HAVE WE OVERLOOKED SOMETHING? HAFTING TRACES AND INDICATIONS OF MODERN TRAITS IN THE PHILIPPINE PALAEOLITHIC

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ABSTRACT

Behavioural modernity has been a widely neglected topic for Southeast Asia's Prehistory. Evidence of modern packages or even traits is basically absent in Palaeolithic assemblages. This absence has considerably influenced the discussion of hominid behaviour and their cultural and cognitive abilities. In a case study on terminal Pleistocene artefacts from Ille Cave on Palawan Island, indications of the presence of several items of the modern trait list, foremost the first evidence of hafted lithic tools and the use of adhesives in the Philippine Palaeolithic, were detected through microwear analysis. The results showed that unretouched and morphologically less characteristic flaked artefacts, often considered as mere expedient tools, could have served as hafted armatures of multicomponent tools. For the on-going discussion of the development and expansion of modern behaviour, methods like microwear analysis can overcome the limitations of traditional technological and morphological analysis of lithic assemblages.

INTRODUCTION

The discussion of cultural, cognitive or behavioural modernity has a long tradition in Europe's prehistoric archaeology (e.g. Jelinek 1982; Hahn 1986; Dibble 1989; Mellars 1989a, 1989b; Klein 1995, 1999). The appearances of apparently significant indicators like specialized blade industries, bone and antler tools, and especially figurative art, musical instruments and personal ornaments are seen as indicators of the highly developed cultural and cognitive abilities of their makers (Clottes 2001; Conard 2003, Conard et al. 2004). The seemingly sudden appearance of expressive art and symbolism together with complex tool technologies in Europe at around 40,000 years ago has been attributed to an explosive cultural and cognitive advancement in Europe with the arrival of anatomically modern *Homo sapiens* (e.g. Mellars 1991; Mithen 1996; Klein and Blake 2002). Whether this Upper Palaeolithic revolution was due to social factors or genetic mutation, related to the ecosystem or a cultural answer to the competition with another human species, the Neanderthals, is still under debate (e.g. McBrearty and Brooks 2000; Zilhão 2001; Bar-Yossef 2002; D'Errico 2003; Conard et al. 2004; Mellars 2005; Haidle 2006). Yet, this hypothesis is used to explain the success of *Homo sapiens* immigrants over the Neanderthals (Bräuer and Smith 1992; Mellars 2005; Conard 2006, 2008). Challenging the Big Bang model, potential indicators for an earlier and gradually developing cultural and cognitive modernity have been seen in African assemblages. The appearance of some traits in Africa has been dated back to the Middle Pleistocene, earlier than the first evidence of anatomically modern hominids 200,000 years ago (McBrearty and Brooks 2000; Henshilwood et al. 2002; McBrearty & Stringer 2007; Johnson and McBrearty 2010). Consequently, it was assumed that *Homo sapiens* left Africa and populated the world with a complete package of modern behavioural traits (Klein 2003).

The comparison of the European archaeological record with the African trait list has lead to the hypothesis that if all these traits are indeed markers of behavioural modernity, then it might have developed parallel to and independent from species. Evidence can not only be found in anatomically modern human context, but also in association with Neanderthal fossils and Middle Palaeolithic cultural remains, e.g. in the use of pigments, notational pieces, personal ornaments and bone tools, as well as grinding stones, composite-tool technology and the use of synthetically produced birch pitch as adhesive (D'Errico 2003; Henshilwood and Marean 2003; Conard 2008; Haidle 2008, 2010; Pawlik and Thissen 2008, 2011).

This hypothesis is also of importance for the large and diverse region of Southeast Asia and the Indo-Pacific. The modernity debate has mostly neglected this region so far, with the exception of the Sahul region (Brumm and Moore 2005; Habgood and Franklin 2008). Habgood and Franklin (2008:214) have recently stated that a "package" of cultural innovations did not exist as an entity in the Indo-Pacific at

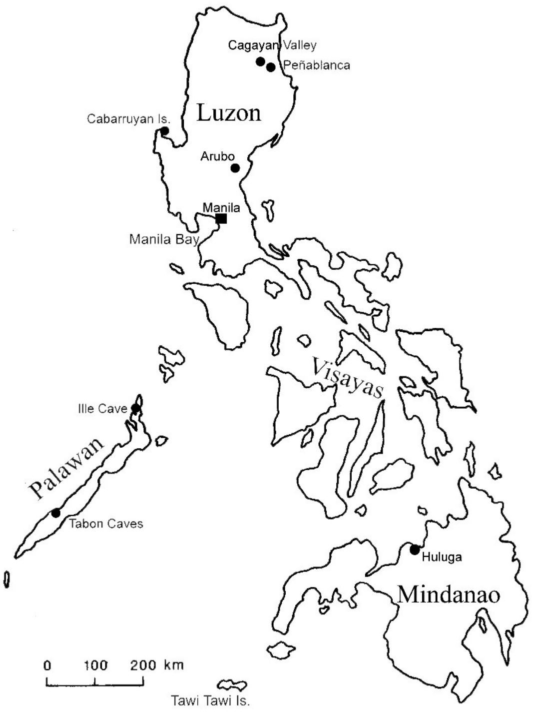


Figure 1. Map of the Philippines with Palaeolithic sites

the beginning of the expansion into Sahul, and that its "components were gradually assembled over a 30,000 year period". But is the current list of traits developed on European and African archaeological records for detecting the existence of modern human behaviour valid for Southeast Asia? Is the occurrence of the entire package necessary, or is the appearance of single traits sufficient to claim behavioural modernity? In Southeast Asia, the fossil record suggests the first appearance of modern hominids approximately 50-40,000 BP (Fox 1978; Détroit et al. 2004; Barker et al. 2007). However, there seems to be a remarkable absence of most of the modern traits listed above in the archaeological record, and this needs to be investigated.

THE PHILIPPINE RECORD

Palaeolithic sites in the Philippines are mainly situated on Palawan Island and Luzon Island (Figure 1). While it is quite certain that Palawan Island was once connected with Borneo and a part of the enlarged landmass of Sundaland during sea-level regressions in the Pleistocene, the possibilities of a connection between Luzon Island and Sundaland are still under discussion. The presence of fossil bones all over the island confirms the existence of large land mammals like *Elephas, Stegodon* and *Rhinoceros* during the Middle Pleistocene, and might indicate the existence of such a land bridge, or at least a very close proximity to the mainland (Figure 2), allowing 'island-hopping' during glacial periods with shallow waters and emerged islands (Koenigswald 1958; Fox 1978; Bondoc 1979; Shutler and Mathisen 1979; Bautista and de Vos 2002; Pawlik and Ronquillo 2003; Piper et al 2009; Dizon and Pawlik 2010).

Fossil hominid remains found in the Philippines have been classified as *Homo sapiens* (Détroit 2002). Best known is the so-called Tabon Man, found in the Upper Palaeolithic layers of Tabon cave at Lipuun Point, Palawan Island (Figure 3). Actually the remains of several individuals of *Homo sapiens* (a frontal bone, two mandible fragments and several teeth), Tabon Man was found during the excavations of Robert Fox from 1960-1967 (Fox 1970). Radiocarbon dated charcoal from the corresponding layer pointed to an age of approximately 22,000-24,000 BP (Fox 1970:40-44). Thirty years later, the frontal bone was directly dated by uranium gamma ray counting at the Institut de Paléontologie Humaine of the Muséum national d'Histoire naturelle in Paris, and its date corrected to 16,500 ± 2000 BP (Dizon et al. 2002). A human tibia from the lowest archaeological layer excavated during a re-investigation of Tabon Cave by the National Museum of the Philippines and the Institut de Paléontologie Humaine, Paris delivered another uranium series date published as 47,000 +11,000/-10,000 BP (Détroit et al. 2004). Although this is consistent with Fox's estimate 50,000 BP for the lowest cultural layer in Tabon Cave, the very high standard error of the U-series dates demands a cautionary consideration of the absolute dates from Tabon.

