Notes

A Levallois point embedded in the vertebra of a wild ass (*Equus africanus*): hafting, projectiles and Mousterian hunting weapons

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The hunting methods of the Neanderthals are rarely evident in detail in the archaeological record. Here, the rare and important discovery of a fragment of broken Levallois point, embedded in the neck-bones of a wild ass, provokes plenty of discussion of the methods of hafting and killing game in the Middle Palaeolithic of Syria.

Key-words: Levallois, Syria, Neanderthal, wild ass, projectile, hunting

The El Kowm basin of Central Syria lies between Palmyra and the Euphrates River (FIGURE 1). It is a valley 25 km wide and 80 km long, dominated to the East by the Jabal Bishri (rising to 850 m) and to the South by the Jabal Minshar (879 m) and the Jabal Mqaïbara (1110 m). Running down the centre of this natural basin is an elongated plateau, the Qdeir, which was carved out by quaternary erosion. During surveys in 1978, directed by Fujimoto (1979) and Cauvin (Cauvin *et al.* 1979) as part of the El Kowm research expedition, numerous sites were discovered in the backdirt of several ancient wells situated on the periphery of this plateau, or on the surfaces of many tells.

One Middle Palaeolithic site, Umm el Tlel (FIGURE 1), has been the subject of detailed research. This is an open-air site located on the northern slope of the Qdeir plateau (Boëda & Muhesen 1993; Molist *et al.* 1987–88). Previous studies have demonstrated its significant archaeological potential, including a continuous stratigraphic sequence from the Acheulean to the Neolithic. Excavations of the Palaeolithic sequence (Boëda & Muhesen 1993), carried out from 1991 to 1998, have resulted in the recognition of 89 layers extending over 6 m in depth: 29 levels are attributed to the Upper Palaeolithic (Levantine Aurignacian and undetermined); 3 to an intermediate Palaeolithic (possibly Ahmarian and transitional phases), and 57 to the Middle Palaeolithic. One of these Middle Palaeolithic levels, IV 3b'1, has yielded a mesial fragment of a Levallois point embedded in the 3rd cervical vertebra of a wild ass (*Equus africanus*) (FIGURES 2a, b, c & 3).

The tool industry of this level has been assigned to the Mousterian. Preliminary thermoluminescence (Mercier *et al.* 1995) measurements yield an age in excess of 50,000 years for this industry. This level, which is rich in osseous material (12,000 objects), belongs to the sedimentary group VI3, corresponding to a lacustrian sedimentation (M.A. Courty pers. comm.). The entire assemblage of lithic and osseous material is remarkably well preserved.

