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### Beyond the Study of Lithic Assemblages: the case of Picareiro cave, Portugal.

Lithic studies during the last century tended to look at the artifacts, mainly retouched tools, as a final product and as an end product for archaeological analysis. In the last decades this traditional perspective has changed, but the tendency still is to examine the lithic assemblage as the main objective, even while integrating new methodological approaches. Perhaps the interpretive process is improved if one includes other data sets and analytical techniques to better understand the lithic assemblages. At Picareiro cave, Central Portugal, Magdalenian habitations, three-dimensional plotting, typological, technological and use wear analyses, raw material economy allowed a solid knowledge of stone tool function for Layer F/G.

**Bicho N.**

FCHS, Universidade do Algarve,  
Campus de Gambelas, 8005-139 Faro,  
Portugal  
Email: nbicho@ualg.pt

**Gibaja Bao J.**

FCHS, Universidade do Algarve,  
Campus de Gambelas, 8005-139 Faro,  
Portugal  
Email: fgibaja@ualg.pt

**Haws J.**

Dept. Of Anthropology, 236 Lutz Hall,  
University of Louisville, Louisville,  
KY 40292, USA  
Email: jonathan.haws@louisville.edu

**Hockett B.**

Elko Field Office, Bureau of Land  
Management, 3900 East Idaho Street,  
Elko, NV 89801, USA  
Email: Bryan.Hockett@nv.blm.gov

**Funk C.**

Stockton College, PO Box 195,  
Pomona, NJ 08240, USA  
Email: cfunk@verizon.net

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### Introduction: the site of Picareiro cave

The site of Picareiro is a small cave located in Portuguese Estremadura at the Serrad'Aire limestone mountain, some 100 kms northwest of Lisbon (Figure 1). It opens to the West at an altitude of ca. 540 meters a.s.l. With less than 100 sq. meters and a high ceiling, it is marked by a wide entrance tall enough to permit access. Outside of the cave there is a cone below the drip line composed of very large blocks, forming a corridor 3 to 5 meters wide between the drip line and the cave entrance, where recent

prehistoric occupations were found (early Neolithic and Bronze age) (Bicho et al, 2006). Excavations started in 1994 and are ongoing under the direction of Bicho and Haws. Excavation is taking place in close to 50% of the cave area, to a depth of nearly 5 meters. The excavation is on a 1 m<sup>2</sup> unit grid and vertical control follows the natural stratigraphy with subdivision of 5 cm thick spits. All artifacts and faunal specimens (mammal, fish, birds, and shell) larger than 1 cm are plotted in three dimensions. Sediment is screened through 6 and 1mm mesh screens. The archeological material found in the larger screen is sorted in the field, while materials from the finer mesh screen are later water screened and floated in the laboratory.

The stratigraphy is comprised of more than 20 geologic layers, and contains at least three main moments of deposition, dated between 25,000 and 3,000 BP: the beginning of OIS 2 (the Solutrean is not represented so far, though it may be present in other areas of the cave), the Tardiglacial and early Holocene, and the Middle Holocene, corresponding, respectively, to Gravettian, Magdalenian and Epipaleolithic (similar to the Upper Paleolithic of Estremadura – Zilhão, 1997; Bicho, 1992), and Neolithic and Bronze age occupations. There are close to 15 archaeological levels, of which the most common are Magdalenian, found in layers K through E (Bicho et al, 2000, 2006). *Éboulis* is the most important component of the cave deposits, caused by the chemical and physical erosion of the ceiling and cave walls. The *éboulis* interstices are packed with silts and clays from eolian and anthropogenic origin.

### The main hearth and fauna from layer F/G

Layer F/G, about 40 cm thick, is composed of fine sediments filling the spaces among the *éboulis*. There are abundant charcoal and faunal remains, which are mainly concentrated in a very large hearth that is about 2.5 m wide. The hearth is a prepared basin made of large flat limestone slabs that formed a platform against the semi-circular lip of the structure. In the interior, deeper section of the hearth, there are thousands of bones, many burned or charred, predominantly from rabbit but also from red deer, wild boar and small fish (Bicho, et al., 2006). The northern section of the feature is composed of compact dark sediment mixed with ashes, charcoal, and bones, which were probably removed during hearth cleaning. It seems that the hearth was used frequently and repeatedly for a long period of time for meat processing; it is different morphologically and in terms of content from all the other hearths found at the site.

