

# IS THE FUNCTIONAL APPROACH HELPFUL TO OVERCOME THE TYPOLOGY DILEMMA OF LITHIC ARCHAEOLOGY IN SOUTHEAST ASIA?

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## ABSTRACT

This article is based on the presentation “Typology, technology and function: a use-wear analyst’s perspective” in Session 1C, “Missing types: overcoming the typology dilemma of lithic archaeology in Southeast Asia”, at the Congress of the Indo-Pacific Prehistory Association in Manila in March 2006.

A large interest in Palaeolithic archaeology and lithic analysis could be noted during the last IPPA congress in Manila in March 2006. However, is it obvious that Palaeolithic archaeology in Southeast Asia is still in its methodological beginning. Most of all, a useful and applicable classification of lithic artefacts seems to be a difficult undertaking.

Since its introduction by Oskar Montelius (1903), *typology* is the basic analytical method for the classification of artefacts, connecting them to time periods, regions and “cultures”. However, classification into “tool types” is a subjective view from a far distance in time. Until the late 1950s and early 1960s, the decision if an artefact made of stone is a tool was rather simple: Any artificial modification of a blank form, flakes, blades, even shattered pieces would create a “tool”. “Types” were those tools with a characteristic recurring modification (Bordes 1961). The origin and nature of the modification, however, were not further scrutinized. As a result of improving excavation and sampling methods during the second half of the past century, lithic assemblages contained more and more unmodified artefacts and non-formal tools. Consequently, lithic archaeologists shifted to a technology-based analysis, investigating the production methods of their artefacts. The recording and statistic evaluation of a wide range of morphological attributes allowed the recognition of significant differences and strategies of core preparation, core reduction and blank modification. Implemented in technological analysis are the study of fracture mechanics, experimental flint knapping and the reconstruction of reduction strategies by refitting. In the 1980s, a holistic method enhancing the technological analysis of reduction sequences would become popular: the “*chaîne opératoire*” (Geneste 1985). Techniques and strategies of raw material

acquisition, core preparation, reduction and modification of usually flaked stone tools were treated and analysed as parts of one manufacturing cycle and, altogether, addressed lithic assemblages more comprehensively (Fig. 1).

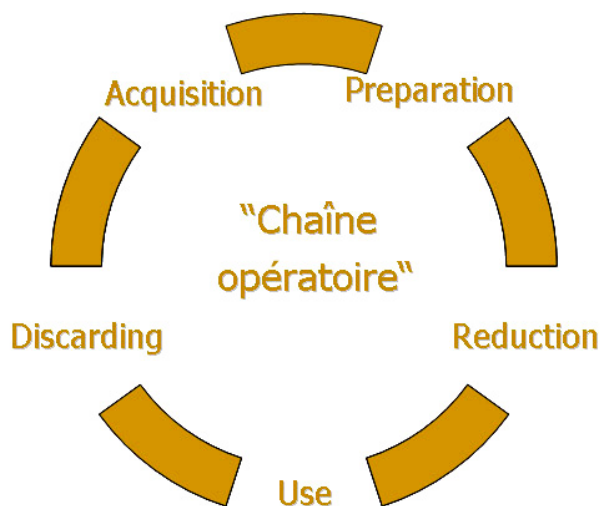


Figure 1. A diagram of the lithic *chaîne opératoire*.

Technological and morphological analyses have not replaced typology. It still remains as the basic instrument for the classification of lithic artefacts, their chronological and regional categorization and the relative dating of archaeological sites and stratigraphies until now. Typologists were certainly aware of the production methods that would lead to a certain tool type. Experimental flint knapping and ethnographic studies are well-known tools for lithic archaeologists long since (Bordes himself was a master flint knapper). But the addition of systematic research on the production cycle to the analysis of lithic artefacts significantly enhanced the possibilities of typology.

Like typology, technological analysis is only functioning if a sufficient number of characteristic, chronologically and regionally distinctive production sequences (*chaînes opératoires*) are available and recognizable.