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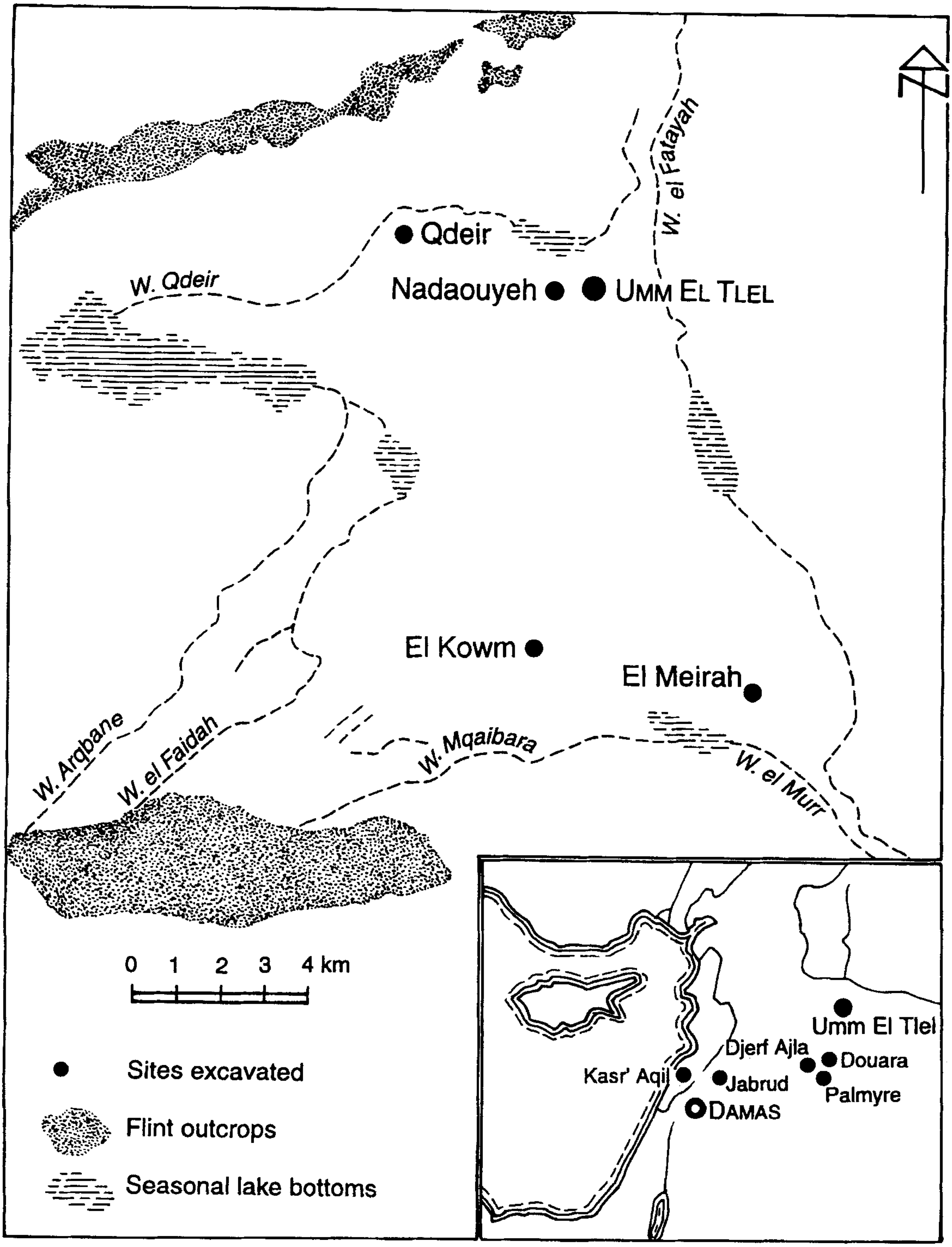
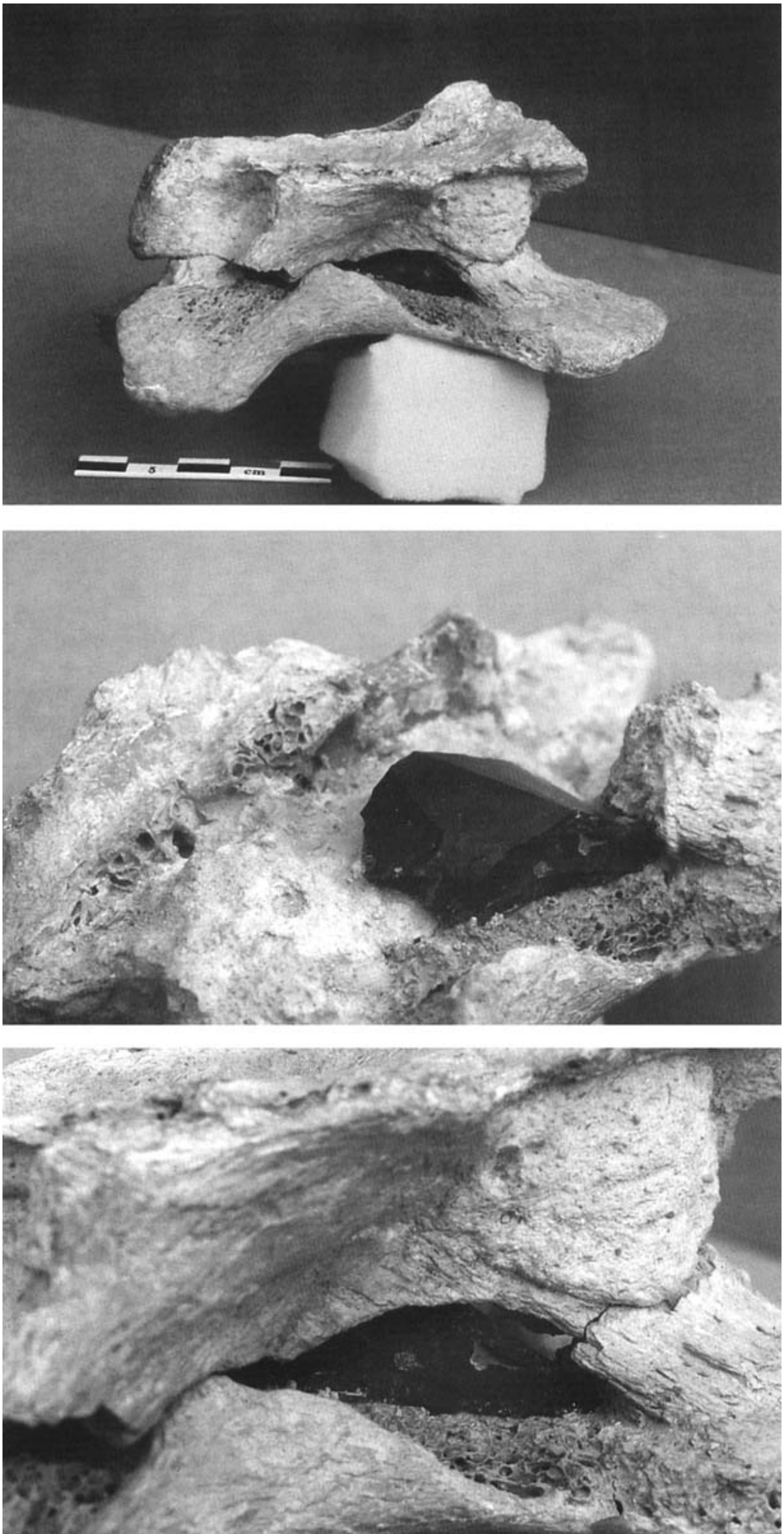