In Peñablanca, Cagayan, in the northern part of the Philippines, Late Pleistocene layers of Callao Cave (Figure 4) contained flaked artefacts and charcoal that delivered a radiocarbon-date of 25,968±373 BP (Wk-14881; Mijares 2007, 2008). Below that, a human third metatarsal bone was found in a breccia layer and dated to 66,700±1000 BP by laser ablation U-Series (Mijares et al. 2010). This sets the earliest human presence in the Philippines even further back than Tabon Cave. Morphology and size of the foot bone fall within the range of *Homo sapiens*, *Homo habilis* and *Homo floresiensis*.

THE PROBLEM OF MODERN TRAITS IN THE PHILIPPINES

Despite the presence of anatomically modern humans in the Philippines during the Late Pleistocene, possibly up to 70,000 years ago, evidence for modern packages in the archaeological record is poor. Very few items from the Afro-European trait list appear in the Philippine Palaeolithic. In particular, its lithic assemblages do not possess a convincing modern character. The general absence of "modern" tool types and formal tools in Southeast Asia's Palaeolithic industries, especially in comparison to European lithic records, has been attributed to 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; Schick and Dong Zhuan 1993; Mijares 2002; Mellars

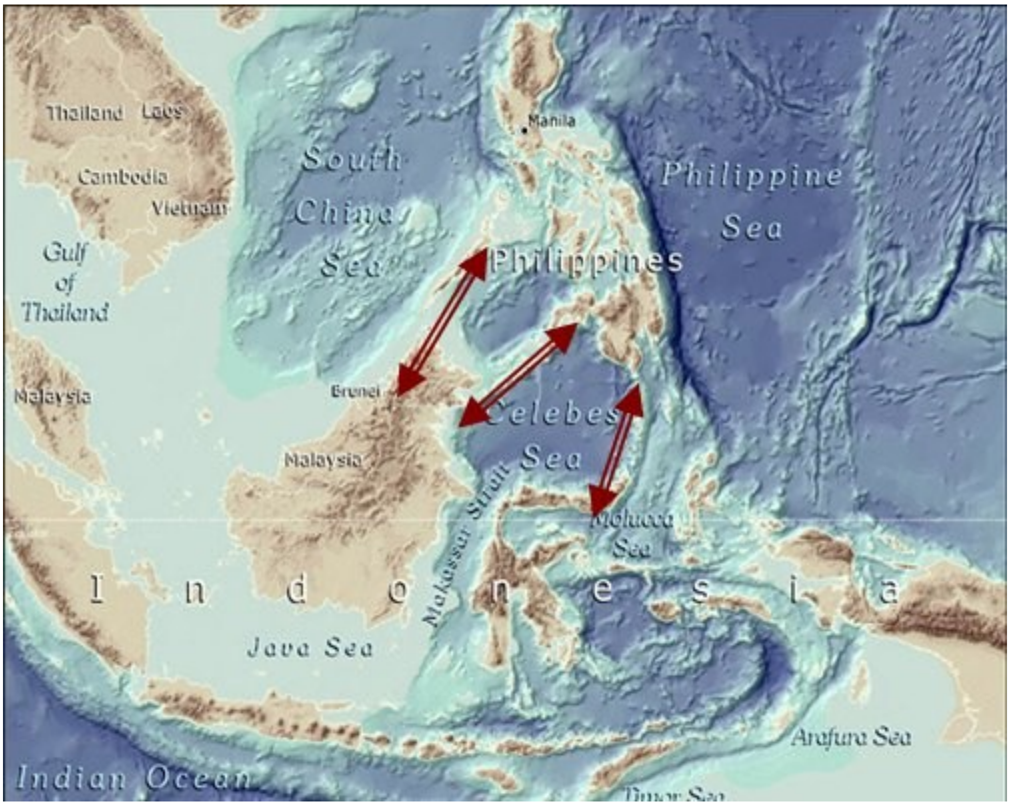


Figure 2. Sunda shelf and potential migration routes into the Philippine archipelago

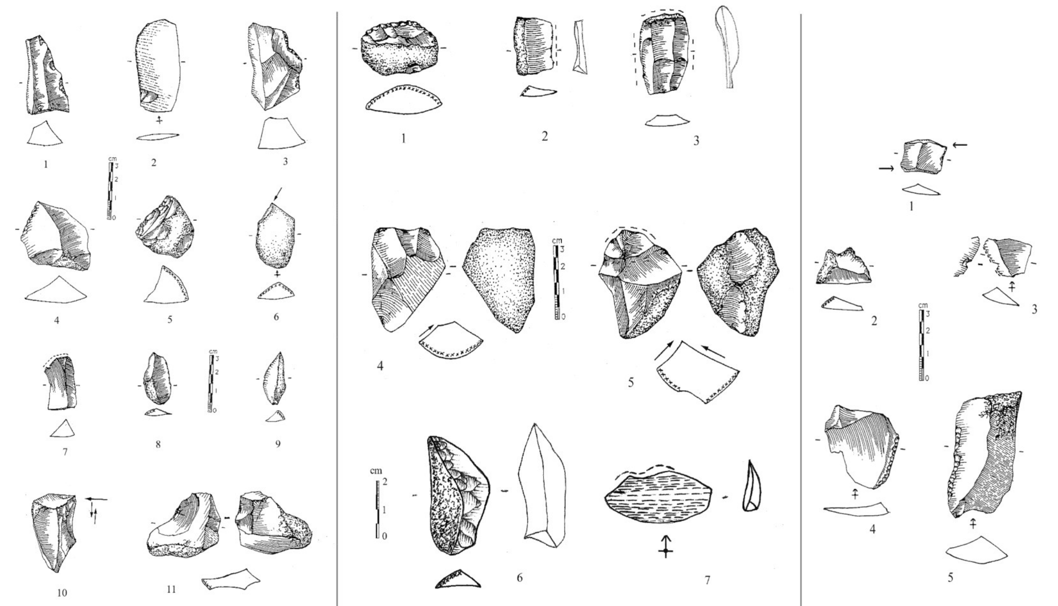
2006; Dennell 2009). For taphonomic reasons, those "vegetal industries" are hypothetical. Tools made of bamboo and wood are not present in Pleistocene and Early Holocene archaeological assemblages, and their production would have required stone tools. The wood/bamboo tool hypothesis neither considers factors of tool mechanics and use nor deals with the fact that large lithic assemblages are present in the archaeological record. It can certainly be assumed that tools and utilitarian objects were made of vegetal materials including bamboo and wood, but they were more likely an addition to the lithic toolkit rather than replacements, like the few bone tools found in Southeast Asia (Barton et al. 2009; Pawlik 2009a). Furthermore, the causal argument that the production of vegetal tools has led to a simplification of lithic industries, has not been convincingly explained. Also, artefacts made of rocks possessing a sufficient knapping quality, (i.e. chert or even obsidian) are not uncommon in Southeast Asian sites (e.g. Beyer 1947; Charoenwongsa 1988; Pookajorn 1988; Moser 2001; Pawlik 2002, 2004a; Mijares 2002, 2004; Neri 2002, 2005).