Unfortunately, the number of stone tool types in Southeast Asia as well as specific production technologies seems to be rather limited. Unlike in other geographic regions, attempts at a typological, morphological and technological classification to establish a relative chronology, therefore, were perhaps not too successful. Consequently, it has been questioned if a “Eurocentric” view and typological method is appropriate to characterize lithic industries in Southeast Asia (see Callenfels 1936; Bowdler 1997; Moser 2001: 30ff). While one can sometimes feel a subliminal nationalism during informal exchange of views, we need to ask a number of questions, indeed, to judge if typology in its traditional form is applicable for Palaeolithic and Epi-palaeolithic assemblages in Southeast Asia.

First of all, what are the reasons that until now so few formal tool types have been defined? Before political correctness had found its way into prehistoric archaeology, the ability of early humans in eastern Asia as toolmakers was labelled as archaic and backward (Colani 1927; Movius 1944). Nowadays, it seems more appropriate to use more practical terms such as “smash-and-grab” (Coutts 1983) or “expedient” technology (Binford 1979; Patole-Edoumba 2002; Mijares 2002). The theory of expedient technology should suggest that its strategy of “use-once-and-discard” resulted in great amounts of used artefacts and large lithic assemblages. This requires an availability of raw material in abundance. However, the small sizes of artefacts, used tools, *débitage* and cores in the respective lithic assemblages points towards the opposite.

A smash-and-grab strategy is difficult to distinguish from the natural breakage of rocks in the archaeological record (see the evaluation of the Kota Tampan assemblages in Moser 2001: 103ff). Rachanie Bannanurag, in her microwear study of Hoabinhian stone tools from Tham Pha Chan, found a quite different behaviour. Most analyzed tools had been thoroughly resharpened, some of them even several times (Bannanurag 1988:75). Her results confirmed an observation made earlier by White and Gorman (1979).

Searching for reasons in the existence of a wooden or bamboo tool industry and/or the poor availability and difficult acquisition of lithic raw material (e.g. Narr 1966; Solheim 1970; Pope 1989; Mijares 2002) can only be purely hypothetical. Tools made of bamboo and wood are not present in the archaeological record, at least not yet. And, their production would most likely have required stone tools. Like the few bone tools found in Southeast Asia, they can be regarded as additions to the lithic toolkit rather than replacements. Artefacts made of rocks having a sufficient knapping quality, chert or even obsidian, are not uncommon in Southeast Asian sites (e.g. Beyer 1947; Charoenwongsa 1988; Pookajorn 1988; Moser 2001; Pawlik 2002; Mijares 2002; Neri 2002, 2005). So it is at least questionable if the typology dilemma is really the result of a raw material dilemma. Perhaps we just don't see the tools and need to have a closer look at tool production and tool use rather than ambiguous types. The neces-

sity of such a reassessment of lithic assemblages in Southeast Asia was convincingly demonstrated during the 18th IPPA congress in Manila (Kamminga 2006).

Furthermore, and indeed contrary to European typology, Palaeolithic assemblages in Southeast Asia often lack a convincing stratigraphic and chronological context. Without such, the main purpose of a typology, building up a relative chronology, can hardly be achieved. On the other hand, it is under critical debate if and to what extent the many surface finds from so-called open sites can be put into a regional chronology by comparative morphological analysis and using the distant typological systems of Eurasia or Africa. Stratigraphic correlation is a condition for lithic technology and the definition of technocomplexes. Both need reference sites with clear and more or less undisturbed stratigraphies. But, what if there is no such reference site nearby? Or, what is an acceptable distance of an unstratified site or assemblage to a reference site to maintain a chronological relationship? Especially, but not exclusively, for Island Southeast Asia and its numerous “open sites”, this question is of importance.

#### *The problem of “Early Palaeolithic” sites in the Philippines*

Although the first discovery of supposedly Lower Palaeolithic pebble tools of the Cabalwanian or Liwanian in the Cagayan Valley in northern Luzon happened more than half a century ago (Koenigswald 1958; Fox and Peralta 1974; Fox 1978; Bondoc 1979), still very few early Palaeolithic sites have been reported in the Philippines



Figure 2. Palaeolithic sites in the Philippines.