FIGURE 1. *Location of archaeological sites in the El Kowm Basin.*



FIGURES 2a, b, c.
A fragment of a Levallois point, the mesial part embedded in the 3rd cervical vertebra of a wild ass (Equus africanus). *(Photos Constant/Boëda/Griggo.)*

Analysis of the lithic point fragment

The artefact in question is a mesial fragment of a triangular shaped flake classified as a Levallois point (FIGURE 4). It is 1·4 cm long and has a trapezoidal morphology. The two extremities of this fragment exhibit scars that indicate simple, bending (flexion) fractures. The distal break is 1·85 cm wide and 4·6 mm thick. The proximal break is 2·5 cm wide and 6 mm thick. This fragment corresponds to the mesial part of a Levallois point.

The Levallois point is characteristic of the Levantine Mousterian (Meignen & Bar Yosef 1992). This tool type is particularly well represented in the archaeological level VI 3b'1, where it appears to have been one of the most desired products of the flintknappers. It is obtained by the recurrent, bipolar Levallois debitage method (Boëda 1994; 1995), which allows for the production of a great number of Levallois points with very diverse morphological, technical and metric characteristics. This diversity of Levallois points is specific to this archaeological level. In other Mousterian levels at Umm el Tlel the technical characteristics of Levallois points are more standardized, and they are thus much more similar to each other.

This disparity, from one archaeological level to another, in the treatment of objects of the same morphological type, can be attributed to different functional intentions. Indeed, the morpho-technical diversity of Levallois points from level VI 3b'1 is due to the fact that this type of object can be associated with several different functions, as well as manners and contexts of function (*fonctionnement*). The first microwear analysis results obtained by H. Plisson (CNRS) attest to a cutting function associated with various materials.

In the case discussed here, the function is very different, since the object in question has penetrated into a vertebral bone. It was lodged in the vertebral foramen after having traversed the vertebra through the vertebral pedicle (the bony wall that connects the vertebral body to the neural arch) from the right side (FIGURE 5). It entered at a slightly oblique angle, from high to low, and its presence in the bone cannot be the result of butchery activity. Indeed, on other cervical vertebrae found at Umm el Tlel, the marks that correspond to butchery activities are fine, superficial striations that are localized at the articular processes. Moreover, a considerable force was required in order to traverse the