Two Upper Palaeolithic/Epipalaeolithic technocomplexes have been morphologically and technologically analysed and published so far in the Philippines: the so-called Tabonian Industry (Fox 1970; Patole-Edoumba 2002) and the Peñablanca expedient technology (Mijares 2002). The distinction between them is mainly based on the dominant raw material, chert—more precisely radiolarian jasper (Schmidt 2008)—for the Tabonian, and andesite at Peñablanca. The emergence of the Tabonian industry goes along with the sudden replacement of the earlier "Lower Palaeolithic" core tool assemblages by small flake industries, without any transitional stage (Pawlik 2009a). Modification of these flakes is rarely observed; edge retouch and alteration are usually caused by use (Fox 1970; Ronquillo 1981; Mijares 2004). A comparison between the Palaeolithic assemblage of Tabon Cave and the lithic materials from several Holocene sites in Palawan, including Duyong Cave, Guri Cave or the Pilanduk rockshelter (Fox 1970:45-65; Fox 1978; Kress 1979; Tulang 2000; Patole-Edoumba 2002), shows a continuation of the Tabonian from the Late Pleistocene into the Holocene and until the early Neolithic (Figure 5).

The lithic technology of Peñablanca in Northern Luzon, more than 1000 km from Tabon, is very similar. The excavation at Callao Cave in the northern part of Luzon Island yielded a small assemblage of flaked artefacts (Figure 6). At Callao, and several other Epipalaeolithic sites of the same limestone formation at Peñablanca, (e.g. Laurente Cave, Minori Cave, Rabel Cave and others) as in Palawan, the Upper Palaeolithic industry continues without significant morphological changes into the Early Holocene (Ronquillo 1981;

Figure 3. Excavation of Tabon Cave with view of Tabon Rock at Lippuun Point and Tabon Man skullcap

Figure 4. Callao Cave, Peñablanca. Entrance hall with excavation area and the Peñablanca formation

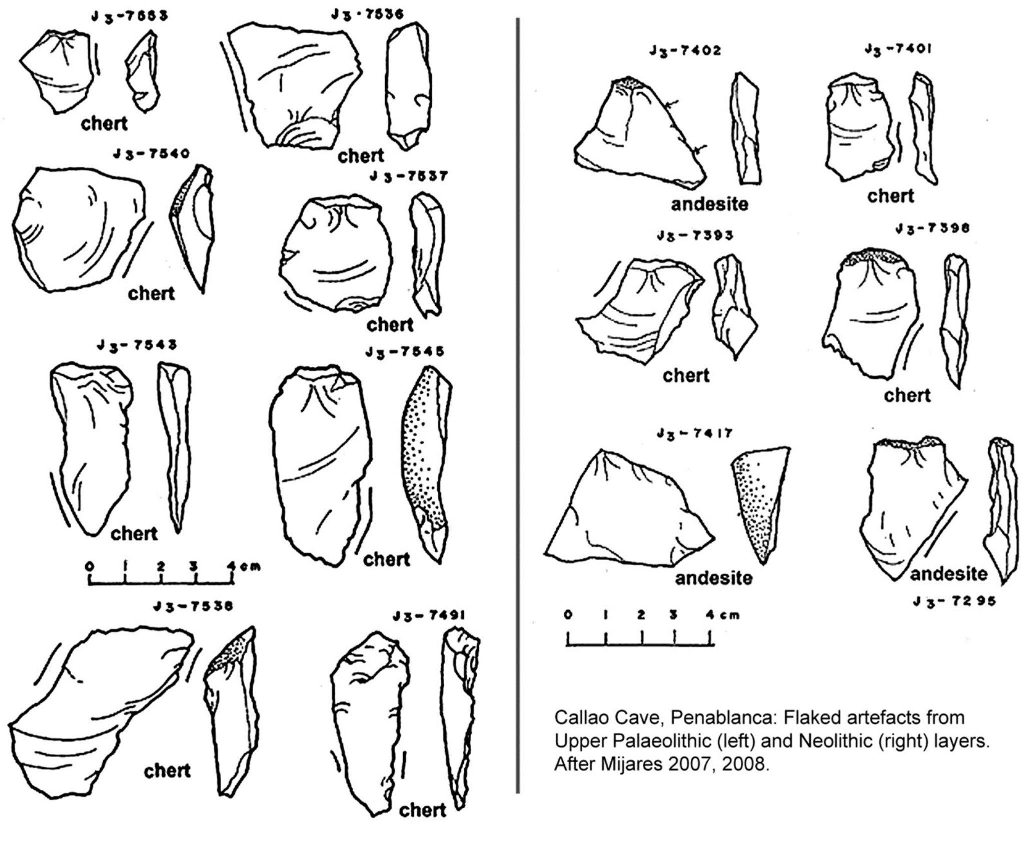


Lithic assemblage from Tabon cave.
1 - 9: stone tools, 10, 11: cores
From Patole-Edoumba 2002;
drawings by H. Forestier.

Lithic artefacts from Guri cave.
1-3:: stone tools; 4,5: cores.
From Patole-Edoumba 2002;
drawings by H. Forestier.

Lithic Artefacts from Duyong cave.
1,3: used flakes; 2,4-5: scrapers.
From patole-Edoumba 2002;
drawings by H. Forestier.

Figures 5 & 6. Above: Flaked artefacts from Tabon, Guri and Duyong caves (from Patole-Edoumba 2002, drawings by H. Forestier). Below: Flaked artefacts from Callao Cave, Peñablanca (after Mijares 2008).



Callao Cave, Penablanca: Flaked artefacts from Upper Palaeolithic (left) and Neolithic (right) layers. After Mijares 2007, 2008.

Figure 7. Ille Cave, El Nido, Palawan

Figure 8. Upper Palaeolithic artefacts from Ille Cave

Mijares 2002; Pawlik and Ronquillo 2003). In general, the Peñablanca technology is represented by simple flake assemblages without formal elements, primarily made of andesite and chert. Based on a technological study combined with a microscopic use-wear analysis, these assemblages have been characterised as products of an "expedient technology" with flakes produced from locally available raw material by direct percussion and without further modification, used for single tasks, and discarded afterwards (Mijares 2002). This interpretation corresponds with recent microwear studies on selected artefacts from Tabon Cave, where the limited appearance of microwear traces suggests a similar strategy for the Tabonian industries on Palawan (Mijares 2004; Xhauflair 2009). Also, the newly excavated chert assemblage from the Pleistocene layer of Callao Cave fits into an expedient technology tradition in terms of technology and use-wear (Mijares 2008).

Since 1998, the Archaeological Studies Program of the University of the Philippines has been conducting field research in the Dewil Valley in El Nido, northern Palawan Island (Figure 7). Within the Palawan Palaeohistory Project, a multi-national team of archaeologists, archaeobiologists and sedimentologists has excavated at the Ille Cave site (Cayron 1999; Szabó et al. 2004; Pawlik 2006; Paz et al. 2006; Archaeological Studies Program 2007; Lewis et al. 2008). Thus far, the excavations have delivered a cultural sequence down to the Upper Palaeolithic and Pleistocene. From Neolithic to Protohistoric times, the site was also used as a burial ground. Burials and artefacts supply evidence for the intensive use of the Dewil Valley area during the Palaeolithic and Neolithic. A small flake assemblage was recovered from Terminal Pleistocene layers (Figure 8). Radiocarbon dates delivered an age of 13,890 to 14,048 cal. BP (Lewis et al. 2008). The morphology of the artefacts appears similar to Tabon and Peñablanca, with simple and irregular flakes manufactured by direct percussion and an absence of formal tools (Pawlik 2009b). Likewise, a lack of modern traits is apparent for the Palaeolithic material of Ille Cave and expedient tool use strategies seem obvious.