(Fig. 2). Peterson (1979) recovered choppers, chopping-tools and several flakes in Novaliches, an archaeological site already discovered in 1926 during the building of a dam for Manila's water supply (Beyer 1947; Ronquillo 1998). In 1996, Nicanor Aves discovered artefacts in Arubo, near the town of General Tinio in central Luzon (Dizon 1996; Garong 2001; Pawlik 2002). Again in Cagayan at Solana, and on Cabbaruyan Island in Pangasinan, Angel Bautista and Jon de Vos found lithic artefacts similar to the Cabalwanian finds, and, as in the Cagayan Valley, fossils of a Middle Pleistocene megafauna (Bautista and De Vos 2002a, 2002b). Recent investigations at the Huluga site in Cagayan de Oro, Mindanao Island (Neri et al. 2004; Neri 2005) delivered a small assemblage of five pebble tools. All these sites are so-called open sites, and the artefacts were mostly found at or close to the surface. The rather amorphous forms of the finds make it often difficult to distinguish them from geofacts.



Figure 3. View of Arubo, Central Luzon.

The recent exploration of Arubo in Central Luzon has again brought up the mentioned limitations of typology and technology for such stand-alone sites. Arubo is a complex of several open sites, situated 80 km north of Manila and approximately 300 km south of the classic Cabalwanian sites of Cagayan (Pawlik 2002, 2004a). In 2001, I conducted archaeological fieldwork in a joint venture of the University of the Philippines Archaeological Studies Program and the National Museum in Manila. At the centre of attention was the investigation of Arubo 1. This site was at that time already heavily disturbed, caused by the dredging of a fishpond. However, that activity brought back the archaeological material to the surface, thus leading to the discovery of the site (Fig. 3). Arubo is characterized by the presence of large chert boulders, which served as the raw material for most of the artefacts found. As of now, Arubo is the only reported primary source for chert used for the production of stone tools in the Philippines. During the 2001 fieldwork, 200 lithic finds were made, at least 18 of which could be identified as stone tools, respectively cores. Most artefacts

were recovered during surveys. A few were excavated and found very close to the sandstone bedrock. This might indicate an old age for the site, but most of all it is the morphology of the artefacts that supports such presumption (Pawlik 2001). Especially, the presence of a bifacial technology with the first handaxe reportedly found in the Philippines is very intriguing (Fig. 4a).

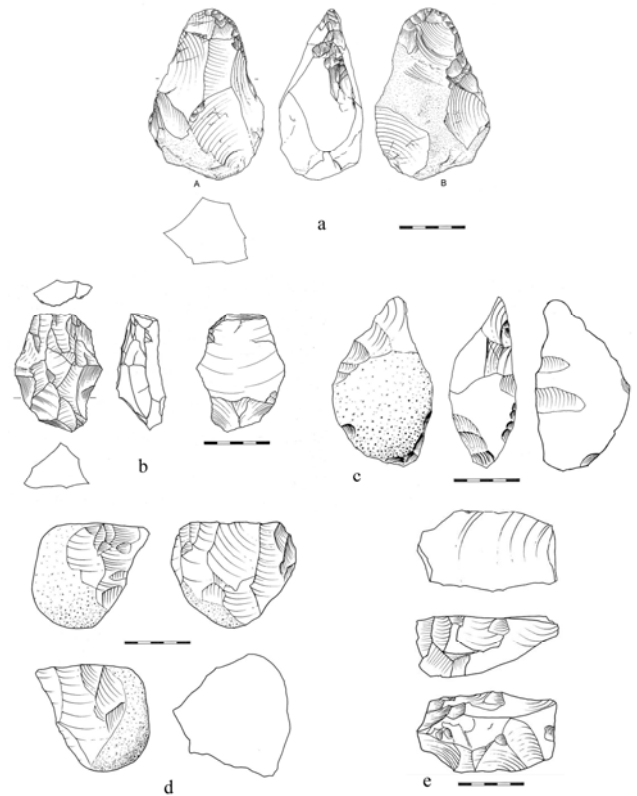


Figure 4. Artefacts from Arubo: a) handaxe, b) pseudo-Levallois flake, c) spatula-tipped boulder flake tool, d) horsehoof core, e) core on a large flake.

