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**Review of [Axe age: Acheulian tool-making from quarry to discard] by  
[N. Goren-Inbar and G. Sharon]**

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that Fresnal Shelter occupants may have had ties with groups to the south and the east. Projectile point type styles confirm this interpretation.

This study is groundbreaking in terms of providing archaeologists with a means for potentially recognizing and ultimately gaining a greater understanding of small groups of people. After decades of focusing on large geographic areas and the groups inhabiting them, it is refreshing for a study to attempt to narrow this focus. While it is clear that the focus of the study is primarily oriented toward demonstrating the effectiveness of perishable artifacts in elucidating what are perceived as small marriage groups occupying narrow geographic ranges, the dismissal of the effectiveness of projectile points for this purpose is disheartening from the perspective of a devoted flake stone analyst. McBrinn does pose the examination of isochrestic style in projectile points as a future research question; the ubiquity and survivability of projectile points certainly make them an ideal class to consider for such questions.

This is a concisely written piece of research that has great potential for broadening our knowledge of people in the past. The volume presents a workable, testable model that asks archaeologists to do exactly what they should always be doing: using multiple lines of evidence and asking new questions to better understand the people they study. This book belongs on the reading list of anyone interested in archaeological research.

***Axe Age. Acheulian Toolmaking from Quarry to Discard***, edited by Naama Goren-Inbar and Gonen Sharon. London/Oakville: Equinox Publishing (2006).

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The Acheulian constitutes one of the major enigmas in Palaeolithic studies. Identifiable by that icon of the Lower Palaeolithic, the bifacial handaxe, it covered major parts of the Old World, from northwestern Europe southward to Cape Town and eastward far into Asia; how far exactly remains unclear, for recent claims that China was an integral part of the Acheulian "community" (Hou *et al.* 2000) are contested (see below). The Acheulian as a cultural tradition lasted very long: handaxes first appeared in the archaeological record at 1.7 MA, about one million years after hominins started producing stone tools, and gradually petered out of the record from about 250,000 years ago onward. From a strictly "lithic" perspective, this is the longest period of non-change recorded since hominins began to produce an archaeological record, at around 2.6 million years ago.

Handaxes played an important role in how we came to know about the prehistory of the human lineage. At Hoxne, England, these stone implements – the easiest to recognize as hominin-made of all Lower and Middle Palaeolithic artefacts – led John Frère (1800) to infer that humans once had been living in "a very remote period indeed; even beyond that of the present world." More than one-and-a-half century later, Mary Leakey, one of Frère's descendants, would be instrumental in quantifying the remoteness of that period and in studying the development of stone tool technology from before "the present world." When Prestwich and Evans had seen and accepted Boucher de Perthes' finds – including many handaxes – in the gravels of the river Somme in northern France in 1859, they rediscovered Frère's Hoxne report on his 1797 observations. Evans later also retraced the first Palaeolithic discovery in the world – a handaxe – by a London pharmacist, in gravel at King's Cross Road, around 1690 (reported on in 1715; Evans 1897: 581-583).

From the early 1860s onwards, tens of thousands of such handaxes, or *coups de poing* as the French used to call them (cf. de Mortillet 1883: 145), have been, and are being, collected from all over the Acheulian world by quarry workers, antiquarians, collectors, and professional archaeologists in surveys and in formal excavations. Tens of thousands of them are stored in amateur collections and museums, some three thousand of which are digitally available on the web in the British AHRB Acheulian Biface Project (Marshall *et al.* 2002).

The numbers of handaxes produced in Acheulian times must have been enormous. Let's make a conservative estimate and assume there were always at least 10,000 individuals at any moment in Acheulian times. Assuming, again conservatively, that each individual "needed" one handaxe per month, this amounts to 120,000 bifaces a year, which, multiplied by the Acheulian time range of approximately 1,500,000 years, yields a sum total of 18,000,000,000 (!) handaxes. If we put their average weight at 300 grams, we are talking about sixty million tons of handaxes. Transporting this amount would take approximately one million lorries, creating a chain of trucks spanning almost the whole circumference of our globe. Such is the power of the deep time we are working with.

As the Acheulian Biface Project and the volume under review show, scientific analysis of the handaxes that have been studied has not only yielded many answers but also generated a whole series of questions regarding these artefacts. On a basic level, most archaeologists treat them in straightforward functional terms, stressing their efficiency in butchering animals, in processing plant materials, and as cores for producing flakes. Here, handaxes appear as multi-purpose tools that could do many jobs: cutting, scraping, hammering, digging, piercing, etc.