Zooarchaeological analyses indicate that large numbers of rabbits were hunted and brought to the site, where they were processed and consumed (Hockett, Bicho 2000; Hockett, Haws, 2002). It appears that portions of the carcasses, such as the vertebral column, are not present and may have been pounded to render grease. Medium sized prey animals (red deer, roe deer, and wild boar) were brought whole to Picareiro (Haws, 2003). At the cave, red deer legs were defleshed and bones were broken for marrow.

Wild boar was partially eaten and carried out to other sites. Marrow was used as snack food, probably smoked.

The very high number of artifacts and evidence of carcass butchering indicate that hunting took place repeatedly as a short-term hunting strategy.

### The lithic assemblages

Based on typological (Urooz, 1953) and technological analysis, the lithic assemblages from Layer F/G in the cave) suggest that the site is a hunting site. In fact, not even core shapes were found at the site. There are very few complete pieces, core fronts, core trimmings, and a few complete cortical flakes. The number of blanks present in the assemblage is nearly exhausted condition, less than 2 cm long. Tool residues found in the cave, as indicated by high magnification, from layer F/G are chips (Bicho et al., 2006). More than 1% of the total assemblage are cores. The assemblage is a regional lithoteca, most likely from local material sources, located between 10 and 20 km from the site.

More than 40% of the artifacts are tips. These are all backed blades with impact fractures (Figures 1 and 2). This pattern of breakage is not typical of artifacts, since there are many artifacts in breakage pattern, together with the tips. This indicates that the projectile was used (Bicho, 2006). Probably the points were used either inside the carcasses or as a result of impact, or simply in broken pieces.

In general, it seems that the artifacts were resharpened, and discarded around the cave, sometimes

Wild boar was partially eaten at the cave (heads and lower limbs) with the meaty parts carried out to other sites. Marine fish, either sardine or shad, were brought in, carried out as snack food, probably smoked or dried (Bicho, *et al.*, 2006). The very high number of rabbit bones and elements from other animal species, the evidence of carcass butchery, and the high degree of fragmentation of compact bones indicate that hunting took place around the site and that Picareiro cave was used repeatedly as a short-term hunting and carcass processing site.

### The lithic assemblages

Based on typological (Upper Paleolithic) typology by Sonneville-Bordes and Perrot, 1953) and technological analyses (e.g., Ferring, 1980; Baunler 1988, Bicho, 1992), the lithic assemblages from Layer F/G (as well as in the other tardeniense occupation levels in the cave) suggest that the complete *chaîne opératoire* did not take place in Picareiro. In fact, not even core shaping, preparation and maintenance seems to have occurred at the site. There are very few core shaping and maintenance products such as created pieces, core fronts, core trimming flakes and core tablets. In addition, there are also very few complete cortical flakes present and partial cortical flakes are rare. The very low number of blanks present in Picareiro seems to confirm that the cores were brought in nearly exhausted condition, an aspect that is reflected by their small size. Flint cores are less than 2 cm long. Tool resharpening was the main reduction strategy performed inside the cave, as indicated by high numbers of very small chips. Close to 80% of all artifacts from layer F/G are chips (Bicho, *et al.*, 2006). While cores are very rare and make up less than 1% of the total assemblage, tools are much more common, reaching 6% of the assemblage or more than 30% without the chippage. Based on macroscopic characteristics and a regional lithoteca, more than 90% of the tools are made of flint from different raw material sources, located between 15 and 60 km away from the site.

More than 40% of the tool assemblage is composed of different types of weapon tips. These are all backed blades, and all, but one, are broken, showing clear evidence of impact fractures (Figures 2 and 3). The comparison to other stone tools, indicate that this pattern of breakage is not due to site formation processes after the deposition of the artifacts, since there are many non-retouched and non-broken blades. This difference in breakage pattern, together with the frequent impact fractures present in the weaponry, indicates that the projectile points were brought to the site already broken (Bicho, *et al.*, 2006). Probably the points were used in bow and arrow hunting and arrived at the site either inside the carcasses of the hunted animals, whereby they were broken at the time of impact, or simply in broken condition to be replaced at Picareiro cave. In general, it seems that retouched tools were brought to the site in final form, used there, resharpened, and discarded. The projectile points were used in hunting near or around the cave, sometimes brought in with the hunted prey. Carcasses were also brought

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to the cave, defleshed, prepared, and dried or smoked. The weaponry was removed from the carcasses and either resharpened and rejuvenated or dropped at the site.