If this kind of strategy for lithic tool production and use has to be considered, then it is not surprising that the lithic elements of modern packages are missing in the Philippine Palaeolithic. Expedient technology lacks curation, core preparation, indirect percussion and therefore a specialized blade production. A microlithic component existed at best only with regards to size, but no geometric microliths like in Africa and Europe were found. Formal tools in general are extremely rare. The simple and indifferent technology that produced an overall amorphous small flake industry is dominant until the developed Neolithic and the beginning of the "Austronesian expansion" (Bellwood 1997). Non-lithic traits like tools made of bone, antler and shell, projectile points, figurative art, musical instruments and personal ornaments are absent as well. Only a few shell artefacts appear in the earlier stages of the Philippine Neolithic but not before 7,000 BP (Ronquillo et al. 1993; Szabó 2005). Although the Philippine Upper Palaeolithic assemblages are most certainly associated with modern *Homo sapiens* since at least about 50,000 years, they obviously failed to assemble a distinctive package of modern traits and behaviour. This leaves us with two possibilities: Either their cognitive, cultural and technological behaviour was completely different from modern hominids in Europe and Africa and not "modern" at all, or the hypothesis that modern behaviour goes along with the assembling of a particular modern package has to be reconsidered.

DETECTING MODERN TRAITS WITH MICROWEAR ANALYSIS

One potential source of clues and traces of modern traits could be microwear analysis. It allows the determination of stone tool uses and functions and reconstructs prehistoric technology and behaviour (Semenov 1964; Keeley 1974; Tringham et al. 1974). This method applies basic physical principles of interacting surfaces in relative motion and studies the wear and tear created during such interaction between a working tool and the worked object (Yamada 1993). The effects are the same for modern as well as for prehistoric tools made of stone, usually chert and flint. Experiments have demonstrated that almost any kind of contact, even with much softer materials, will result in wear traces on the stone tool (Kamminga 1979; Keeley 1980; Odell 1981; Vaughan 1985; Unrath et al. 1986; Beyries 1988; Pawlik 1992; Anderson et al. 1993; and many others). Knowledge of the specific prehistoric activities and worked materials is imperative. Fundamental research in microwear analysis is analogy-based using archaeological and ethnographic accounts and experimentation (Semenov 1964). An extensive framework of experiments replicating prehistoric tasks and activities and using replicas of stone tools on all kinds of possible working materials under close monitoring builds up the basic data pool that enables the analyst to interpret wear patterns on prehistoric stone tools. Although a large number of experiments and their results have been published in detail, microwear analysts need to conduct their own experiments to become acquainted with the effects and patterns of wear formation and to be able to recognize wear traces on archaeological artefacts. Two main categories of use-wear are relevant for analysis: edge damage patterns (e.g. scarring and rounding of edges), usually observed under relatively low magnifications using stereo-microscopes, and so-called micropolishes, altered, higher reflecting areas on the microtopography of a stone tool, visible under high magnifications and using modified metallurgical reflected-light microscopes. Micropolishes in particular can develop diagnostic features that allow the identification of the specific contact material (Keeley 1980; Vaughan 1985). Along with the detection of wear patterns, residues of the contact material adhering on

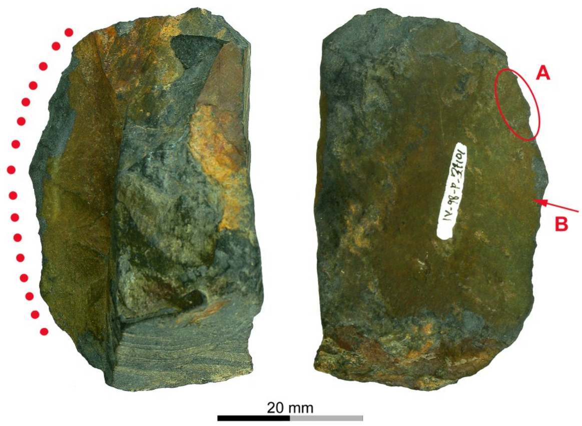


Figure 9. Artefact no. 37101: flake used as side scraper for working harder organic material. The working area and locations of the microphotos are indicated

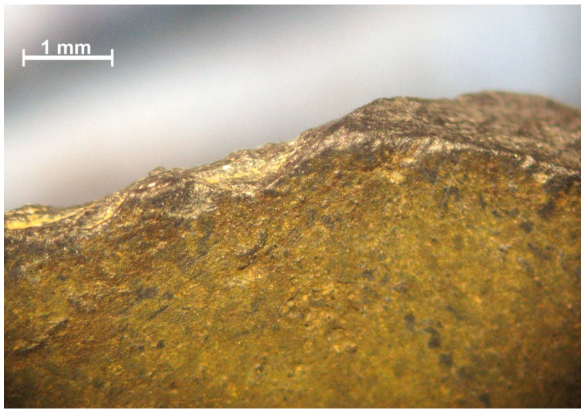


Figure 10. Artefact no. 37101, position A: abraded working edge

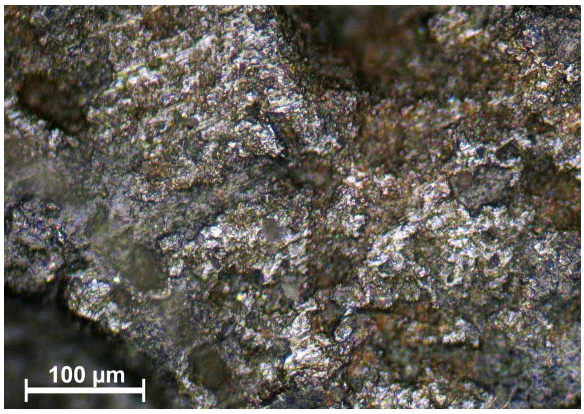


Figure 11. Artefact no. 37101, position B: use-polish and striations from working harder organic material.

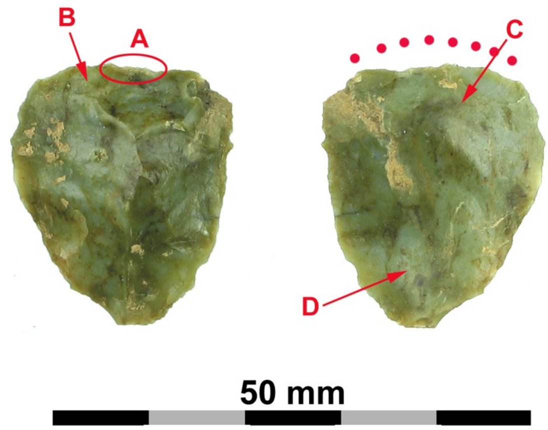


Figure 12. Artefact no. 40408: flake used as endscraper for working harder organic material. The working area and locations of the microphotos are indicated