Others have taken such functional interpretations into the social domain. Kohn and Mithen (1999) think a social-sexual technology was superimposed on their mechanical functionality. They see handaxes as items of aesthetic social display, suggesting that they "were products of sexual selection and as such were integral to the process of mate choice within socially complex and competitive groups" (Kohn and Mithen 1999: 519).

This approach has, understandably, attracted much attention from the general public, but little criticism thus far from professional quarters (however, see Nowell and Chang 2008). One obvious argument against this interpretation is that Kohn and Mithen focus on just a tiny part of the wide range of forms labeled as "handaxes," to wit, well-finished, symmetrical ones, which they interpret as potential indicators of health and intelligence.

Museums are indeed chock-a-block with such well-made symmetrical exemplars, and very probably for a simple reason: not so much sexual selection by Acheulians as aesthetic selection by amateur collectors in search of eye-pleasing pieces. Indeed, when large assemblages derived from controlled conditions are studied, standardization and symmetry do not seem to have been a high priority for their makers. Handaxes, McNabb *et al.* (2004) argue, often reflect the size and shape of the raw material selected and, in many cases, they appear to have been made with a minimal number of removals. In most securely collected or excavated biface assemblages, such "non-classic bifaces" are present in sizeable proportions, shading into the well-made symmetrical ones at the other end of the variability continuum.

Nevertheless, some archaeologists do think that many handaxes were over-engineered for functional purposes only, and those who think so have spilt most of their ink over the symmetrical ones. They assume that the form is the intentional product of a mental template, a blueprint that hominins applied to blocks of raw materials, for a variety of reasons: symmetrical handaxes could be more efficient in butchering (a testable assumption: see Machin *et al.* 2007), could play a role in social display (Kohn and Mithen 1999), were an "unintentional" expression of belonging to a certain group, testified to the "aesthetic sense" of early hominins, and so on.

A smaller group has stressed the "unintentional" character of handaxe morphology, emphasizing the role of reduction, of refreshing the working edges in the course of the use-life of the tool. In their view, what hits the archaeological record is not the wanted shape, but the shape that is *no longer* wanted, *i.e.*, waste (McPherron, in the edited volume under review here). Treating the final product as the manifestation of a hominin blueprint

has been termed the "finished artifact fallacy" (Noble and Davidson 1996). But even archaeologists who focus on resharpening and reduction assume that bifaces must have been produced with some concept of functionality in mind, however minimal: sharp durable edges, a tip and a butt (prehensile zone), bifaciality, lenticular section, basic symmetry. Next to these minimal functional requirements, handaxe variability is determined by other factors, such as reworking and raw material shape (Ashton and MacNabb 1994).

This takes us to one of the many interesting problems with handaxes: the wide range of variability found in artefacts classified as handaxes or bifaces. They can be regular or rough, small or large, ovate or pointed. This variability was already known to Boucher de Perthes (1847), who referred to them as *haches diluviennes* (diluvial axes) to differentiate them from ground neolithic axes, and developed a classification of their various shapes. Even if the continuity in handaxe morphology and variability is so striking that "Acheulian stasis" has become topical, and exceptions notwithstanding, there would seem to be some long-term trends and changes in the course of the Pleistocene: from large to smaller, from thick to thinner, from roughly hewn to more finely finished.

The identification of such trends should be based on observation, on archaeological patterns, distilled from countless archaeological sites and regional reports from all over the Acheulian world. Description and presentation of sites and assemblages and trying to distill meaningful patterns from these is the archaeologist's first task, immediately followed by that of explaining the patterns. Description and, somewhat less, pattern recognition certainly is the core business of the volume at stake here. The editors of *Axe Age* – a handsomely edited and lavishly illustrated 500-page book – rightly stress the value of direct observation over what one learns from the literature alone. The volume provides the reader with an almost hands-on knowledge of the many dimensions of the Acheulian phenomenon in a detailed presentation of sites and finds, which has become rare in the current *Zeitgeist* with its focus on short and syncretic papers. Most contributors to the volume are, in the words of the editors, dedicated to "hard core archaeology."

This impressive volume on handaxes/bifaces – or, as descriptive as the latter term but functional, "large cutting tools" – is organized in five parts, respectively dealing with obtaining raw materials, the technology of biface knapping, a world typology of large cutting tools, the meaning of cleavers, and a final part on regional perspectives. The volume ends with an *In Memoriam* for Gudrun Corvinus, one of the participants of the 2005 workshop from which this volume resulted, and who contributed a paper on Acheulian handaxes from the Upper Siwalik in Nepal. Some chapters present new data in considerable detail, others survey bodies of evidence and sometimes bear implicitly or explicitly on the more general issues discussed above.

