(ca. 7900 to 6200 BP), the method enabling this reconstruction is presented, here on the framework of a gradual study. Some of the methodological stages are in reality independent with a fruitful back and forth anthropological questioning. Reconstruction of *chaînes opératoires* is made per anatomical parts and species. It enables highlighting the value of the studied assemblage, characterizing types of items that have been manufactured, as well as recognizing past techniques and processes involved in tool making. Contextualized, these unearth further analysis, not presented here, notably on skills and past technical traditions. Only the principles of the concept, as presented for our given training course on bone technology, are explained here.

Keywords: Methodology, Chaîne Opératoire, Industry, Techniques

PREMISE

The technological approach uses the *chaîne opératoire* to reconstruct how raw materials are transformed into manufactured items. An important premise to the technological approach is that human behaviour always follows a logic regarding its practical production of things. It is accepted that these are not produced differently every day, so that confidently a production is significant in term of human behaviour for a given group. For what concerns prehistoric societies, the way it was made has eventually been transmitted from one generation to the other while these societies were strictly dependant to hunting, an activity that require long process aquisition of various techniques. Study of these, when still recorded on archaeological artefacts, renders know and help characterizing past human societies.

The concept of *chaîne opératoire* was first introduced by Leroi-Gourhan during the 1960s, after his intense ethnographical investigations (Djindjian 2013). He proposed that any project concerning artefacts production involves a mental template, which materializes in the form of *chaîne opératoire* (Leroi-Gourhan 1988, 26 and 1989, 164). It is seen as a linkage of several (technical) actions that employ, in a systematic way, one or several techniques in order to accomplish a task (Tixier 1980, 92). For past industries, it is seen as a logic chain of operations undertaken to transform a raw material-here, any animal's osseous part-into specific manufactured pieces, including use/repair events, until they are finally discarded (Pelegrin et al. 1988). It leads integrating way to recognize raw materials and chronological ordering of technical events recorded on the fashioned archaeological artefacts themselves.

It is the reconstruction of the physical transformation of the raw material into technical stages or sequences of tool making that enables, thanks to the logic they yield, archaeologists to rediscover the intention of the project (Balfet 1991). This quest to find the intention is mainly done according to a qualitative understanding of the coherence of how the recorded technical actions articulate (Tixier 1978, 67). In such terms, the concept was introduced for bone and antler productions in the second mid of the 1990s, notably by a member of Tixier's laboratory of research (Vincent 1993) and, on Mesolithic bone industries, by present author (David 1999). As a result, which included intensive experimental research, 21 techniques supplementary to several complementary processes (See note) used for manufacturing and hafting have been identified (David 2004). On the basis of experimental referential series on the techniques themselves, and with help of comparative osteological collections, the diagnostic criteria for identifying the techniques on archaeological collections are recorded thanks to binocular glasses used to observe aspects of the studied osseous surfaces.

CONSIDERING THE WHOLE MATERIAL

For each concerned archaeological assemblage, the issues of recognizing artefacts made from man-hand lead to consider all kind of "osseous" materials (antler, bone, teeth, shell, ivory, horn…). These potential raw materials are at the start living forms. More than for given a state of their dedicated implication in artefact productions, or that upon their preservation, or their natural availability on site, this is of importance considering that we could lack at the start of the study the upper part of the more general *chaîne opératoire* of exploitating animal species (Plate Ⅰ), i. e. in what original stage the animal has been exploited? Male or female?

Sub-adult or adult? As a carcase or a killed body? This is not without consequences for reconstructing methods of production, knowing that some anatomical parts joins together at a specific time-span during animal growth, or differently between male and female, and that, subsequently, some of these could be missing amongst the expected worked remains. It could lead us to incorrect interpretations, especially when trying to relate in situ versus imported products. For instance, peculiar raw materials may also not have a same way to stand in situ depending on how they were treated there. This could imply differences in representation of some raw materials and give unequal importance to related anatomical parts when considering them for reconstructing subsistence strategies (Bridault et al. 2009). Thus, these different forms (species, anatomical parts) of osseous material are listed.

REVISITING MAN-MADE ARTEFACTS

The examination concerns not only what is supposed to belong to the apparent worked items, but also to the faunal remains as a whole. Usually, these latter yield indeed several if not all waste of debitage, as well as the other broken and/or burnt tools. Regularly, a lot of "forgotten" pieces that concern the bone industry are expected from the faunal remain. Knowing the related technologies emphasized already by more obvious pieces known as belonging to the bone industry from the site, while recognized during excavations, one has to accept that we truly seek finding only what we already know. No wonder, then, if supplementary material is yielded by the revisiting of the unidentified anatomical parts/species as well as of the sieved material (2 and 4 mm meshes). Some other pieces are found during this re-examination while this latter precisely enables acquaintance with aspects of the bony matter at the basis of this new investigation on how worked material shall look like, in terms of surface modifications (David 2010). Osseous items that show natural-made forms, as well as transformed osseous material by animal agents or climato and/or edaphic events (Binford 1981) are excluded from the studied assemblage. Contrary to them, the man-made artefacts are the pieces showing manufacture traces and/or morphologies in the form of deliberately transformed anatomical parts. This is why all identified osseous remains showing modified ends or sides are grouped here per anatomical parts and species. Such a way, deliberately made forms are emphasized compared to natural forms that could have been shaped the same by non-anthropic phenomena.