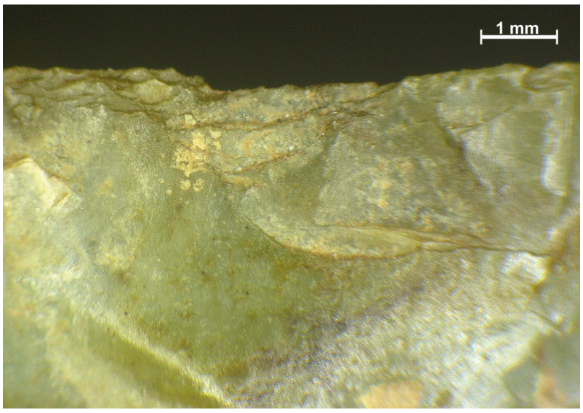


Figure 13. Artefact 40408, position A: intensive scarring of the working area

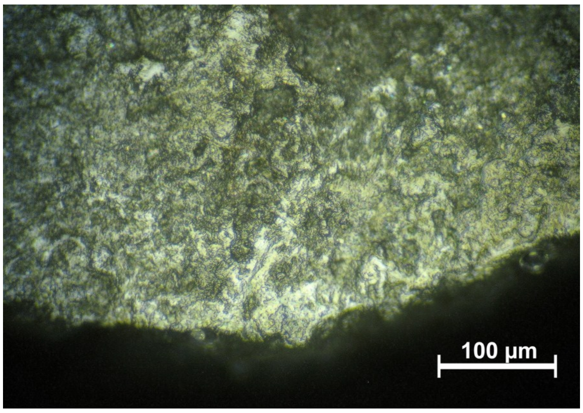


Figure 14. Artefact 40408, position B: micropolish and transverse striations along the contact surface

stone tool surfaces are sometimes found, thus providing direct clues to the origin and nature of the worked material and the activities conducted (e.g. Anderson 1980; Christensen et al. 1992; Pawlik 1995; Fullagar 1998; Hardy and Garufi 1998; Kealhofer et al. 1999; Rots 2003; Pawlik 2004b, 2004c; Rots and Williamson 2004; Torrence and Barton 2006; Dinnis et al. 2009).

As a member of the Palawan Island Palaeolithic Research Project, this author has been conducting the microwear analysis of the Ille Cave material since 2006 on selected Neolithic materials (Pawlik 2006) and the Upper Palaeolithic flaked artefacts. Although they appear as mostly irregularly shaped flakes made of rather inferior raw material like andesite and heavily fissured radiolarian jasper (Schmidt 2008), they carry use-wear features that may indicate the presence of modern traits and complex behaviour. The preliminary results for the Ille assemblage show traces of working harder organic materials like bone, antler, wood and bamboo analogous to the above-mentioned wear traces on artefacts from Tabon and Minori Cave, (artefact no. 37101: Figures 9-11; no. 40408: Figures 12-14; no. 41809: Figures 15-17). Hide processing, an activity considered as a modern trait for Sahul and the western Pacific region (Mellars 2005:22; Gilligan 2010), was observed on no. 41763 (Figures 18-20). Perhaps even more characteristic for modern behaviour are traces and residues that resulted from the working of shell (no. 35569: Figures 21-25) and the use of pigment as indicated by residues of red ochre on some artefacts. On one endscraper-like flake, traces of red pigment appear in combination with hide working (no. 41713: Figures 26-28). Although it cannot be determined with absolute certainty whether the pigment stains are directly associated with hide processing or if they resulted from a different activity, the use of red ochre as a coloring or tanning agent for skins and leather in the Palaeolithic has frequently been observed (e.g. Vaughan 1985; Büller 1988; Juel Jensen 1988; van Gijn 1989; Pawlik 1995).

The surfaces of several artefacts from Ille Cave carry so-called bright spots (Figures 29, 30). They are commonly seen as the result of non-intentional, repetitive rubbing contacts between siliceous artefacts, for example, when carried together in a pouch for some time (Unrath et al. 1986; Levi-Sala 1996). The appearance of such traces can, therefore, be interpreted as signs of curation, the process reflecting a tool's actual use relative to its maximum potential use (Andrefsky 2008). This can also be interpreted as an advanced behavioural concept, contrary to the use-once-and-discard expedient technology model (Mijares 2002).

Impact scars with hinge and step-terminations on a triangular flake, as well as the presence of polish spots on the tip and longitudinal striations on elevated parts of the microtopography of both faces (Figures 31-35), suggest it was used as projectile implement (e.g. Fischer et al. 1984; Lombard 2005a, 2005b; Lombard and Pargeter 2008) . The interior

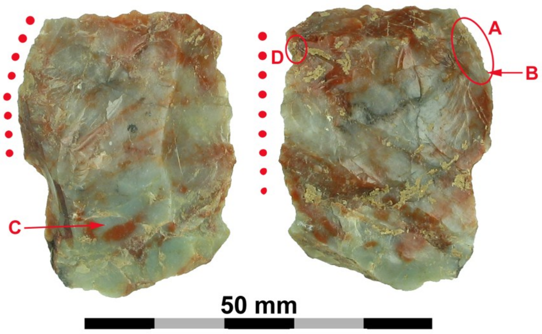


Figure 15. Artefact no. 41809: flake used for scraping and sawing harder organic material. The working area and locations of the microphotos are indicated

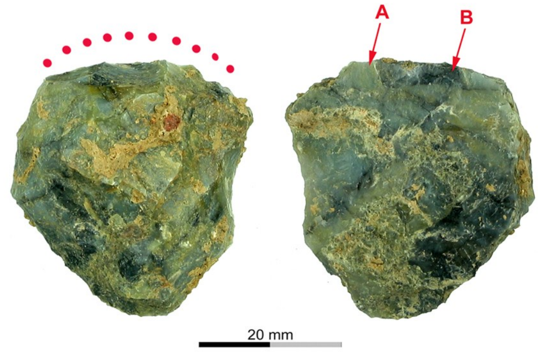


Figure 18. Artefact no. 41763: flake used for hide processing. The working area and locations of the microphotos are indicated

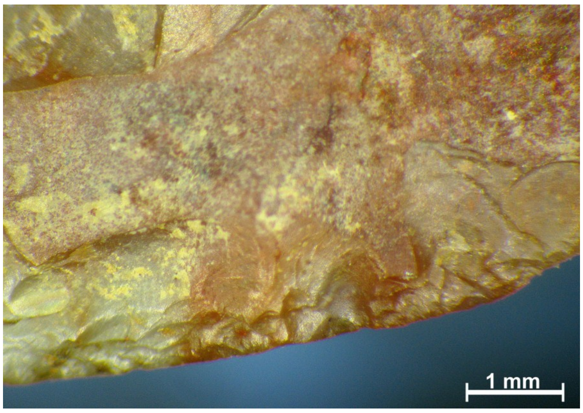


Figure 16. Artefact no. 41809, position A: scarring of the working edge caused by scraping harder organic material

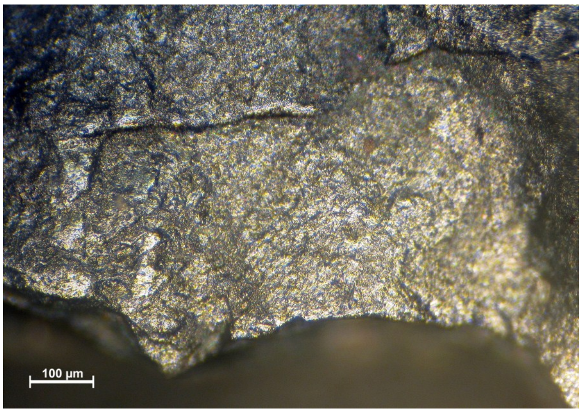


Figure 19. Artefact no. 41763, position A: rounded working edge and transversely oriented micropolish