Using a low power (10-90x) and a high power (50 to 400x) Olympus microscopes (for general analytical procedures see Vaughan, 1985; Terradas, Clemente, 2001), over 100 artifacts were studied during the use wear preliminary analysis of the lithic assemblage. The results show that 65 artifacts (63.1%) had evidence of use with 76 active areas, 33 (32.1%) artifacts has surface alteration and thus, it was not possible to confirm their use and, finally, only 5 pieces did not have any use wear present.

The use wear evidence present in the most common type of artefact, the backed bladelet, indicates that they were used as projectiles. Also fairly common are blades used to deflesh the carcasses and perform raw and dry hide processing, which is common in other Upper Paleolithic sites (Ibáñez, González, 1996; Araujo, 2005). Flakes were used to cut vegetal matter, perhaps of a softer type than hard wood, while some burins were used to scrape wood or bone, possibly to prepare and maintain arrow shafts or bows, also

TABLE 1. Radiocarbon dates from the Magdalenian levels of Lapa do Picareiro.

Lab. #	Layer	Material	Date BP	Notes	evaluation (a)
Wk-4217	E Top	charcoal	10,070±80		A
Wk-5431	E Middle	charcoal	11,700±120		A
Wk-10434	E Middle	charcoal	12,500±160	hearth	R (b)
Wk-4218	E Lower	charcoal	11,550±120		A
Wk-4219	F	charcoal	11,780±90		A
Wk-6677	F	charcoal	12,210±100	hearth	A
OxA-5527	G	charcoal	12,320 ±90		A
Wk-10433	J	charcoal	10,490±110	hearth	R (c)
Wk-6678	J	charcoal	11,880±80		A

a) A- accepted; R - rejected.

b) The sample was likely contaminated with charcoal coming from Layer G.

c) The sample was likely contaminated with charcoal coming overlaying levels through the éboulis interstices.