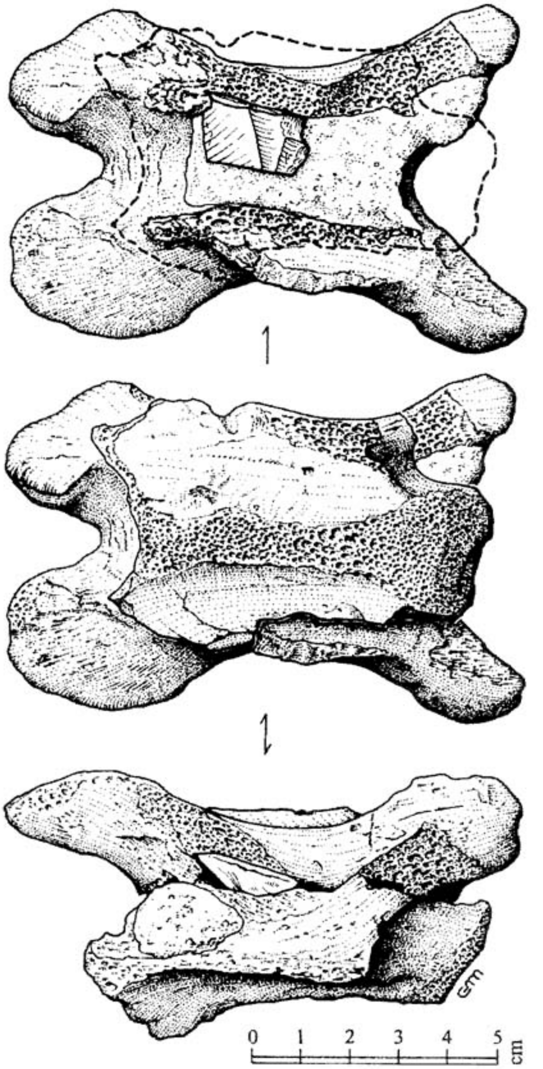


FIGURE 3. *A Levallois point embedded in the vertebra of a wild ass.*

bony wall of the vertebral pedicle of the 3rd cervical vertebra of a wild ass (*Equus africanus*).

The reconstruction of the Levallois point from this mesial fragment is possible without a great margin of error. The missing distal extremity, the easiest to evaluate, is estimated to be 2·4 cm long, or 3·8 cm long if we join the distal and mesial parts. By comparison with other Levallois points found in the same archaeological level, we estimate the total length of the point along its morphological axis to be 7 or 8 cm, with a basal width between 4·5 and 5 cm.

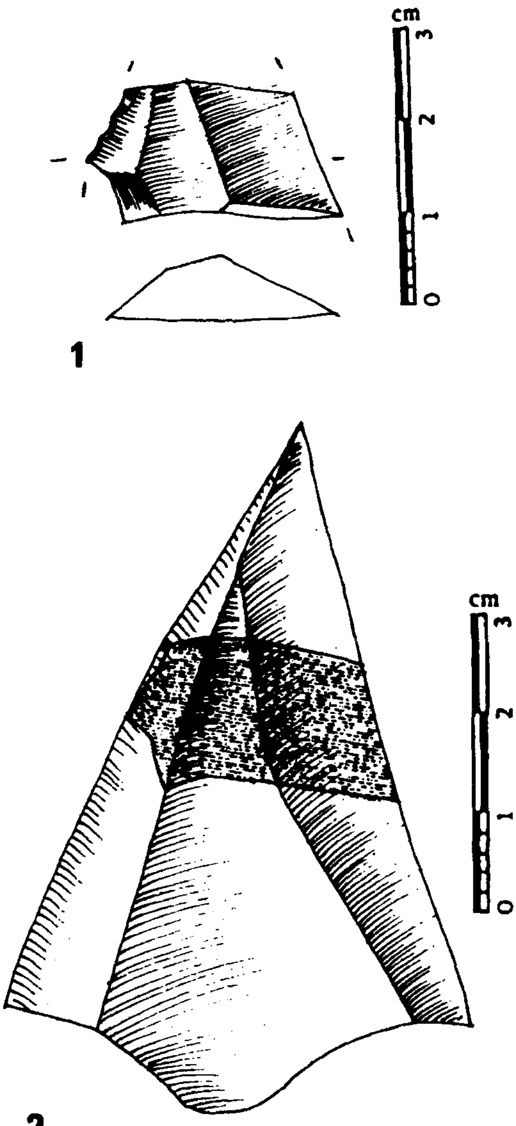


FIGURE 4. *The fragment of a Levallois point (1) and its reconstruction (2).*

A hafting hypothesis

The left edge of the lithic fragment presents traces of alteration. The most marked are observable at the base and present a scarring of the edge due to a strong pressure when the proximal end broke. Indeed, the base broke off when the fragmentary point was solidly embedded into the vertebra and could no longer move. This fracture was accompanied by a scarring of part of the edge. These accidents, the mesial/proximal fracture and the scarring of part of the fracture plane and the left edge, indicate that the non-embedded portion of the Levallois point exerted a strong, asymmetrical force on part of the fracture plane. However, for this to occur, the proximal part of the Levallois point must have been firmly hafted.

