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Analysis of Two Polished Stone Adzes from Ille Cave at El Nido, Palawan Island, Philippines

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Introduction

Ille Cave is among several cave sites of El Nido, Palawan Island, which had been investigated by Robert Fox in the mid-1960s. The cave is situated in Barangay New Ibajay, fifteen kilometres northeast of El Nido town. It is part of the Late Eocene Pabellion karst formation of El Nido and is found inside a tower-like rock, (SEAICE 1999). The cave is easily accessible with its mouth at ground level. The entrance is under a massive overhang that forms a large rockshelter. Protected by the overhang is a spacious platform with a usable area of about 450 square meters situated like a terrace in front of the cave's entrance (Pawlik 2004). Especially this platform has caught the attention of Wilhelm G. Solheim II who immediately recognized the importance of Ille Cave as a prehistoric settlement site bearing a long chronological sequence during his initial visit in 1998 when he remarked it was *"...a beautiful, huge rockshelter which appeared to me to be but the potential Pleistocene archaeological site I have ever*

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seen either pictured or in person" (SEAICE 1999: 90). Since then, an international Museum of the Philippines, the Southeast Asian Institute of Culture and Environment, Australian National University, and the University of Cambridge is excavating Ille Cave (Cayron 1999, Szabo *et al.* 2004, Paz and Ronquillo 2004).

The still ongoing excavation has shown that Ille Cave was continuously inhabited from fairly recent times down to the Late Pleistocene, as several radiocarbon dates on charcoal indicate (Lewis *et al.* 2006). The cultural layers contained a number of burials, including a dog burial in the historic and Neolithic layers. Belonging to the rich Neolithic cultural materials recovered are two complete and skillfully produced adze blades. They were subject to the following morphological and functional analysis.

Polished Stone Adzes in the Philippines

Numerous artefacts labeled as adze blades have been found and reported from all over the Philippines. However, many of them are fragmented, originate either from surface collections or were found apart from any archaeological context. The pioneer of Philippine archaeology, H. Otley Beyer (1947, 1948), reconstructed a typo-chronology for Philippine Neolithic adzes based on his collections during the first half of the last century. He attributed oval and shouldered adze forms to a middle Neolithic between 2250 and 1750 BC and stepped forms to the late Neolithic (1750 - 200 BC). For Palawan, Robert Fox (1970) reported several stone adzes associated with other lithic and shell artefacts and pottery from the excavations of Leta-leta Cave, a burial site on Langen Island, El Nido, and cave sites and rockshelters around Lipuun Point, Quezon including Duyong Cave. Several sites in Lal-lo, located in the Cagayan Valley of the northern Philippines, have delivered adze blades made of various rocks (De la Torre 2001; Ogawa 2001). Radiocarbon dates for the Catayauan site of around 1000 BP suggest that stone adzes were used from the early Neolithic until close to the protohistoric period (Mihara *et al.* 2005).

Despite the many references to stone adzes, only few lithic analyses have been carried out. Regrettably left unpublished, Lynch (1949) in his masteral thesis worked intensively on the morphological and typological classification of adzes and other ground stone tools in the Philippines. His work pays tribute to the large variety of ground adze blades in the region, distinguishing already over 20 different types and variations for just two provinces, Bulacan and Rizal, in Luzon Island. Mijares (1996) studied two apparently unusual stone adze types from the Luyang