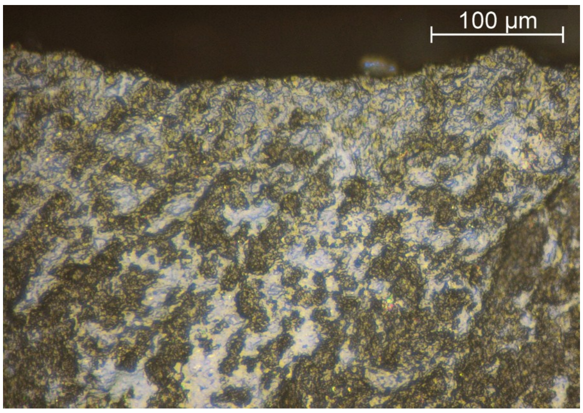


Figure 17. Artefact no. 41809, position B: micropolish and characteristic reticular pattern

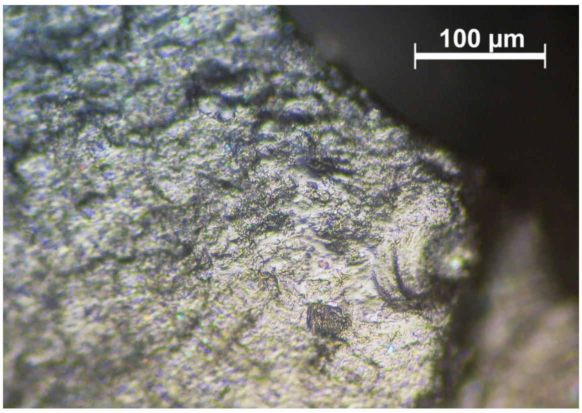


Figure 20. Artefact no. 41763, position B: extensive micropolish and surface abrasion caused by scraping hide

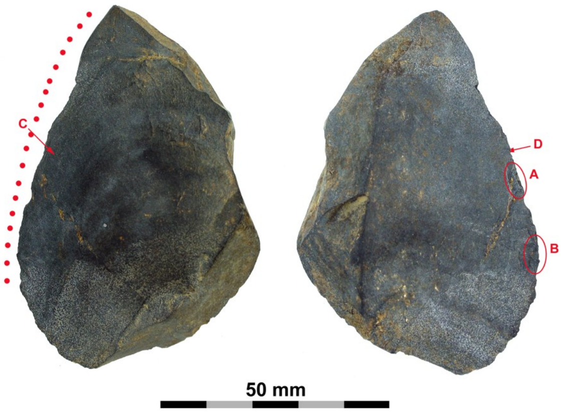


Figure 21. Artefact no. 35569: relatively large flake used for shell working. The working area and locations of the microphotos are indicated.

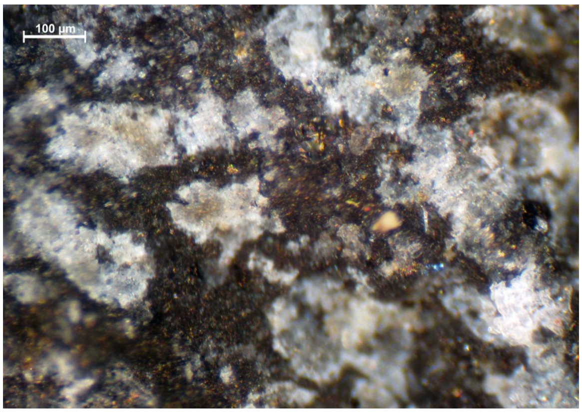


Figure 24. Artefact no. 35569, position C: high power microphoto of scattered particles of shell on the dorsal face of the working edge.

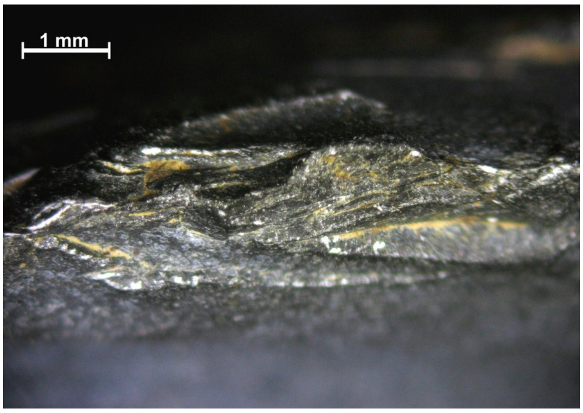


Figure 22. Artefact no. 35569, position A: heavily worn and scarred working edge.

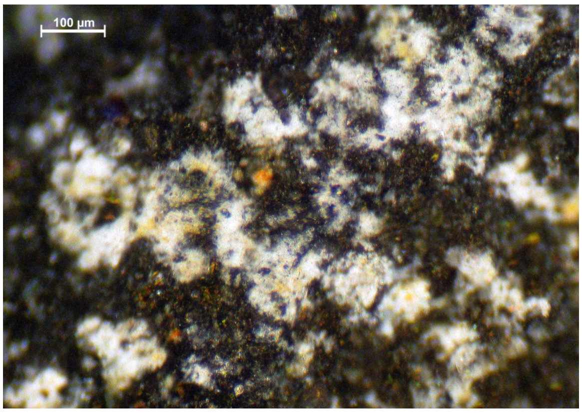


Figure 25. Artefact no. 35569, position D: high power microphoto of scattered particles of shell on

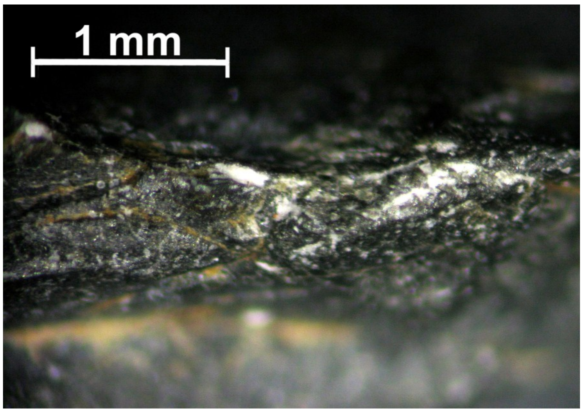


Figure 23. Artefact no. 35569, position B: shell residues on use-scars.

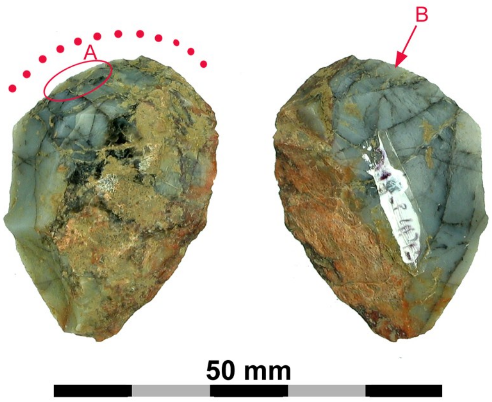


Figure 26. Artefact no. 41713: endscraper-like flake used for hide processing. The working area and locations of the microphotos are indicated.