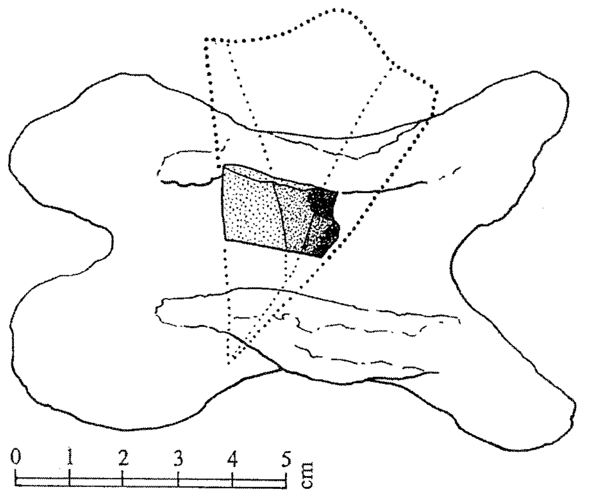
Other traces of alteration are observable on the dorsal face of the left edge. These consist of micro-denticulations formed by small, adjacent removals (1 to 2 mm in depth) which were detached following a violent contact of the edge with bone.

The missing distal extremity of the point was not found in the medullary canal, and the reasons for this can have important implications. Did the point initially penetrate the vertebra and then break off in the medullary canal? Or, alternatively, was the point already broken before it penetrated into the vertebral body? Several indices favour the second hypothesis. In effect, according to the reconstitution of the missing distal extremity, its length is estimated at 2·4 cm; however, the distance separating the distal extremity fixed in the bone and the opposing wall of the foramen is only 1 cm. Thus, if the distal extremity of the point had been in place at the time of penetration, there would forcibly have been a violent contact with the bone situated in its trajectory and there would be evidence in the form of impact traces. However, there are none. It is thus probable that the distal end of the Levallois point was broken off upon initial contact with soft tissue, or with bone, and only the mesial part penetrated into the vertebra.

In order for such an object to penetrate into a vertebral body, a strong force is necessary, thus requiring a very strong grip. Such a grip cannot be achieved by holding the object directly in the hand, even with some sort of protection. Moreover, independent of the fact that a considerable force was necessary to penetrate the bone, the object also needed to traverse the intermediate soft tissues. It thus seems evident that this Levallois point was hafted onto a shaft that extended the long axis of the triangular object.

A projectile point hypothesis

Macroscopic indices are an integral component of the functional criteria observed on experimental lithic projectile points (Fisher *et al.* 1984;



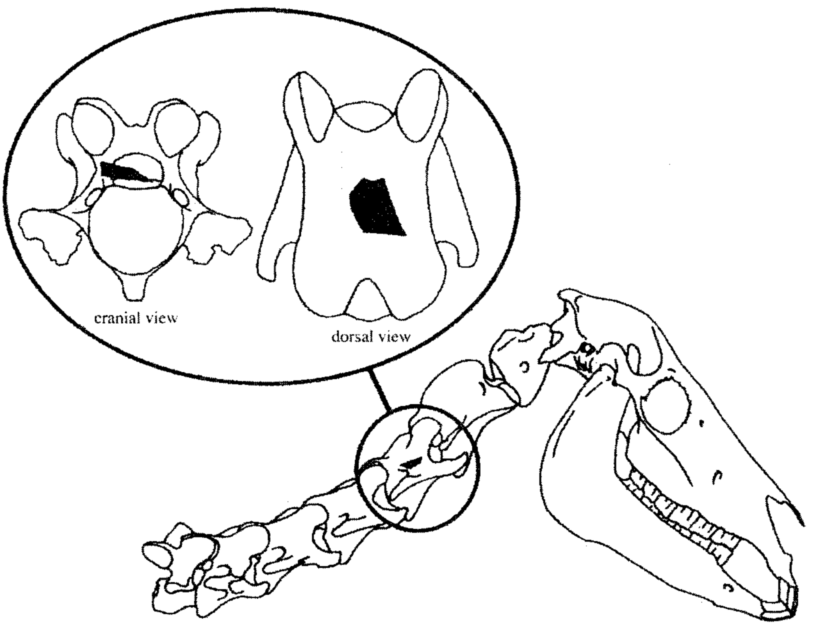


FIGURE 5. *Position of the Levallois point fragment embedded into the 3rd cervical vertebra of a wild ass (*Equus africanus*).*

Barton & Bergman 1982; Geneste & Plisson 1993; Odell & Cowan 1986). They are frequently associated with microtraces, which have not yet been studied on the object presented here.