Baga Cave Complex in Mindoro, associated with cord-marked pottery and small obsidian debitage. One adze made of basalt has a very distinctive elongated form which resembles the shell adzes found in Palawan and Tawi-Tawi rather than any known stone adze type in Southeast Asia. A blade fragment of an adze from the same site was made of jade and appears unusually thin with a maximum thickness of only seven millimeters (Mijares 1996: 32-33). In her Master's thesis, Hung (2000) conducted a comparative study of Taiwanese, South Chinese and Philippine stone adzes. Bellwood and Dizon (2005) used the presence of stone adzes in Neolithic sites on Batanes island as an indicator for the Austronesian expansion beginning at around 2500 BC and the existence of a migration route leading from Taiwan into the Philippines via the Batanes islands. However, a morphological analysis of these adze blades was not part of their site report. The interaction between Taiwanese sites, the Batanes Islands and Luzon with regards to the dispersal of Fengtian nephrite by means of trade and exchange into the Philippines was supported by a sourcing study (Iizuka and Hung 2005; Hung and Iizuka 2006). However, the artefacts selected for this study are associated with the later Anaro and Naidi phases of prehistoric Batanes, and according to a number of radiocarbon dates, range into the first centuries AD (Bellwood and Dizon 2005: 21). Nephrite or jade is a semiprecious stone, and since the Early Neolithic a much sought-after raw material for jewelry. Yet, it has not been convincingly explained why Neolithic craftsmen in the Philippines would need to import or acquire Taiwanese nephrite and slate to produce adze blades, a tool type highly exposed to damage and attrition. Adzes can be produced out of various igneous rocks, locally available in Batanes and all over the Philippines. It seems more likely that the presence of various adze blades with foreign raw material in Batanes and elsewhere in the Philippines is a result of occasional or even frequent visits of Proto-Austronesian speaking and perhaps other seafarers to the archipelago rather than of trade. Certainly, they carried adzes with them in their boats as a standard item of their tool kits. Upon arrival on the island, the used and worn-out adzes were then replaced with new and locally made blades.

Definition and Production

The ground adze is a major type form of the Neolithic. The term "adze" is commonly used to describe an imperforated artefact with a symmetrically shaped adze blade, trapezoidal, ovoid or plano-convex in cross-section and with one functional edge. Adzes with edges symmetrical in cross-section were supposedly parallel hafted, an asymmetric cross-section of the edge is considered for the use in a transverse hafting. Different hafting methods are known from archaeological context, mostly coming from waterlogged sites and lake dwellings (Böhm and Pleyer 1990, Weiner and Pawlik 1995). Direct hafting of the blade on a wooden shaft as well as the use of antler or wooden sleeves were observed. Birch tar residues on short adzes from Twann, Switzerland indicated that they were also glued into or on the hafting (Willms 1980: 67).

For Southeast Asia, Duff's Illustrated Typology is apparently still used as a standard reference for the lithic analysis of adze blades (Duff 1970; cf. Hung 2004, Bellwood and Dizon 2005, Boer-Mah 2006). It discusses mainly the variations of the shape, the cross-section and the presence/ absence and form of the shoulders. In a recent evaluation of Duff's typological model, Boer-Mah in her analysis of Neolithic adze blades from Thailand strongly suggests considering the aspects of reworking and curation (Boer-Mah 2006). Surprisingly, little attention was given to the various ways and the effects of hafting and to the morphology of the functional part of adze blades, the edge.

The chaîne operatoire of adzes is well known. The initial shaping of a rock into an adze pre-form was done by knapping and picking. Traces from this initial process are often still visible on the butt and the lateral faces of the adze. According to Hahn (1993:287), sawing was also applied to cut larger blocks into smaller pieces to make them suitable for further preparation. Sawing is labour-intensive but allows a more precise preparation of the raw material and causes the least amount of débitage. The knapping and picking and, if necessary, also sawing would prepare the raw material (and reduce the remaining amount of labour) for the next step of coarse grinding, and consequent polishing and sharpening. Findings of pre-forms and numerous experiments have shown that this chaîne opératoire was probably the common way of manufacturing ground adze blades (Willms 1980, Weiner 1987, Weiner and Pawlik 1995). Exceptions are the flint adzes of the Old Kingdom of Dynastic Egypt. They were skillfully flaked but remained unpolished, although they are often heavily rounded from use (Pawlik 2000, 2005).