Among the core forms recovered at Arubo is a so-called horsehoof core (Fig. 4d), similar to those associated with the Lower Palaeolithic Pajitanian industry in Java (Koenigswald 1936; Heekeren 1972; Bartstra 1984; Soejono 1984). Another relationship seems to exist between Arubo and recently excavated Lower Palaeolithic sites in south China (Pawlik 2004:10), where handaxes and other bifacial and unifacial forms similar to Arubo are frequently observed (e.g. Huang 1989; Schick and Dong Zhuan 1993; Leng Jian and Shannon 2000; Xiang An-qiang 1990; Xie Guangmo 1990; n.d.; Peng Shulin, n.d.). Based on data from handaxe sites in the Bose basin, Yamei et al. (2000) postulated the beginning of bifacial technology in south China about 800,000 years ago.

Arubo delivered a distinctive assemblage, significantly different from the stereotyped "chopper/chopping tool industries" (Movius 1944). Unlike the Cabalwanian and the Pajitanian, it has a true bifacial component. The evidence for curation is obvious, as well as a variation in core preparation and core reduction. The morphology of

the Arubo artefacts would fit into the Lower Palaeolithic, and the handaxe is even of Acheulean-type. But like the pebble tools from Cagayan Valley, they lack a stratified context. Would the Arubo assemblage have been located somewhere in Africa or Eurasia, a relative chronological classification into the Lower Palaeolithic based on typology certainly could be established without much dispute.

In the Philippines however, the Arubo assemblage is unique and Palaeolithic stratigraphies are rare. The only available stratigraphy for the Palaeolithic so far is found in Tabon cave, with an Upper Palaeolithic sequence covering perhaps the past 40,000 years. However, the artefacts from Arubo and Tabon show little similarity. The Tabonian industry is a small-sized flake industry with few retouched artefacts that continued into the Holocene, e.g. at Duyong cave or Guri cave (Fox 1970; Tulang 2001; Patole-Edoumba 2002; Pawlik and Ronquillo 2003). This, and the fact that no signs of a Neolithic or more recent occupation, and no potsherds or ground tools, were found in Arubo are at least hints for a *terminus ante quem* and a pre-Tabonian age of the Arubo artefacts.

The few other supposedly Lower Palaeolithic sites in Luzon and Mindanao are unstratified sites as well and do not exhibit other “types” than choppers and chopping tools (Koenigswald 1958; Shutler and Mathisen 1979; Ronquillo 1982; Neri et al. 2004). Unlike those ad-hoc tools, the bifaces from Arubo exhibit multiple uses and functions (Pawlik 2002; Teodosio 2006). In her comprehensive functional study of the Arubo artefacts, Teodosio noted use traces from working soft and hard materials of organic and inorganic origin, including bamboo. Not just the handaxe but also some of the used flakes and core tools show signs of multiple uses on various contact materials (Teodosio 2006: 84ff). Consequently, Arubo represents a technological concept quite different from smash-and-grab or expedient strategies (Teodosio 2006: 112). The reason can be found in the different use of the tools. Teodosio’s functional study showed that the basic chopping tools and simple flakes had limited microwear indicating a sparse use while the thoroughly prepared and modified tools were more intensively and longer utilized.