EMPHASIZING INDUSTRIAL REMAINS

A logic pattern in tool making is soon emphasized by the type of bony matter that has been employed for making the recorded transformed forms. On the one hand, one's notices presence of close shapes between different manufactured products and, on the other hand, that of specific anatomical parts removed as debris. Left behind on the site, broken anatomical parts are problematic to understand at this stage. Indeed, some marrowbones (tibia, radius, metapodials, for instance), with the possibilities they offer thanks to their natural rectilinear and long anatomical forms, naturally deliver original geometries that were eventually seen by prehistoric hunters as ready to be sub-divided in similar blanks for manufacturing standard forms. Most problems concern interpretation made on these bones that were intentionally broken, and which could be, at first, directly interpreted either as tool-blanks or as resulting from marrow fracturing only. It is without considering that a single fracturing technique may have been adopted to acquire all kind of products from a unique anatomical part: the substances linked to food and/or fat procurement (yellow and red marrows) as well as these concerning the production (cortex, sinew, hide). Thus, regarding the complementary utilization of these resources possibly extracted from a single bone, it is possible that sequences were, in fact, embedded into a single *chaîne opératoire* only, albeit they precisely pinpoint to distinct intentions (David 1998). Depending on the quality of the observations on the whole worked osseous material, the interpretations would imply very different results in terms of subsistence economy and social organization. Thus, broken anatomical parts, that possibly record various sustainable practices, are also documented as potential candidates related to tool making.

The intention of the debitage (all actions enabling exploiting an anatomy for getting advantage of part or all its soft and hard substances) by means of breaking anatomical parts is yielded by how impacts of percussion are organized on the matrix compared to the concerned anatomy and if this organisation can be related to the acquisition of blanks for (part or all) the recorded products. This can notably be emphasized thanks to the refitting of complete anatomical parts (Leduc 2010). The presence of articular ends re-split soon after they have been removed from their diaphysis, for its use in the manufacture, and in order to proceed extraction of their red marrow, richer in protein (Delluc et al. 1995), indicates the articulation between both food and tool production (David 1998).

EVALUATING THE VALUE OF THE ASSEMBLAGE

Composition of the assemblage of worked remains may reveal significant differences in terms of surface's aspects, notably in porosity and colour. This is potentially due to differences of buried conditions of the osseous assemblage. It is possible that the collection reflects either several archaeological deposits and/or various areas of a single occupation layer, with all conceivable bio- and animal perturbations. So that the grouping of pieces, per osseous material, presenting same outer aspects can help, together with the archaeological data, sorting out assemblage who can best represent reliefs of most reliable rests of single human activities. It requires notably approaching conditions of buried scenarios thanks to stratigraphical data on sediment deposits.

When it is possible, questioning the value of the recorded items thanks to this taphonomical approach is a mean to find again the most presumable original assemblage, potentialy dispersed at the start of the study amongst all kind of remains (David in print-a). For our purpose, it is better to take into consideration first small-sized but homogenous assemblage of artefacts that can be broadening to a larger material, than to proceed oppositely.

IDENTIFYING TOOL-CATEGORIES

From the recorded assemblage of worked osseous remains made by man, several yield parts or entire matrix that show an active end (David 1999, 34), in the form of a recognizable morphology: a pointed tip (arrow-/spear-points, harpoons, awls, needles, gorges and hooks), a bevel end (axes and chisels), a cutting edge (knives), a hollowed extremity (sleeves), a rounded-tip end (punches and hammers), a plane-side end or edge (*lissoirs*). As they all belong to tools and arms, i. e. pieces used to transform other raw materials or to kill/catch animals, as such defined per types (*ibid.*), they show a working end that was precisely made with specific dimensions and morphological shapes. They concern mainly pieces designated to be used as projectile points, heavy duty tools and tools used for other activities. The working end is usually damage before the piece has been discarded.

Apart from these main tool-categories, other artefact-types also belong to the mobiliary items and concern principally manipulated or adopted anatomical parts for a certain use (all types of pendants, amulets, head-dresses, containers, trophies etc.). In that sense, and compared to the arms and tools, these yield no working end, unless the entire piece itself would represent the working part. These forms are usually left broken or lost in place on site. A last category concerns other implements which utilization aims at converting a force into an energy (all types of bows, music instruments etc.). When made of bone, these artefacts show no working end, but eventually record compound zones. They are found in all kind of state on archaeological sites. On most well preserved material, the objects and implements often display, except where their attributes stand (perforation, notch, protuberance etc.), a surface that could display all over a shiny aspect (*lustre*). It suggests, when compared to the tools and arms (here, usually made without being intentionally polished), a longer term in their using.