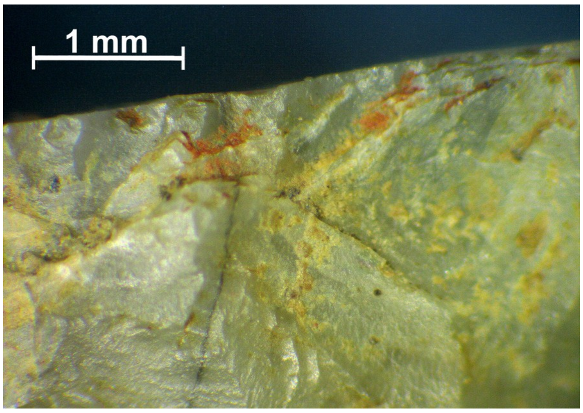


Figure 27. Artefact no. 41713, position A: residues of ochre on the working edge.

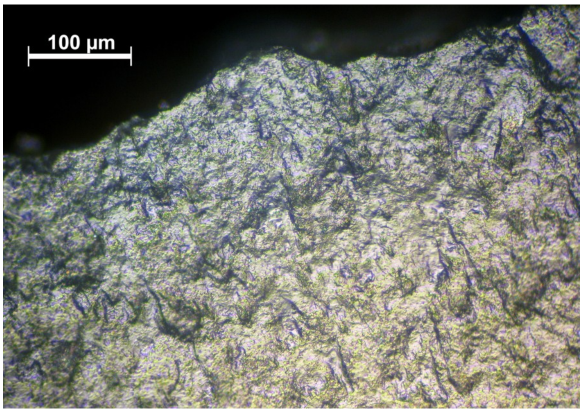


Figure 28. Artefact no. 41713, position B: extensive micropolish caused by working hide.

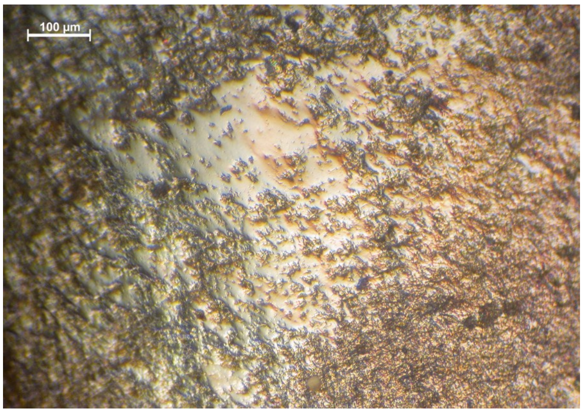


Figure 29. Artefact no. 41809, position B: bright spots

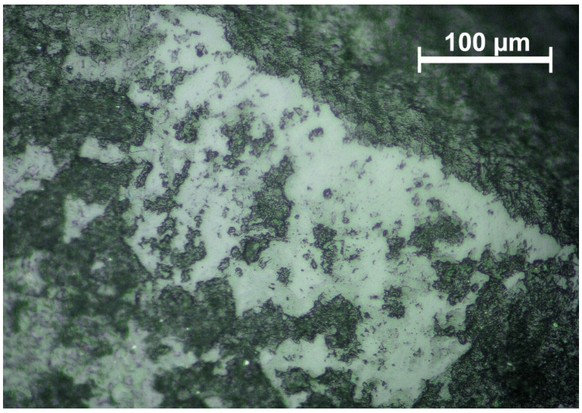


Figure 30. Artefact 40408: bright spots.

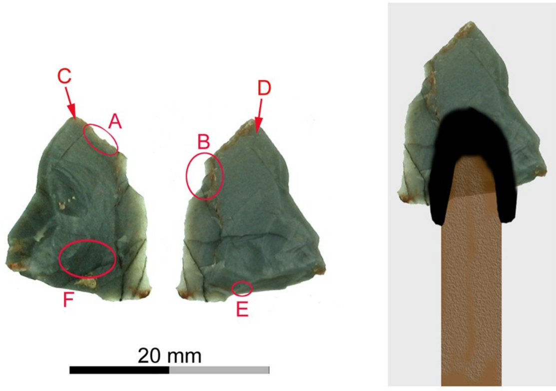


Figure 31. Artefact no. 40406: triangular flake used as projectile point. The working area and locations of the microphotos are indicated.

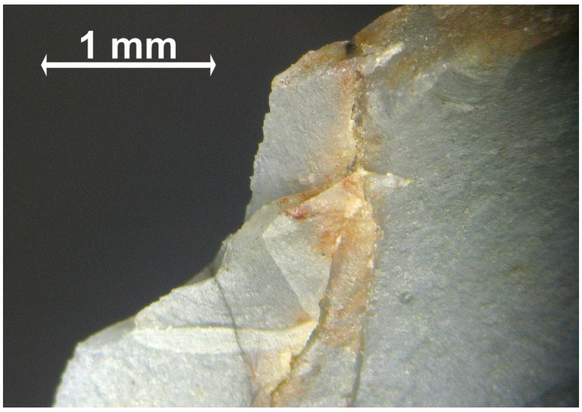


Figure 32. Artefact no. 40406, position A: impact scar near the tip

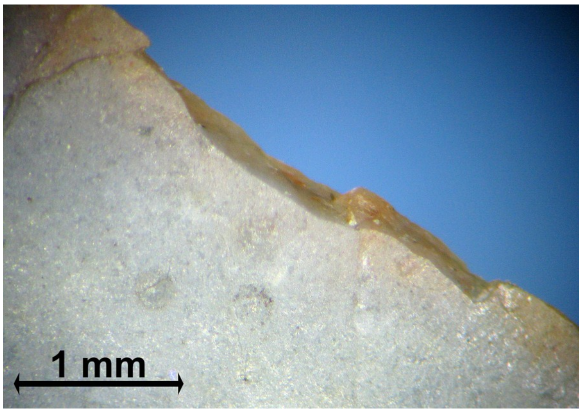


Figure 33. Artefact no. 40406, position B: lateral impact scar.

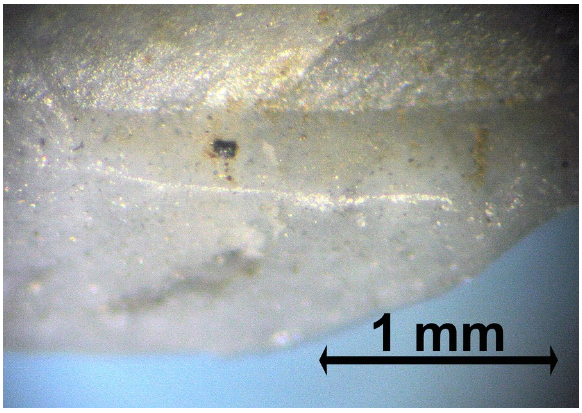


Figure 36. Artefact no. 40406, position E: blackish residues of organic hafting mastic on the ventral base

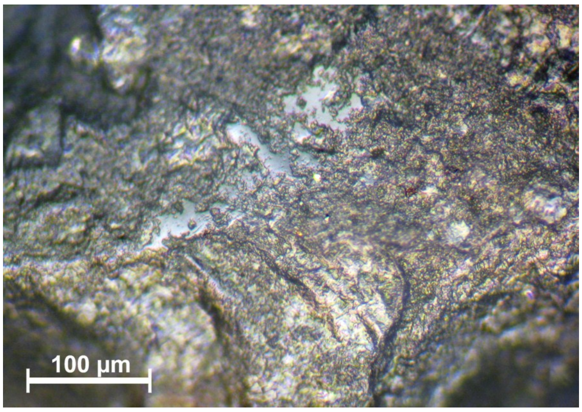


Figure 34. Artefact no. 40406, position C: longitudinally oriented polish spots and striations on the dorsal tip,

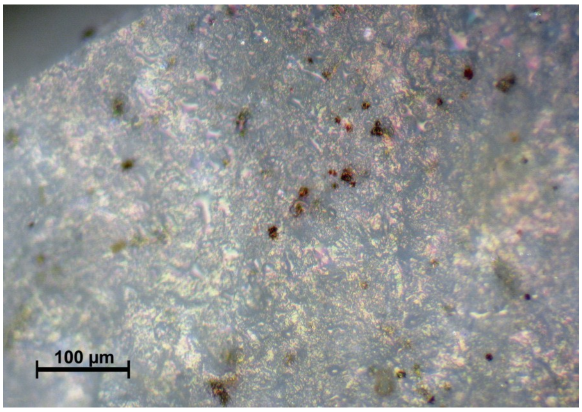


Figure 37. Artefact no. 40406, position F: blackish residues of organic hafting mastic on the dorsal base.