Experimental archaeologists have demonstrated that the grinding can be done by moving the adze pre-form in a back-and-forth motion over a granular grinding stone. During the process of grinding, abrasive agents such as quartz sand or pounded quartz and water will be added. The finer the abrasive or grit, the smoother the surface will become. For the final step, the polishing or finishing, a very fine grit (silt, chalk, etc.) and leather will be used (Weiner 1987, Weiner 1990, Hahn 1993: 284). In front of Ille Cave and still within the habitation platform, two large (but unfortunately later vandalized) limestone rocks with polishing marks, grooves and dimples were discovered by Bill Solheim in 1998. His immediate reaction was that they were used to polish stone adzes (Solheim 2000, Pawlik 2004).

Although shoe-last adzes have been regarded by some researchers as implements for ploughs (Hahn 1993: 288), adzes are commonly associated with woodworking activities, foremost felling and hewing. Müller-Beck (1965: 37f.) interpreted smaller adzes as hewing adzes, the larger ones as felling adzes. However, the constant reduction of size due to multiple resharpening and reworking needs to be considered here.

Principles of Microwear Analysis

Aside from the technological aspects of tool production, a realistic characterization of stone tools must include their actual uses and purposes. From a user's viewpoint, the production of a tool is merely a preparatory step before its use. The techniques of manufacturing the tools used might be even irrelevant to the user. Therefore, it can be argued 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 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. Keeley 1974, Kamminga 1979, Anderson 1980, Keeley 1980, Odell 1981, Unrath 1982, Plisson 1983, Vaughan 1985).

Use-wear analysis is a comprehensive research based on a data and information pool that enables the analyst to identify and interpret wear patterns and surface alterations on lithic artefacts (Pawlik 2001). This data pool is mainly supplied by experiments using stone tool replicas and imitating prehistoric working activities. Complemented by archaeological accounts, ethnographic observations, and also technical descriptions, this experimental framework is crucial for the reconstruction of prehistoric stone tool uses. A thorough microscopic analysis of the replicas provides the use-wear analyst with a set of different experimentally created microwear traces. Subsequently, they are to 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 the principles 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).

Only few microwear studies have been conducted in the Philippines so far. They all focused on flaked artefacts. Ronquillo (1981) conducted a morphological and functional analysis of flaked materials from Rabel Cave in Penablanca, Cagayan using low power microscopy. Further Low Power analyses were carried out by Coutts and Wesson (1980) on flake tools from Panay Island, and Cherry in his analysis of the lithic industry of Buad Island in Samar. The first use-wear study implementing both, low power and high power techniques was conducted by Mijares (2002) in his research on the lithic technology of Minori Cave in Penablanca. A preliminary functional study of Lower Palaeolithic artefacts from Arubo, Nueva Ecija was conducted by this author (Pawlik 2002). This research was then taken further by Teodosio (2006) in her Master's thesis as well, combining low power and high power analysis (Teodosio 2006). Still to come is the technological and functional study of the so-called flake-and-blade industry of Duyong Cave (Tulang 2000; Fox 1970).

Analysis of Adze Blade IV-1998-P-20184

This polished adze blade (Figure 1) is made of a fine grained, homogenous chert with a greenish color. The artefact is complete, measuring 58.2 millimeters in length, has a maximum width of 32.0 millimeters, a maximum thickness of 12.7 millimeters, and weighs 36.2 grams.

The artifact's edge is slightly convex. The immediate edge angle is approximately 63°. In cross-section, the edge is of asymmetric form. The ventral surface of the tool is almost flat and just slightly curved. The dorsal surface is at the frontal part of the edge hyperbolically domed, and the distal part towards the butt is flat and parallel to the ventral. Both lateral faces are convex and bear the remains of preparation negatives. The shape of the adze is laterally slightly asymmetric, with the left side of the adze being more curved than the right side. This adze blade possesses the typical features of early to middle Neolithic flat adzes. However, it has been stressed earlier that the form of adze blades depends on their function rather than their cultural and regional origin. Such an association has to be made with utmost caution, if at all. For example, although clearly of Philippine origin, its morphology is similar to Middle European adzes and would even fit perfectly into the category 2 for Swiss Middle Neolithic adzes (cf. Willms 1980: 25).