The classification of these mobiliary pieces makes possible comparing archaeological assemblages and gathering components of manufactured productions requisited to define past hunting groups material cultures together with that from other spheres (knapped flint, ceramic etc.). To a certain extent only, typological composition, and its spatial distribution, enables discussing forms of activities (Bonsall 1996). This study-step is an unavoidable while enabling sharing, using common(ly) defined terminologies, our understanding of archaeological manufactured pieces.

RECOGNIZING TOOL-TYPES

Most difficulties rely naturally on the recognition of original hand made morphologies. Sometimes worked extremities are looking very much alike but, in fact, they are belonging to different types of tools when considering them particularly (Plate Ⅱ). Is it a tip of a hook or that of a needle? A basal or, to the contrary, a tip end of a point? Even if some pieces will stay unclassified, answering these questions is not so much a matter of understanding, than that of observing the bone fragment itself: Is it oval or, to the contrary, octagonal-shaped in crosssection, for instance? Is its general morphology symmetrical or not? It is often forgotten that final aspect of any hand made tool is first and always prefigured by its destination, used as a projectile point or a heavy duty tool, for instance. Firstly, because of ergonomic issues that are related to tools efficiency and, secondly, precisely because original osseous anatomical parts already display very specific morphologies in their original state. So, that there is no many ways to obtain a reliable product when using an osseous matter as raw material. Depending of the expected tool-form as well as the morphology of the matrix from which it is made, integration of both these constraints makes certain anatomical parts, tool-types and/or techniques firmly unavoidable at a certain time span—implementing the bony matter depend indeed of the type of available animal resources—or for a given stone kit when it is used to implement them. Leaving apart the problem of dimensions linked to the use of certain matrix, tool-types will be very differently shaped in case they will serve as weapons, for which symmetry is a prior parameter, or just thrown attached onto a line as hooks, for which placing an attribute will unearth effective products. In this latter case, and for the most tiny fragments difficult to classified, it is not only the general shape, but also the dimensions, as well as the aspect of them in cross-section, that enable identification of the location of the fragment compare to more recognizable and/or entire forms (Plate Ⅲ. i)

CHARACTERIZING SIMILAR LOOKING-LIKE FORMS

Most complex duty during the typological classification is to gather, on the one hand, the homogenous aspect of a production by means of the possible categorisation of its manufactured items and, on the other hand, its (idiosyncratic) variability while these items may indeed show various forms of same tool-types. Emphasizing the variety of forms of a single tool-type certainly differs from that related to the identification of the tool-types themselves. However, different types of tools may sometimes record close morphologies, as here, for instance, concerning bone spoon baits previously published as pendants (Bergsvik and Hufthammer 2009). What makes them different when both show a perforation at an end suggesting they were suspended? Here again, the gathering of other complementary parameters in a dynamic reflexion enables recording different intentions. For that purpose, the precise consideration of the location of the perforation leads to emphasize that it was here no need it is centrally placed (Plate Ⅱ: 18 to 20). Moreover, a close up to the perforation's morphologies makes understandable that the way it has been suspended is aleatory, its worn-out parts are indeed each time differently displayed on the piece. Also, the general morphology of these items shows that it was no need of getting them identical. They look more or less the same but are not made exactly similar. These three evidences are not equally recorded so far on bone pendants that always display a highly regular patterning in terms of dimensions and attributes (Vanhaeren 2002). A high regularity when shaping things eventually happen to be related only to bone elements, Such as ornaments, that can be used to express codes and identities when it concerns prehistoric material productions. It seams it goes the same for Mesolithic groups (David 1999, 369). To the contrary, spoon baits show no need to put much effort for their manufacture as far as they are regular enough. It is probably because they are of an every day use, for fishing carnivorous fish. Attached to a line, close to the fishhook, each of them was used to attract the fish with vibrations he made when standing in water current. A final use-wear analysis would eventually confirm the record of a specific random-like cinematic for these items, per piece, in the form of different types, locations and extends of their wear zones, contrary to what concerns pendants.

To conclude, typological investigations require extremely precise observations of the fashioned material in a dynamic integration of data concerning regularities in shapes, dimensions and locations of hafted/used parts. Use-wear analysis contributes to precise the degree of damage of the used parts as well as, when it is possible, the material responsible of it. Typological identifications are never based on use-wear analysis at first, precisely because what is in focus here is especially to be able to correlate (systematic) behaviours towards certain anatomical parts and/or certain forms of productions made by prehistoric societies.

RECORDING MANUFACTURING TECHNIQUES

Recognition of techniques enables identifying how mobiliary pieces and anatomical parts have been shaped and/or removed. But, technical patterns yielded by a tool, for instance, are not always all related to the manufacture. If it can be difficult sometimes to distinguish the use-wear from traces related to the fashioning of the tool, distinctions between both of them in our material is often yielded by their noticeable differences in size, either microscopic ("shiny" zone) or macroscopic (broken and "retouched-like" end/edge), for the main (David 2014).

For the Mesolithic, 21 techniques have been identified (David 2004): 9 wear or abrasive techniques (grinding, incising, scraping, sawing, filing, grooving, boring, drilling, coring), 3 nicking techniques (nicking, inverse nicking and dotted perforation), and 9 fracturing tech-