The volume contains many recommendable papers. We were especially struck by Part 1, which consists of three papers dealing with quarrying activities related to the production of handaxes in Israel, India and South Africa, respectively. Paddayya et al. discuss the well-known Isampur site in India, where limestone was extracted for the production of a Lower Palaeolithic assemblage, possibly dating to around 1.2 Ma. In the final part of the volume, Petraglia describes how at Isampur the lifting and breaking of the large bedrock slabs, subsequently turned over for alternate flaking, was best achieved when two individuals were engaged in the activity (p. 407). Paddayya et al. suggest that "Isampur served as a localized hub for manufacturing and occupation activities, from where the hominins radiated onto the uplands and across the valley floor as part of their daily foraging activities" (p. 71).

Barkai, Gopher and LaPorta report on Middle Pleistocene flint quarries and workshop complexes in northern Israel. They suggest that these later Acheulian sites testify to long-term, recurrent and large-scale use of designated "industrial areas" for "sophisticated, well-planned and fully rational" mining procedures" (p. 39). The amounts of material from these sites is, as the pictures in their paper show, staggering indeed. Such extreme heaps of debris are not common in the southern African hornfels quarries treated in Sampson's paper, but when they do occur, "[what] strikes all visitors to a high-density apron is the sheer profligacy of the Acheulian knappers ... and their wasteful ways in reducing their only source of high quality hornfels for many kilometers around" (p. 104). The

archaeological record contains many sites, testifying to the fact that Lower and Middle Palaeolithic hominins were exploiting lithic resources for the production of stone tools. But these three papers show clearly that these activities must have resulted in sometimes highly visible piles of debris which altered the "pristine landscape" in which we project their producers to have lived (p. 39).

Part 2, on the technology of biface manufacture, once again underlines the relative consistency in knapping procedures over long periods of time and vast spaces, combined with strong variability in form. It has papers on Gesher Benot Ya'aqov (Israel), Tabun Cave (Israel), Attirampakkam (South India), and several Vaal River (South Africa) Acheulian sites with Victoria West core technology. Naama Goren-Inbar and Gonen Sharon's analyses of the Gesher Benot Ya'aqov bifacial tools are indicative of different behavioural mobility patterns coexisting in the same archaeological horizons. Blanks for cleavers and handaxes were meticulously selected according to a pre-planned desired size and form and shaped with much expertise and care, then transported to the spot of butchering, where they were often discarded immediately after use without much rejuvenation – just as at the much younger Acheulian site of Boxgrove (England). The pattern is similar for both raw materials used, basalt and flint.

Part 3 deals with bifacial Large Cutting Tool (LCT) typology and the partitioning of LCT variability to its various determinants. McPherron presently is a clear protagonist of the reuse–resharpening–reduction model – an outspoken critic of mental-templates viewpoints, and a mild critic of raw materials constraints (McPherron 2000). John Gowlett, on the other hand, applies cluster analysis and Principle Components Analysis to assemblages, explaining biface variance in terms not of mental templates, but of "a set of imperatives or pressing needs that must be balanced or traded off to get a solution" (p. 216). In his view, this probably helped to reduce a too-heavy cognitive load on short-term working memory. Olaf Jöris studies the chronological succession and regional differentiation in Central European *Keilmessergruppen* with their characteristic backed bifacial knives, in relation to climatic fluctuations and demographic patterns in the last glacial. Two further papers in this section deal with Revadim

Quarry and Misliya Cave, both in Israel.

Part 4 is concerned with cleavers. After Derek Roe's thoughts on such "broad-tipped large cutting tools," we are taken to Tabun, then to the Caucasus, and end up with the British record. Everywhere the distinction between "true" cleavers and bifaces is a bit of a problem. Small wonder: our basically 19th-century typology craves for order, whereas in the archaeological record, little is neat and variation reigns. But Roe thinks that cleavers, although they are closely related to handaxes, have enough features of their own to suggest that their makers viewed them as a distinct type. Mark White takes the opposite view, based on the the British record: for him they are not a discrete, intentionally different form, but part of the overall variation within handaxes/bifaces that occasionally emerges from a common technological practice.