Both macro- and microscopic traces indicating projectile point function have been regularly observed on flint elements in archaeological contexts. However, most such direct evidence of lithic projectile use comes from the Upper Palaeolithic (Geneste & Plisson 1993; Soriano 1995) and Lateglacial periods (Barton & Bergman 1982), and is sometimes attributed to bow use (Bachechi *et al.* 1997). The most precise evidence comes from the Lateglacial and Postglacial periods, consisting of lithic points hafted onto arrows that were discovered well preserved in waterlogged contexts in northern Europe (e.g. in the Ahrensburgian level at Stellmoor, Germany) (Rust 1943; Bratlund 1990). Such evidence does not yet exist for the Middle

Palaeolithic, and even if the hafting of flint tools during this period has been increasingly documented, the question of true projectile points remains open (Shea 1988; 1997).

From a ballistic and functional point of view, the macroscopic traces observed on the Levallois point fragment, and even more significantly, the degree of kinetic energy necessary to penetrate and damage the bone, clearly imply a projectile whose composite elements were efficiently and solidly fixed together. This maximal cohesion between the point and the shaft could not have been realized solely by the use of ligature and organic materials. However, an adhesive agent such as bitumen could perfectly ensure a highly stable and resistant cohesion between a flint point and a heavy calibre shaft. The utilization of this type of natural material in the Near East has been revealed at Umm el Tlel (Boëda *et al.* 1996) for the hafting of Mousterian tools found in other archaeological levels. Evidently, other adhesives that would ensure stable hafting could also have been used (Friedman *et al.* 1995).

The Levallois point discussed here could have hafted with a shaft of approximately 1·5 to 2 cm in diameter. Even if the kinetic energy (E=1/2mv2) at impact must have been high in order to result in such a deep penetration and the pulverization of the distal extremity of the point, it does not necessarily imply a high projectile speed. In fact, the large diameter of the shaft necessary for the hafting of a throwing weapon (i.e. a javelin thrown by hand) or a thrusting weapon determines, especially if it is long, a mass that is sufficient to produce the kinetic energy necessary at impact (Carrère 1991). As it is described here, despite its mass and length, this weapon would have been more easily manoeuvrable as a thrown projectile than as a heavy, wooden thrusting spear. Therefore, in the same hunting situation, it could have been thrown at short distance (its mass prohibiting longer distances), or hand-held and pushed more or less violently into the prey, aided by the weight of the body pushing it. However, there remains one important fact: whatever the mode of functioning, the efficiency of a weapon is dependent upon a significant degree of kinetic energy at arrival. In the case of a thrown weapon, the mass of the projectile permits no more than a relatively low speed of only about 8 to 10 m per second. In the other case, despite a much lower velocity, the simple hand-held weapon benefits from the inertia of the weight of the body that pushes it. In this latter case, the resulting energy can be very high.

The energy levels resulting from the two modes of functioning described above overlap in part within the range between 100 and 250 joules, or even more depending on the mass of the weapon and the strength of the individual using it. It is important to remember that a 300-gramme spear thrown with a spearthrower at the speed of 25 m per second possesses a kinetic energy at arrival of no more than about 50 to 60 joules! The exact mode of utilization of this type of heavy projectile cannot be identified through an experimental approach due to this overlapping of kinetic energy levels related to the different types of function.

Therefore, regardless of whether this weapon was thrown by hand, or simply hand-held, what is essential is that it would have been much more efficient and lethal than a simple wooden thrusting spear. A heavy projectile of this type, armed with a robust flint point and hafted onto a shaft that prolongs the long axis of the triangular object, possesses a high degree of kinetic energy that does not depend on the speed at which it is projected (always weak) but on its mass and its force at the moment of penetration. The latter explains the ease of penetration into bones as robust as the vertebrae of a wild ass in our case, and the complete sectioning of small ungulate bones, as has been recently demonstrated by other researchers (Beyries & Plisson in press) in the context of the Levantine Mousterian. The stopping power of such a heavy but slow projectile is highly efficient. The wooden thrusting sticks discovered in Western Europe from well before the Mousterian already attest to analogous ballistic principles for prehistoric hunting weapons (Oakley 1949; Thieme & Maier 1995).