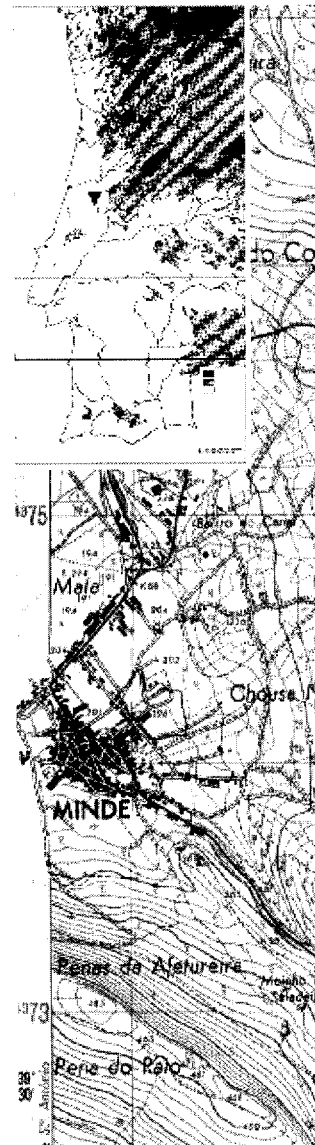


Figure 1. Map with the location of

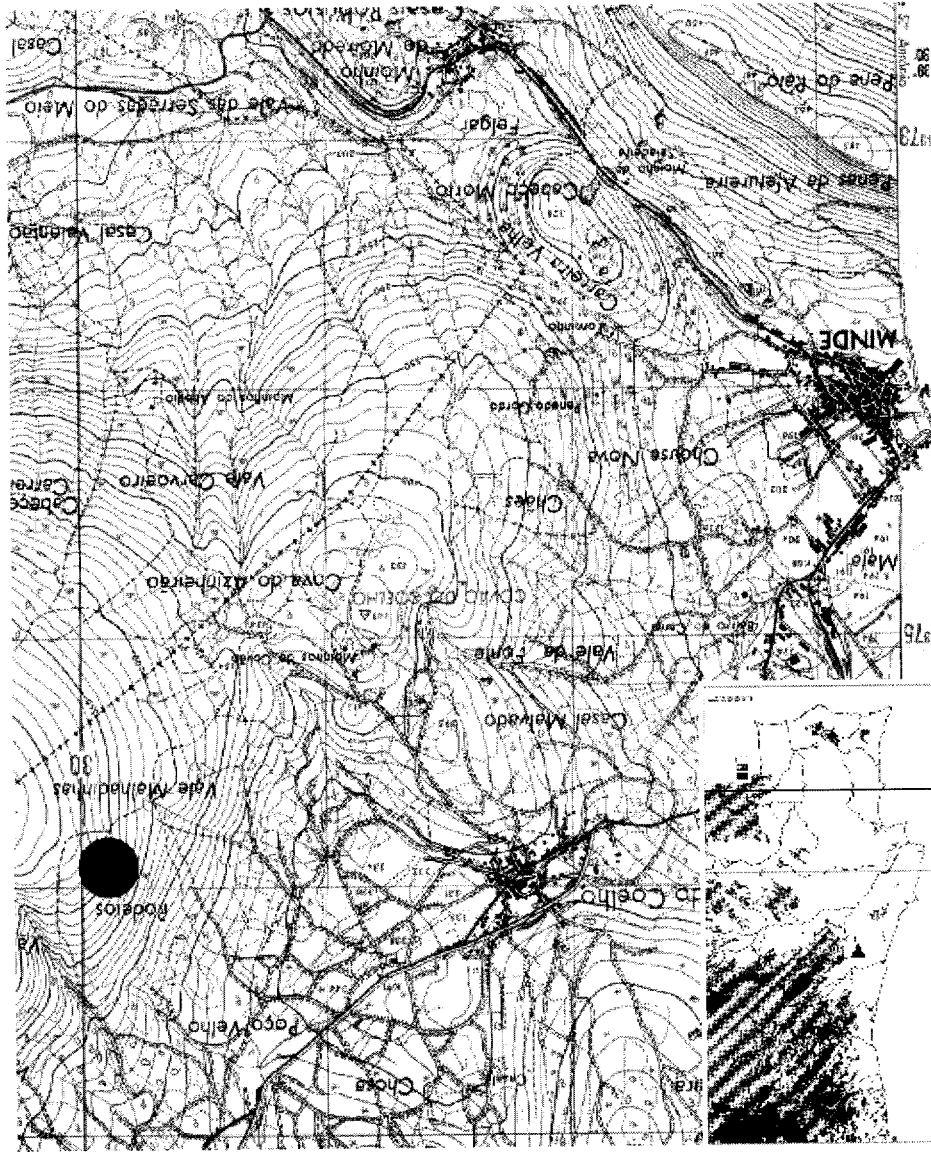


Figure 1. Map with the location of Picareiro cave.

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(0x) Olympus microscopes  
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analysis of the lithic assem-  
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was not possible to confirm  
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ly common are blades used  
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O, 2005). Flakes were used  
d, while some burins were  
arrow shafts or bows, also

careiro.