#### *Functional analysis: an alternative to typology?*

A common misunderstanding in the evaluation of lithic artefacts is that “stone tool types” are related to their recent “counterparts”, although no determination of their former function was made. But we cannot assume *per se* without further analysis that every borer was used for drilling holes nor every scraper used for scraping hide, nor every chopping tool for chopping wood and bone. When Leakey defined the Oldowan by the presence of choppers and chopping tools, she regarded them as the desired product in this initial period of intentional tool production (Leakey 1971). Flaked artefacts, present as well in the Oldowan, were classified as *débitage* only, waste from the preparation and sharpening of chopping tools. Nicholas Toth (1985), however, concluded in his analysis just the opposite: chopper and pebble tools served as cores for flake production while the flakes were the wanted tools, used for cutting and scraping.

While it is difficult with typology to take into account the dynamic process of tool form changes during use, technological studies deal foremost with the production of stone tools only. A realistic characterization of stone tools must also include their actual uses and purposes. From a user’s viewpoint the production of a tool is merely a preparatory step before its use. For the user, the techniques of manufacturing the tools used might be even irrelevant. Therefore, we can argue that tool use rather than the production process and tool design reflects user capabilities and intentions. The identification of tool use and tool function is a rather complex task. It requires experimental framework, ethnographic data and the aid of microscopes (Semenov 1964). This method, called use-wear analysis, microwear analysis or *tracéologie* was introduced in the 1950s by Sergej Semenov, adopted and further developed by a number of lithic archaeologists since the 1970s (e.g. Kamminga 1979; Anderson 1980; Keeley 1980; Odell 1981; Unrath 1982; Plisson 1985; Vaughan 1985).

Use-wear analysis is a comprehensive research system based on a data and information pool that enables the analyst to identify and interpret wear patterns and surface alterations on lithic artefacts (Fig. 5). This data pool is mainly supplied by experiments using stone tool replicas and imitating prehistoric working activities as realistically as possible. Complemented by archaeological accounts, ethnographic observations and also technical descriptions, this experimental framework is crucial for the reconstruction of prehistoric stone tool uses (Fig. 6). A thorough microscopic analysis of the replicas provides the use-wear analyst with a set of different experimentally created microwear traces. Subsequently, they will be compared with wear traces on archaeological lithic material. Although microwear analysis appears as a straightforward method, the interpretation and reconstruction of tool use stills depends heavily on the understanding of mechanics and the research experience of the analyst:

...microwear analysis is not for the dilettante. The techniques of examination are time consuming and demand attention to technical details, and the methodology behind any good microwear study must be specially constructed and carefully implemented. (Keeley 1974: 334).

#### *Form follows function*

This golden rule of engineering and design is also valid for lithic technologies. However, would modern archaeologists and prehistoric toolmakers share the same view? In an ethno-archaeological study, White and Thomas (1972) pointed out that users of stone tools and “typologists” have different systems of classification. Experiments and ethnographic studies show that many prehistoric working activities do not need highly specialized tools. Furthermore, microwear analysis has shown that different tool types could be used for the same task (Keeley 1980). Vice versa, a specific tool type was not exclusively used for the same purpose or working process (Pawlik 1995). To make things even worse for a typolo-