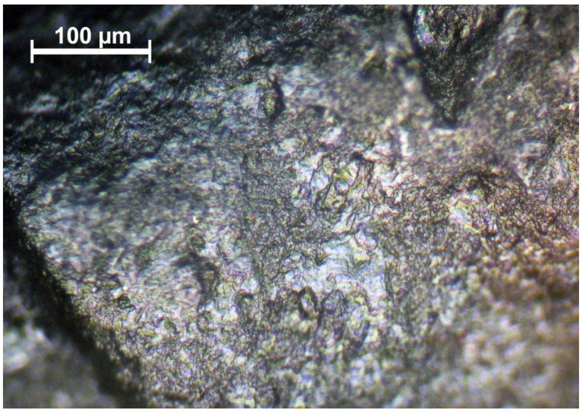


Figure 35. Artefact no. 40406, Position D: Longitudinally oriented polish spots and striations on the ventral tip.

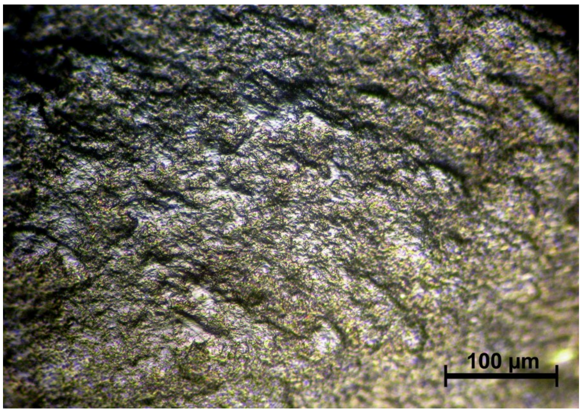


Figure 38. Artefact no. 40408, position D: hafting polish on the proximal part of the end scraper.

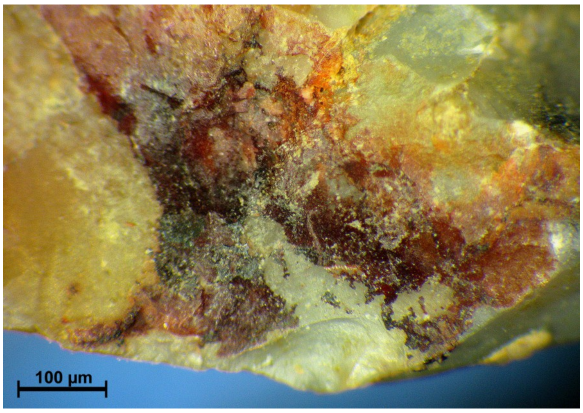


Figure 39. Artefact no. 41809, position D: dark residue film

surface of the base displays polishes which are not use-related but do conform to what is expected from minor movements of a tool against its haft (Cahenet al. 1979:681). Blackish residues that appear along with such polishes are obviously the remains of organic resin used as hafting mastic (no. 40406:Fig. 36, 37). The drop-shaped endscraper no. 40408 exhibits characteristic hafting polishes on its proximal part (Fig. 38), while a blackish-reddish residue film appears along the lateral edge of no. 41809, also indicating hafting (Fig. 39). The combination of impact wear, hafting traces and residues is quite remarkable and identifies these artefacts as hafted armatures that were attached to shafts and fixed with resinous glue. This kind of adhesive appears to be very similar to resin residues found on projectile points made of bone and stingray spine from the West Mouth of Niah Cave in Borneo, dated to 11,700-10,690 cal. BP (OxA-12391 and OXA-11865; Barton et al. 2009). The resins have been identified as deriving from either *Shorea* spp., *Agathis* spp. or *Canarium* spp. These trees and their resins are common in the Philippines and have also been found in the Neolithic layers of Ille Cave, where they were used as appliqués on shell disk beads (Basilia 2011). *Shorea* resin appears to be especially suitable for hafting purposes since it becomes soft again when heated up above 75°C (Tschirch and Glimmann 1896), which would make it an ideal binding material with regards to retooling processes and the replacement of worn-out implements. While the specialised bone points from Niah give further proof for the availability of a Late Pleistocene hafting technology in Island SE-Asia, the use of unretouched lithic flakes as hafted implements for multicomponent tools at Ille Cave is unique and points to a technological concept that is beyond traditional morphological and typological models, but is nevertheless a reflection of the constructive memory of its makers and their ability to perform complex sequences of action (Ambrose 2010).

The hafted artefacts from Ille Cave mark the first evidence for composite-tool making and complex tool design in the Philippine Palaeolithic. Hafted composite tools and the making of hafting mastic for fixing lithic armatures in wooden shafts have been observed in European Micoquien and Aurignacian assemblages (Pawlik and Thissen 2008; Dinnis et al. 2009; Pawlik and Thissen, in prep.) They are considered to be components of the European and African package (Keeley 1982; Wurz 1999; Deacon 2000; Ambrose 2010), and have been regarded as a significant trait of behavioural modernity for Southeast Asia and the western Pacific region (Barton et al. 2009). However, hafting traces are easily overlooked or neglected in microwear analysis (Cahen et al. 1979; Keeley 1982) This analysis of relatively simple flakes from the Philippine Upper Palaeolithic shows that some were actually hafted armatures and parts of more complex composite tools (Pawlik 2009a, 2009b). The dominantly small size of the flakes in Philippine lithic assemblages could even indicate the intention of the toolmakers to use them as hafted implements. This result presents a different angle to the above-mentioned discussion of wood and bamboo industries to explain the absence of formal tools and lithic typologies in Southeast Asia. Considering bamboo and wood as prime material for the manufacturing of the shafts for composite tools rather than replacements for stone tools might shed a new light on the discussion of the dilemma of missing types in SE -Asia's Palaeolithic and Epipalaeolithic (Haidle and Pawlik 2009).

CONCLUSION

The microwear study of the lithic artefacts from Ille Cave indicated that components of the package of modern behavioural traits were present in the Upper Palaeolithic of the Philippine archipelago. It also demonstrated that the traditional methods of typological and technological studies are sometimes insufficient for the recognition of modern traits, and that additional analytical tools are needed. Microwear analysis offers actual technical and functional characterizations of lithic artefacts, the identification of working and hunting tools, and a determination of activities and site functions (Pawlik 2009a). It has no regional and chronological limitations and shows a potential for the detection of differentiated "modern" behaviour and complex technologies, like hafting and composite tool making, projectile points, curation, fabrication of ornaments, shellfishing, use of pigments and more. Even if modern traits are seemingly absent in the lithic record, taking a closer look can make them visible.

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