The adze is almost completely ground and polished. Only a few remaining negatives on the butt reveal that the initial shaping of the tool into an adze pre-form was done by knapping and picking to reduce the amount of labour for the next step of coarse grinding, and the consequent polishing.

The structural integrity of the adze is affected by many internal cracks and breaks, certainly caused by the heavy duty working activity (Figure 2). However, its edge has only few wear traces. A large impact scar at the left corner of the edge with a fresh looking surface (Figure 3: Pos. A) and a few "nibbling" scars along the edge seem to be post-depositional damages (Figure 4: Pos. B) as well as a crack at the opposite end (Figure 5: Pos. C). The edge line is slightly curved and it appears as if the edge had been resharpened just before the tool was discarded.

The steep dorsal face of the edge shows very fine grinding parallel to the tool's longitudinal axis (Fig. 6: Pos. D). This grinding continues into the distal part of the tool (marked line AA') but becomes gradually coarser with deeper grooves and striations (Fig. 7: Pos. E). On the flat medial and distal part of the dorsal surface, perpendicularly oriented deep grooves are cutting through the finer parallel striations (Fig. 8, 9: Pos. F, G).

Likewise, the ventral face exhibits a fine perpendicular grinding of the functional area (Fig. 10: Pos. H). Towards the butt, the surface was again rather coarse ground (Fig. 11: Pos. I). The coarse grinding could be a secondary modification to adapt the adze blade to another shaft and hafting that perhaps had become necessary due to the progressive use of the adze blade and the change of the tool's shape caused by continuous re-sharpening and consequent reduction in size.

The most prominent use-wear features on the tool are areas with an intensive reflection, similar to what is commonly known as "sickle-gloss" and a result of contacts with plants rich in phytoliths such as grass (Fig. 12, 13: Pos. J, K). This phenomenon is even visible with the naked eye. Already in the 19th century, sickle gloss has been observed on Neolithic flint implements and identified as the result of harvesting cereal plants (Spurrell 1892).

This intensive gloss on the hafted areas of the artefact appears under higher magnifications shining bright and with deep striations or grinding grooves (Fig. 14: Pos. 1). A closer look at the polish surfaces reveals micropitting and more or less longitudinally oriented short (micro-)striations (Fig. 15). Also the lateral edges show such intensive polish (Fig. 16: Pos. 2). Again, perpendicular and transverse striations cut through the polished surface. Quite surprising was that some striations seem to group and form a diamond-pattern (Fig. 17, 18: Pos. 3): These imprint-like traces could indicate a criss-cross binding of the tool.

However, only the dorsal and lateral faces possess such glossy areas. On ventral and at the edge no gloss was detected. Along the working edge any micropolish is barely visible. The few existing polish spots appear undeveloped and isolated, but with a bright reflection and some shallow micropitting (Fig. 19: Pos. 4). Although they just reach the stage of initial polish formation, their texture is similar to polishes created by working on harder organic materials like wood. More polish spots appear on the interior of the ventral face within the hafted area. They are better developed and show the typical features of contacts with hard organic materials: a flat structure, bright reflection and micropitting (Fig. 20: Pos. 5).

Intensive glossy polishes appear on the presumed hafting area but not on the functional part of the tool. They were therefore caused by the hafting and fixation of the adze blade in the shaft. The difference of the contact material of the ventral face to the contact material of the lateral and dorsal faces is obvious and significant for the reconstruction of the hafting and handling of the tool. The ventral face was resting directly on a most likely wooden shaft in the shape of a toe haft. The adze blade was then transversely fixed to the shaft by a binding made of grass-like plants or other phytolith-containing fibers.