The fifth, Regional Perspectives, part opens with a fascinating account of the Indian Acheulian in a global perspective, going beyond mere description to address the behavioral implications of the tool-making practices of Acheulian hominins in India. These are discussed with reference to social transmission and the learning of skills. The maintenance of the Acheulian technology over long periods and large areas after hominins had dispersed from Africa into Eurasia, in Petraglia's view, demonstrates that they successfully employed their technology to adapt to ecological diversity and pressures. His perspective on the geographical distribution of the Acheulian is refreshing. In recent years the presence of handaxes in East Asia has generated some discussion about the inferred dichotomy in the distribution of handaxes over the eastern and western parts of the Old World, visualized by the famous Movius Line (Movius 1948). The Bose (China) assemblage has been especially important in this discussion, as the handaxes from this site were taken to falsify the idea of the Movius Line (Hou *et al.* 2000). Petraglia points out that, despite the presence of some handaxes, East Asia certainly "does not attest to a systematically produced Acheulian industrial complex, since it has only a handful of sites laying claim to Mode 2 [*i.e.*, bifacial] technology. ... In contrast, the frequency of large cutting tools in India runs into the tens of thousands, and single localities have produced more bifaces than the total combined count of bifaces in the whole of China" (p. 403). While the geographical dichotomy as

visualized by the Movius Line may not be as clear-cut as previously imagined, in Petraglia's view the presence of the Acheulian in East Asia has not been adequately established.

Also in the Regional Perspectives section, Manuel Santonja and Paola Villa provide a concise, up-to-date discussion of the Western European evidence. They pay considerable attention to the role of sedimentary regimes and processes in patterns of former hominin presence (*e.g.*, p. 435), based on detailed knowledge of the understudied Spanish evidence. Can the small Atapuerca TD6 assemblage be labeled Acheulian? Santonja and Villa think so, in contrast to the Atapuerca excavators, who have suggested that TD6 reflects a first colonization of Europe by hominins of a Mode 1 or "non-Acheulian" tradition at around one million years ago. This is contrasted to the period beginning about 600,000 years ago when a more substantial occupation of Europe took place by hominins who created an "Acheulian" record (Carbonell *et al.* 1996). According to Santonja and Villa, the presence of industries representative of a pre-Acheulian technological stage within the Acheulian time range should be treated with caution when not based on strong dating evidence, combined with coherent and representative assemblages.

The aforementioned study by the volume's editors of the assemblages from two levels of the Gesher Benot Ya'aqov site in Israel underlines this last point by stressing the exceptional variability of Acheulian assemblages within the sequence there. Despite the paucity of bifacial tools in these two horizons, a detailed typo-technological study of the assemblages, supported by a series of experiments, allowed the editors to identify them as Acheulian. Handaxes may be invisible because hominins transported them from the site, but the debris still contains traces of a biface technology.

The papers in *Axe Age* present solid data on Acheulian Large Cutting Tools. Many authors leave it there and, as "hard core" archeologists, do not go beyond the descriptive stage, with the exception of the editors in their introduction and Michael Petraglia. He is the only one stressing the maintenance of Acheulian technology over such long time periods and large areas. Indeed, that minimal concept of functionality reflected in the Acheulian handaxe lasted for a very long time. As

archaeologists, we are keen at explaining changes in the archaeological record, but we are less adept at explaining non-change. And how real is the Acheulian non-change? Is it present in other domains as well, *e.g.*, subsistence practices or range expansion and contraction? Apparently not, as hominins colonized major parts of the Old World between 1.7 and 0.3 Ma, and may have done so by developing into successful hunters of a wide variety of large game in a wide range of different environments.

Relative stability of lithic technology during that time has often been interpreted in cognitive terms. For example, Tomasello *et al.* (2005) argue that cultural change may be something uniquely (modern-)human: the emergence of modern humans would have involved new kinds of social motivations, social emotions and social cognition, which would have enabled the development of full-fledged shared intentionality involving joint goals, joint intentions and joint attention (Tomasello *et al.* 2005: 726). Together with observational learning and imitation, these were preconditions for a ratchet effect (Tomasello 1999) that is visible in the relatively fast rate of changes in the later phases of the Palaeolithic, when anatomically modern humans created the archaeological record. Innovations need something to build on, and the process of cumulative cultural evolution requires not only creative invention, but also faithful social transmission that can act as a ratchet to prevent slipping back. Only then can a tool one person makes be improved upon by another person who learns to use that tool, and then that tool can be improved upon, and so on.