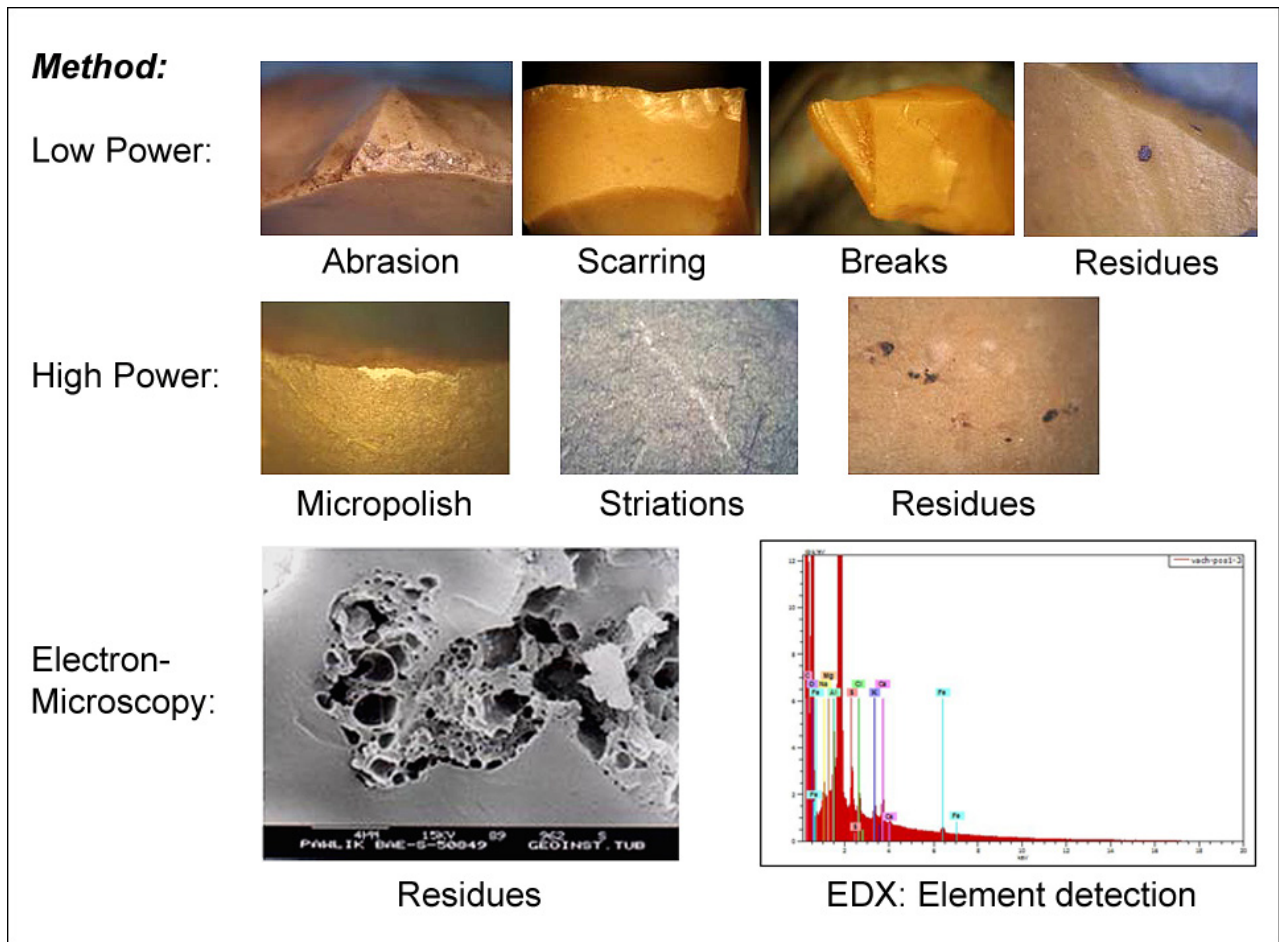


Figure 5. Examples of microwear patterns and analysis.

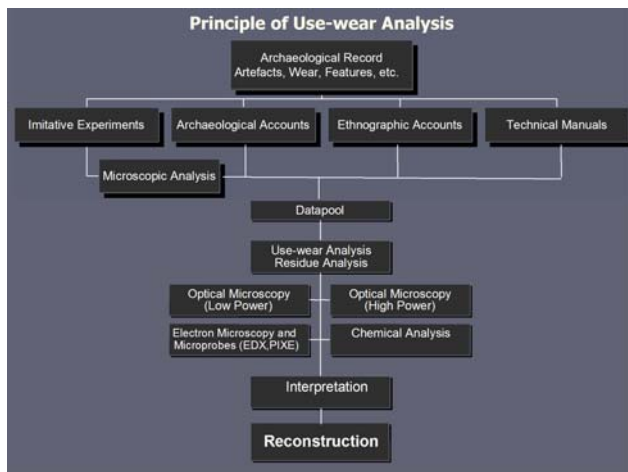


Figure 6. Principles of use-wear analysis.