Also the traces on the butt can contribute to the reconstruction of the adze's hafting: As already mentioned, there are large and irregular negatives from the initial preparation of the pre-form. Only the surface of a steep hinge negative was slightly affected by the grinding (Fig. 21: Pos. L). The other negatives show unpolished surfaces. A step scar along the lateral edge (Fig. 22: Pos. M) and a large scalar negative from the (right) edge of the butt on the lower face (Fig. 23, Pos. N) appear with a "fresher" surface (but not post-depositional) and un-abraded edges. Their direction of impact is toward the butt which make them look like typical reflex-impact scars (Pawlik 1997). Very likely, they are the result of the *reaction* of the haft against the worked material when the butt was pushed against its shaft rest by the impacts of the edge on the working material. Furthermore, the butt shows secondary modification. This was perhaps carried out together with a secondary preparation of the more convex curved left edge which is suggested by the presence of remaining preparation negatives (esp. Pos. F). This observation seems to confirm the already mentioned assumption that the adze blade was modified at a later stage of its use to fit into a new shaft. The rounded and polished edges of the lateral scars show that the artefact was then again hafted and used.

Analysis of Adze Blade IV-1998-P-20780

This adze blade was made out of an igneous rock of dark grey to anthracite color (Figure 24). Under the low power microscope, a coarse grained but homogenous texture becomes visible. Intrusions of hornblende (amphibole) minerals identify this rock tentatively as an amphibolite (Fig. 25). Palawan amphibolites were formed during inception of the southward subduction within the proto-South China Sea oceanic lithosphere south of the Eurasian margin. Amphibolite samples from central Palawan yield hornblende $^{39}Ar/^{40}Ar$–$^{36}Ar/Ar^{40}Ar$ isochron ages of 34.0±0.6 million years ago (Ma), dating them into the early Oligocene (Encarnacion *et al.* 1995).

Also this artefact is a flat adze, although its morphology is different from the first presented adze. On the ventral side, a slight but distinctive step halfway is visible, reducing the thickness of the artefact towards the butt. However, this adze does not fall into Beyer's (1947) stepped adze type category but can rather be categorized as "partly-stepped adze with pseudo-shoulders" according to Lynch's (1949:193) typology. The lateral edges have informal but as well distinctive shoulders. The distal part of the artefact is therefore thinner and smaller than the proximal part. In length it measures approximately 66 millimeters; its maximum widths are 38.6 millimeters before, and 34.5 millimeters at, the shoulders; and its thickness are 15.5 millimeters before, and 13.6 millimeters after, the step. This step marks the boundary between the active functional part and the hafted area of the tool (Line AA').

The adze's weight is 66.0 grams. The edge angle is approximately 58°. The edge appears almost straight but has a minor convexity. In cross-section, the edge is of asymmetric form. The ventral part of the edge is almost flat and just slightly curved. At the dorsal aspect, the edge is hyperbolically domed. After that, the dorsal face remains flat and straight towards the butt. The two lateral faces have different angles. Lateral face A has a steeper angle than lateral face B and is slightly convex while face B is slightly concave shaped. This shaping seems not to have been carried out very skillfully, or at least not much attention was paid to the symmetry of the adze. This feature and the irregular and coarse grinding of the lateral edges might as well indicate a secondary modification and reworking of the tool. Like the previous adze, this artefact is an almost completely ground tool. Again, only the butt was left unpolished. Scars on the butt and the lateral edges still show that the initial preparation of the rock was done by knapping.

Due to the coarser lithic texture of this adze blade compared to the chert adze, fewer traces of the manufacturing and the use are observed. It has been demonstrated by Mijares (2002:70) in his study of flaked andesite and chert artifacts from Minori Cave in northern Luzon that the poorer optical quality of igneous rocks compared to chert affects the microscopic analysis. Nevertheless, he argues strongly against dismissing coarse-grained lithic artifacts from analysis (Mijares 2002: 75).