A hunting weapon hypothesis

The good state of preservation of the osseous material has permitted the undertaking of an archaeozoological study aimed at reconstructing the subsistence activities of the Mousterians of level VI 3'b1. The study of the quantitative representation of different skeletal parts has shown differences between the dromedary and equidae:

- for the dromedary, the humerus, radio-ulnar, femur and tibia are the best represented elements; cranial bones and metapodes are rare and phalanges are nearly absent.

- for the equidae, all skeletal elements are represented in nearly natural proportions.

These observations lead us to think that the Mousterians of Umm el Tlel hunted both of these animals, which depending on their size could have been butchered at the kill site and the best pieces transported back to the camp. Concerning the equidae, it seems certain that whole animals were brought back to the camp. The absence of traces of carnivore teeth on the bones, and especially the abundance of marks related to butchery activities, are strong arguments in favour of hunting practices.

The hafted Levallois point discussed here could have penetrated into to the animal under two different conditions: while the animal was standing, or while the animal was lying down. In the case of the standing position, we distinguish two possibilities: either the animal's head was lowered, or the animal's head was raised.

The Levallois point penetrated into the body of the 3rd cervical vertebra from high to low and from front to back. Thus, in the case of a lowered head, the trajectory of the weapon would have been relatively straight and flat, thus implying a thrust weapon. On the other hand, if the head were in a raised position, the weapon would have impacted after following a parabolic trajectory, undoubtedly indicating a thrown weapon. According to the position of the point fragment in the bone, this seems the most likely possibility.

If the animal had already been on the ground, it was lying on its left side, since the weapon penetrated from the right side. Ethological studies concerning this species indicate that for this to be possible the animal would have to be dying, and already severely wounded. The additional blow from the weapon discussed here thus would not have had significant consequences, and would not have merited the effort on the part of the hunter. It is thus highly probable that the animal was struck while in standing position.

Conclusion

The flint fragment discovered embedded in a cervical vertebra of a wild ass is a fragment of a Levallois point that was hafted onto the distal extremity of a shaft. This weapon must have had a strong degree of kinetic energy, as is evidenced by its penetration into the cervical body. If the weapon struck the animal while it was in standing position, which is highly probable, its trajectory must have been parabolic. While it is difficult to distinguish between thrust and thrown projectiles on the basis of kinetic energy alone, the addition of this second argument of a parabolic trajectory is strongly in favour of a thrown weapon.

The wound would have abruptly disabled the animal because upon entering the medullary canal of the vertebra the point would have caused an immediate and irreversible paralysis of the limbs.

The use of Levallois points as projectile weapons is only one of several functional possibilities. The great majority of Levallois points found in level VI 3b'1 served in the cutting of different materials. The Levallois point must thus be considered as a tool with multiple functions and manners and contexts of use, explaining why it became omnipresent throughout the Mousterian of the Near East (Beyries 1987).

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Encoding information: unique Natufian objects from Hayonim Cave, Western Galilee, Israel

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New incised bone and limestone Natufian objects discovered during the 1997 season of excavations at Hayonim cave (Western Galilee, Israel), as well as a bone object found earlier in Kebara cave (Mount Carmel), indicate direct connections between the two sites. The incised pattern on the slab is interpreted as supportive evidence for emerging territoriality among Natufian communities in the Levant.

Key-words: Natufian, art, Hayonim, Israel, Levant

Since the original discoveries of Natufian cultural remains by D. Garrod in Shukbah and El-Wad caves in Mt Carmel and by R. Neuville in the Judean Desert (Garrod 1957; Neuville 1951), the 'art' objects recovered from those sites have become a focal point in attempts to reconstruct aspects of the Natufian spiritual domain. Some researchers have even considered them as manifestations of a prehistoric religion in the Near East (e.g. M.-C. Cauvin 1991; J. Cauvin 1997). In the 1950s and 1960s, further excavations of Natufian sites, defined on the basis of their content as base camps or sedentary hamlets, considerably augmented the number of known objects placed in this category of 'artistic' or 'symbolic' manifestations. These sites include Nahal Oren, Ain Mallaha (Eynan), Hayonim Cave and Terrace, Rosh Zin, Wadi Hammeh 27

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