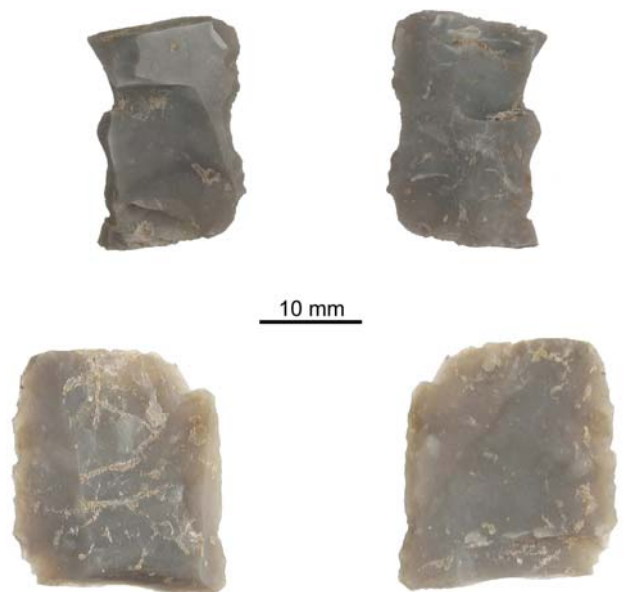


Figure 7. Worn "thumbnail" scraper and sickle blades re-used as chisels.

gist, Vaughan demonstrated in his case study that macroscopically unmodified artefacts were used almost as intensively as modified artefacts (Vaughan 1985: 103).

A number of factors like resharpening, reworking, change of function, the reduction of size, working damages etc. are causing a significant transformation of the tool's shape. A scraper tool at the beginning of its life

cycle does not have its original form any more at the end of its life cycle. But in a typological system, this particular tool would be classified as two different tool types. Another factor to be considered is multi-functionality: Stone tools can possess more than one actively used area. Even the transformation into a different type is possible, like in the case of Neolithic sickle blades, which were used as implements for harvesting first, and later remodelled into chisels for woodworking (Pawlik and Schimmelpfennig in press; Fig. 7). How would typology and technology deal with such artefacts?

*Spatial analysis and functional plotting*

An important aim of every excavation is to recognize what happened within a prehistoric site, and to interpret its purpose and function. For a meaningful lithic analysis it is essential that a complete recording of every find and feature is undertaken, including the three-dimensional plotting of artefacts. Only then, the combination of use-wear analysis and the analysis of the spatial distribution of artefacts will help to identify workshop areas and distinct activity zones (Cahen et al. 1979). The accurate recording of all finds is the condition for the recognition of intra-site activities. Holdermann et al. (2005) demonstrated in their research about the Mesolithic site of Ullafelsen in the Austrian Alps that such a functional characterization is even possible for open sites (Schaefer et al., in press). There, at least four different working areas could be identified in an excavation area of only 6x4 m (Fig. 8). One of them, an intricate pattern of exclusively weapon inserts around firepit no.1, suggested an activity described as ‘hafting and retooling’ which required the presence of heat and fire (Keeley 1982).

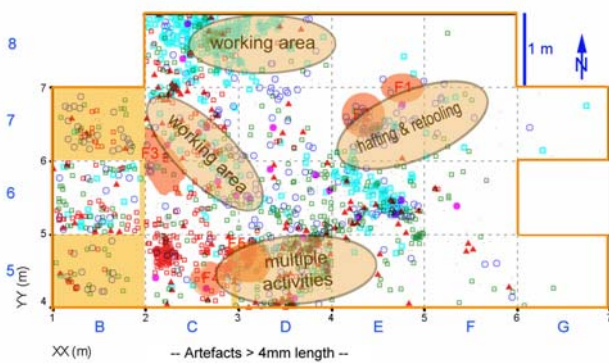


Figure 8. Ullafelsen, Austria: a reconstruction of working areas and hafting/retooling activities.