On the dorsal face, longitudinal to slightly transverse striations are dominant from the butt to the edge (Fig. 26). Towards the edge, the grinding becomes gradually finer (Fig. 27). A still up-to-date technical feature appears on the immediate edge, a so-called bevel (Fig. 28, 29). Bevelling is a standard procedure in mechanical engineering and although it is also called the "breaking of the edge" since it seems to reverse the sharpening of the edge, it actually enhances its structural integrity. The presence of this feature actually counters the above-mentioned suggestion that the secondary modifications were not made very skillfully. To apply bevelling certainly requires technical know-how and experience. To the writer's knowledge, Neolithic adzes with bevelled edges have not been reported so far.

From the edge to the step, both lateral edges carry longitudinal striations as traces from a parallel grinding. However, where deep groves cross-cut these striations while in the hafted area, only perpendicular striations are visible (Fig. 30: Pos. A). These striations as well as signs of rounding and surface abrasion were caused by the binding of the adze blade on the haft. The presence of glossy areas along the distal parts of the lateral edges again points to the use of phytolith-containing plant fibers as tie (Fig. 31). Although the gloss appears less intensive due to the coarser structure of the amphibolite it is equivalent to the shine observed on No. 20184. Additionally, sticky brownish residues were found on the shoulders, associated with probable binding imprints (Fig. 32-33: Pos. B, C). The residues could be the remains of mastics to support the binding and to attach the tool to the shaft.

In contrast to the dorsal face, the grinding of the ventral face was performed perpendicular to the longitudinal axis of the adze. Towards the edge, the grinding gets slightly smoother but the whole ventral face seems to be ground and polished in the same fashion (Fig. 35: Pos D). No signs of reworking can be observed here, and as in the previous adze no gloss appears on the ventral aspect, therefore suggesting a direct contact of the ventral face with the shaft (Fig. 36: Pos. E).

The basal termination of the asymmetric butt was not affected by the grinding and polishing. However, there are traces of abrasion and rounding (Fig. 37: Pos. F). They might have been the result of a "shock absorbing" contact with a butt rest of the shaft. Such a feature would have prevented the sliding of the adze blade on the haft away from the direction of impact. However, the outstanding vertical plane of the butt does not show any rounding but presents a shattered surface similar to those of hammerstones (Fig. 38: Pos. G). Perhaps, a secondary *ad hoc* use as a hammer left these traces on the butt. Towards the dorsal and ventral faces, the rounding appears again (Fig. 39).

Edge and edge bevel are almost intact and neither can any significant edge damage nor any developed use polish be observed. At best, the immediate edge shows few isolated initial polish spots (Fig. 40, 41: Pos. 1 and 2). A few millimeters away from the edge a more and better developed polish gradually becomes visible (Fig. 42: Pos. 3). Here, the use-wear was not removed by the resharpening. The polish possesses a bright reflection, smooth surface, and irregular micropitting and displays vaguely shallow striations in longitudinal direction (Fig. 43: Pos. 4). It certainly developed from the contact with a hard organic material, and considering the common idea that adzes may have been used in woodworking seems a very likely cause. Similar polish is present on the ventral surface along the hafted area (Fig. 44, 45: Pos. 5, 6). This suggests that the contact material and the shaft material were of a similar kind, which in this case is not very surprising.

The hafted areas on dorsal and lateral faces show an intensive glossy polish on the elevated parts of the microtopography similar to the one observed on adze no. 20184 (Fig. 46, 47: Pos. 7, 8). However unlike the fine grained, cryptocrystalline chert adze, the polish appears less linked on the amphibolite adze. Nevertheless, it is a distinctive phytolith-plant polish.

After the last resharpening and edge bevelling, the adze was not significantly used anymore. A reason for discarding the tool might be a long scar at the corner of the edge. To remove this scar by edge grinding might have reduced the adze blade too much for further use.