Notes	evaluation (a)
	A
	A
earth	R (b)
	A
	A
earth	A
	A
earth	R (c)
	A

from Layer G.  
overlying levels

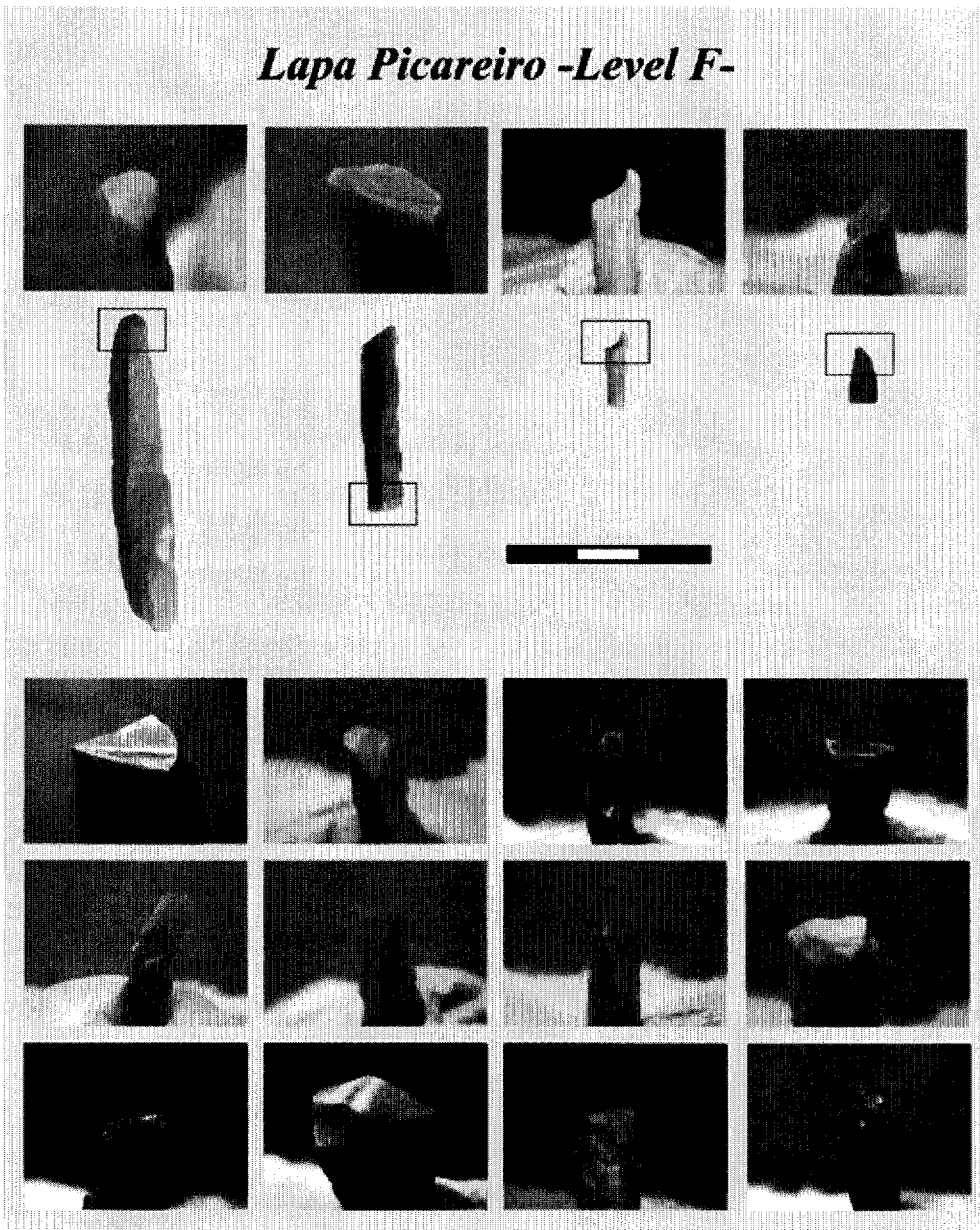


Figure 2. Backed bladelets with impact fractures on the distal ends. Magnification at 40X.



Figure 3. Microlithic tools from

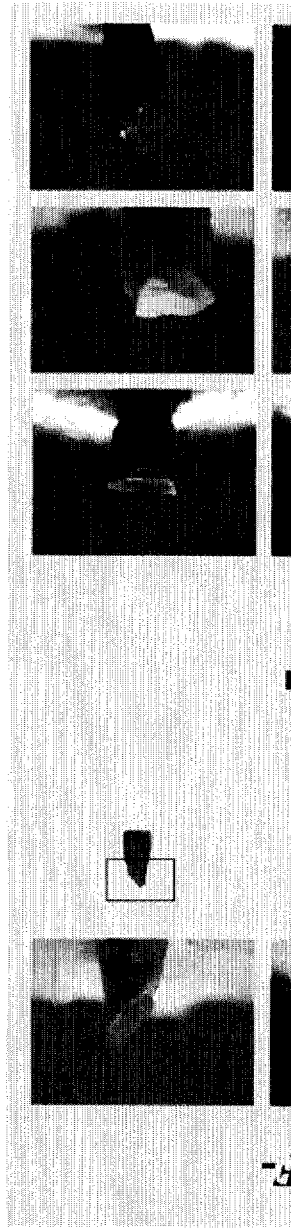
as seen in other Iberian sites... other functions: while the b... edges were utilized for work... as meat or vegetal matter. T... sites: Verberie (Symens, 19... France, San Cassiano (Arrig... (Ibáñez, González, 1996) in