*Hafting and Retooling*

Technically, almost any artefact made of stone could have been used as hafted implement. Especially for smaller flaked artefacts, the possibility of a hafted use has to be taken into consideration. Already 25 years ago, Lawrence Keeley elaborated on the effects of hafting on the archaeological record (Keeley 1982). Although this icon of microwear analysis stated its high importance for the functional determination of stone tools and the recognition

of intra-site activities, the issue of hafting is still widely neglected by lithic analysis. Neither typology nor technological analysis can give direct clues to whether stone tools were hafted or not. It is therefore not surprising that concepts of hafting and related experimental framework are rare or absent in the lithic archaeology of Southeast Asia.

With the aid of microscopic use-wear analysis, it has become possible to identify hafting wear and residues on stone tools (Pawlik 1995, 2004b; Rots and Vermeersch 2004). While the shafts themselves were made of organic material and are rarely present in the archaeological record, the recognition of hafting traces will lead to the reconstruction of composite tool designs even if the hafting device itself is gone. The effects of hafting for lithic technology are distinct. The use as hafted implement influenced not just the tool use but also the tool form and can lead to rather unexpected reconstructions (Fig. 9: micro-point). Technological theories like the concept of expedient technology can be affected with clear consequences for the characterisation of prehistoric behaviour. Artefacts labelled as expedient technology could as well be parts of carefully curated composite tools. The way we look at seemingly insignificant artefacts will have to change. Fixed in a shaft even a tiny micro-flake can become the active part of a rather outstanding and long-lasting instrument (Fig. 10; Mikdad and Eiwanger 2000).

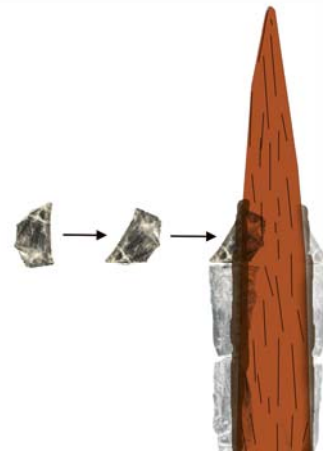


Figure 9. The effects of hafting: typology vs. function.

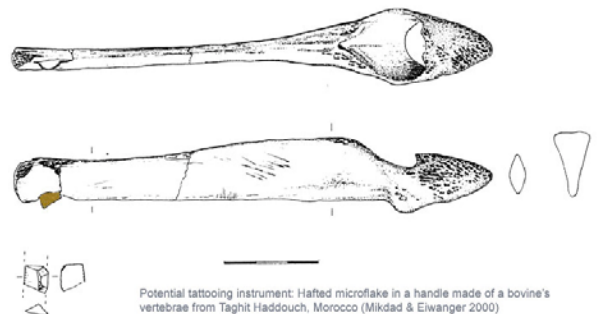


Figure 10. The effects of hafting: a micro-flake possibly used as hafted tattooing needle (courtesy DAI/KAOK).

## CONCLUSION

Microwear analysis is a powerful instrument for lithic archaeologists. The determination of wear and tear on artefacts by means of optical light microscopy, chemical analysis and scanning electron microscopy provides a realistic characterization of stone tools (Fig. 11). This method enables the analyst to reconstruct if and how stone tools were used, and to identify former tool functions. Integrated in modern archaeological fieldwork functional analysis it let us receive insights into intra-site activities such as manufacture or retooling and recognize site functions and activities. Functional analysis can be applied regionally and chronologically independently. It



Figure 11. The use-wear analysis workplace in the Lithic Studies Laboratory, University of the Philippines.

does neither depend on typology nor lithic technology, although the microwear analyst needs to be acquainted with those methods. If we consider solving our problem of missing types by searching for the tools, then perhaps it can be achieved by the functional approach. Such a “New Typology” would be based on use-wear analysis. Not only would we be able to receive information about the uses of artefacts in particular, but also identify “tool-function types”, especially in assemblages where “typological types” are few or missing. Seemingly simple or “backward” lithic production would then hopefully receive more attention and consequently deliver actual information to the prehistoric life, technology and subsistence of their makers and users.

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