Results

Although both adze blades differ in raw material and shape, they show several similarities. They are both flat adzes manufactured in the same fashion, with the addition of a slight step and informal shoulders on no. 20780. They had been hafted in the same manner as adze blades, their edges oriented perpendicular to the adze's motion. The adze blades were tied on a wooden shaft with phytolith-containing plant fibers, perhaps supported by glue-like mastics. The shafts were probably toe hafts, their form and handling can be reconstructed according to the use traces. Both adze blades show signs of reworking and constant resharpening. They show traces typical for woodworking and were certainly used in the same way. And, after the last resharpening they were not or barely used anymore. The technological and microwear analysis of these two adze blades revealed some unexpected features and traces, e.g., the design of a beveled edge which make these artefacts at present quite unique for the Philippine Neolithic.

The effects of use, reworking, hafting, and re-hafting are very meaningful, especially for intensively used and highly curated tools such as adze blades. Based on the results of this study it is questionable if adze morphology and typology are adequate to use for proposing models of chronology, dispersal, migration or trade without first studying and evaluating the traces of manufacture, function, use and handling. Moreover, it can be argued that adze blades as well as all other tools that underwent major changes in shape and size due to prolonged use are not very suitable for typological analysis and typology-based interpretations.

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Abstract

Since 1998, excavations are ongoing at Ille Cave in El Nido, Palawan Island. They have delivered a cultural sequence ranging from recent times down to the Upper Palaeolithic until now. Radiocarbon dates indicate the use of the cave as a habitation and burial site since more than 12.000 years. The burials and artefacts supply evidence for the intensive use of Ille cave during the Neolithic. Among the Neolithic finds are several adze blades and their fragments. Two complete and skillfully produced adze blades were subject to a detailed morphological and functional study. They both show significant traces of the manufacturing and use, thus allowing the reconstruction of prehistoric technologies and activities.

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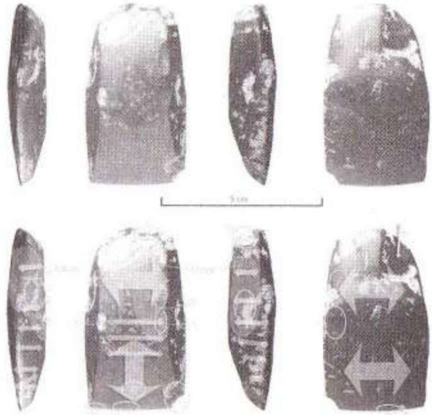

Fig. 1 : Adze Blade No. IV-1998-P 20184

Fig. 2 : Internal cracks on no. 20184

Fig. 3 : No. 20184: Pos. A

Fig. 4 : No. 20184: Pos. B

Fig. 5 : No. 20184: Pos. C

Fig. 6 : No. 20184: Pos. D

Fig. 7 : No. 20184: Pos. E

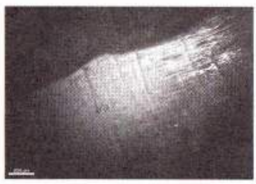

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Fig. 14: No. 20184: Pos. 1


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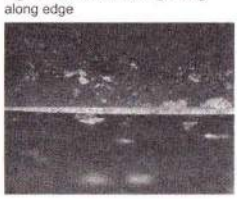

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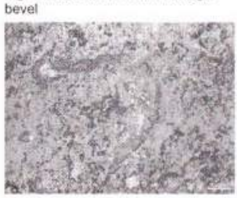

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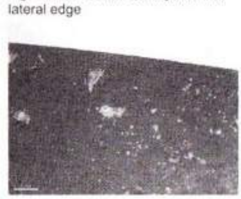

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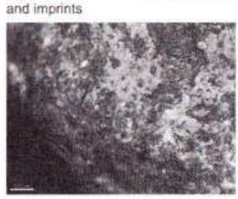

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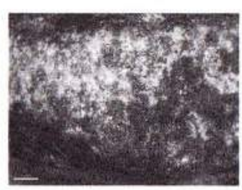

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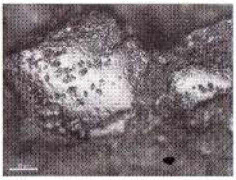
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