The evidence for impact... and hinge fractured, which... Naturally, some of these fra... by site formation processes... most retouched bladelets pro... ally are complete. Finally, th... of deep striations with flat p... tip of the piece, also indicat... as the skeleton. Thus, the m... confirm their use as hunting

as seen in other Iberian sites (Ibáñez, González, 1996). These tools were also used for other functions: while the burin facet was utilized for working bone or antler, the side edges were utilized for working other materials such as hide, cutting soft materials such as meat or vegetal matter. This pattern has been documented in other western European sites: Verberie (Symens, 1986), La Vigne Brun (Araujo, 2005), Isturitz (Rios, 2006) in France, San Cassiano (Arrigui, *et al.*, in press) in Italy, or Santa Catalina and Berniollo (Ibáñez, González, 1996) in Spain.

The evidence for impact fractures is clear in the weaponry artifacts. They are step and hinge fractured, which results from direct forceful contact with the animal skeleton. Naturally, some of these fractures could have been produced during blank production or by site formation processes, such as stepping or rock fall. It is significant, however, that most retouched bladelets present this type of fractures, while those non-retouched generally are complete. Finally, the presence, although partially masked by surface alteration, of deep striations with flat planes parallel to the main axis of the bladelet, starting on the tip of the piece, also indicate penetration in the flesh and impact with hard surfaces, such as the skeleton. Thus, the many types of use wear characteristics on the backed bladelets confirm their use as hunting weaponry.

Figure 3. Microlithic tools from Layer F.





## Conclusions

The final integrative conclusion presented here includes data from layers F/G of Picareiro Cave, which was published recently elsewhere (Bicho, *et al.*, 2006; Gibaja *et al.*, 2007), and the results of a series of analyses: lithic, with both typological and technological perspectives, use wear, zooarchaeological, and preliminary spatial analysis of the cave including artifact positions relative to the hearth location.

Faunal analysis indicates that the local hunter-gatherers preyed mostly on rabbits, red deer and wild boar, although they also brought in fish and occasional birds. The rabbits were hunted near the cave (likely with the use of nets and traps), probably in the limestone slopes of the mountain that are covered with Mediterranean vegetation. Red deer and wild boar were hunted at the bottom of the hill, in a wide valley with close vegetation and plenty of water.

The preys were transported into the cave, and there were defleshed, processed, and dried or smoked. While some of the meat stayed at the site, most of it was transported away, probably into residential sites, in a highly logistical organization of the region.

The technological and typological analysis of the lithic assemblage confirms those patterns: the majority of the lithic artifacts are very small chippage, smaller than 2 mm, resulting from the retouching and resharpening of stone tools. Cores are rare and tend to be completely exhausted. The exceptions are large chopper like cores made on quartzite. Contrary to the low number of cores, retouched tools are frequent and among them the high number of small backed points, many with evidence of impact fractures, suggests the use of bow and arrow technology in hunting.

The use wear data, again, suggest a similar pattern: the backed bladelets were used as projectiles and the non-retouched bladelets were used to cut and deflesh. In addition, other, rarer, retouched tools such as endscrapers or burins show evidence of hide working and wood cutting and scraping, probably to prepare the wood for the large hearths used in meat smoking.

The example of Picareiro cave shows how reliance on only the technological and typological analysis of lithic assemblages truncates holistic interpretation. In the present case, the traditional information from lithic analysis would simply indicate the lack of complex and long reduction sequences at the site and the presence of a strong weaponry component. Together with the zooarchaeological, spatial and use wear analyses, the scenario is complete and each type of data serves as independent confirmation for the assumptions or interpretations based on each data set.

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