Such processes would not seem to have happened during the Acheulian, or would they, in archaeologically less visible domains? Handaxes, handaxes, handaxes, millions of them, discarded during hundreds of thousands of years during the *Axe Age*, along rivers in southern Africa, Morocco, France, England, and India, in a wide range of environments, with little spatial or chronological patterning. However, there must have been considerable pressure on lithic technology to change over such a long time and such a vast area and during so many phases of range expansion and contraction. At the very least, this would indicate that the Acheulian toolkit was versatile enough to do its job. Selection pressure for change may have acted upon other domains of hominin technology,

which we have not recognized yet or might never "see" because they did not fossilize - domains such as "ecological knowledge."

*Axe Age* complements another edited volume, *Multiple Approaches to the Study of Bifacial Technologies* (Soressi and Dibble 2003), with contributions by, among others, McPherron, Petraglia, White, and Roe again. Together these two books provide quite complete access and coverage, also bibliographically, of the body of specialized publications on biface variability. The Soressi and Dibble volume ranges as widely geographically and complements *Axe Age* by paying attention to Palaeoindian and Old World Upper Palaeolithic bifacial point technologies.

*Axe Age's* focus on the Acheulian makes for a tight and valuable volume. It provides readers with a good grip on Acheulian archaeological patterns, in particular their temporal and regional variability. At the same time, it shows the considerable extent to which Large Cutting Tools and the Acheulian still are enigmatic.

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***Sociedades Prehistóricas, Recursos Abióticos y Territorio, Actas de la III Reunión de Trabajo Sobre Aprovisionamiento de Recursos Abióticos en la Prehistoria***, edited by G. Martínez Fernández, A. Morgado Rodríguez and J.A. Afonso Marrero. Fundación Ibn al-Jatib de Estudios de Cooperación Cultural y Universidad de Granada, Granada. 440 pp., 120 figs., 13 colour plates. 2006.

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This volume consists of 22 papers that resulted from the conference called "*III Reunión de trabajo sobre aprovisionamiento de recursos abióticos en la Prehistoria*," held in Loja, Spain, October 21-23, 2004. Participants of the sessions and authors of the papers included in this book are mainly from Spain, but there are also some researchers from France, Portugal and Argentina.

The information developed and reported is presented in a durable volume with high quality figures and plates. On the down side, there are some typographical errors, and major references (countries and continents, scales) are missing from most of the maps. References of archeological bibliography in English are scarce through the chapters, with very few exceptions (Guraieb et al. and Hernandez Gomez and Santos).

The bulk of the book is devoted to case studies, ranging between the highly specific and the more general. The first four papers are oriented toward theoretical and methodological issues. Allué Martí and García-Antón Trassiera present a fascinating analysis of wood as an abiotic resource that can be used as fuel, food or raw material. The authors deal with wood resources in a refreshing way, by modelling their possible *chaînes opératoires*. The chapter by Joaquim Parcerisas Civit includes a useful set of operative definitions for the study of lithic sources. An important distinction between potential, accessible, and adequate sources is introduced. Carrión Méndez and coauthors present a basic and concise list of necessary steps in the study of lithic sources, emphasizing methodology and techniques. And the paper by Terradas et al. is unusual in that it introduces elements of a collective research design. It is a protocol shared by several research teams from different institutions within France and Spain, consisting of a useful list of basic variables that should be recorded in the analysis of siliceous rocks.

The following section includes seven chapters focused on the Paleolithic and Epipaleolithic periods. The first is another chapter by Parcerisas Civit, who presents a geological characterization of the lithic resources for the classic Paleolithic sites of Torralba and Ambrona. Then Caro Gomez analyzes the relationship between the availability of rocks and lithic technology at several Paleolithic sites in the Guadalquivir basin. The chapter by López Reyes and Martínez Fernández is focused on the El Aculadero site, a study from which a critical review of Middle Paleolithic sites is derived.

Domínguez Bella and coauthors present a study of the case of the Benzú rockshelter in North Africa, in the context of evaluating cultural connections between that area and Iberia. Galvan Santos and coauthors present an interesting discussion of different models of lithic exploitation. It is based on the study of stages in the reduction sequence of Middle Paleolithic cores recovered at several sites in Alicante. An important role is given to the process of lithic reclamation in the Neanderthal world. Mangado and coauthors discuss provisioning of rocks for the Upper Paleolithic of the Coa Valley, Portugal, while the following chapter by Mangado Llach and Nadal Lorenzo characterizes rocks of the Epipaleolithic at the Balma del Gai.